The use of virtual patients for developing the evidence informed, shared decision making of clinicians

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Abstract

Background

Shared decision-making (SDM) involves a patient and a health professional sharing information to arrive at a decision that aligns with both the best available evidence and the patient's preferences. Research shows that SDM is not occurring in practice to the extent that it ought to. SDM is proposed as a skill of communication which means that it can be learnt and developed.

Virtual Patients (VPs) are computer programs that simulate real-life clinical scenarios; learners take on the role of a health professional to interact with a patient and make decisions. VPs may provide a way for students and professionals to practice SDM. Very few VPs published in the literature focus on SDM or related concepts.

Aim

To design and evaluate a VP for developing the shared decision-making skills of undergraduate medical and pharmacy students, and General Practice Registrars (GPRs).

Method

A multi-step design process incorporating patient involvement was followed to create the VP.

Mixed-method evaluations of the VP utilising pre- and post-questionnaires and semi-structured interviews were conducted at a series of workshops. The qualitative questionnaire data was analysed using content analysis. Descriptive statistics were used for the majority of the quantitative data; one question was analysed using a Wilcoxon rank test. The interview data was analysed by data-driven thematic analysis.

Results

The VP was found by workshop participants to be both enjoyable and easy to use. The multiple-choice system of interaction provided useful prompts to the participants as to which words and phrases they could use. In future, an extended feedback activity may be required but the optimal composition of this is unclear.

For the pharmacy and medical student evaluations, there was a statistically significant change in the rank position of "Respecting patient choices" when comparing pre- and post-VP ($p=0.026$ and $p=0.038$ respectively); in both cases, the median rank changed from 2nd to 1st. The modal suggestion for each evaluation was that it was "Likely" there would be changes in the participants' practice as a result of the VP; the suggested changes were broadly in line with the aims of the VP.

Conclusions

The VP was well accepted by the majority of the participants in all of the evaluations. The multiple-choice system had some particular advantages for less experienced consulters but its place with those more experienced is unclear. The VP resulted in positive changes in both the participants reported priorities within a consultation and suggested changes in their practice.

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Abbreviations

CA – Content Analysis

CCT – Certificate of Completed Training

CSA – Consultation Skills Assessment

DDT – Digital Development Team

GMC – General Medical Council

GPhC – General Pharmaceutical Council

GP – General Practitioner

GPR – General Practice Registrar

MMRSSoc – Manchester Medical Research Student Society

MPharm – Master in Pharmacy

MRCGP – Member of the Royal College of General Practitioners

NHS – National Health Service

NICE – National Institute for Health and Care Excellence

NIHR – National Institute for Health Research

NMC – Nursing and Midwifery Council

PBL – Problem Based Learning

RCGP – Royal College of General Practitioners

SDM – Shared Decision Making

TA – Thematic analysis

VP – Virtual Patient

Aims

The overarching aim of this PhD was;

- To evaluate the use of a virtual patient for developing the shared decision-making skills of undergraduate medical and pharmacy students, and General Practice Registrars.

Alongside the primary aim, there were secondary aims;

- To evaluate students and General Practice registrars' perceptions of at which stages of development the virtual patient for shared decision-making is appropriate.

- To evaluate students' and General Practice registrars views of the multiple-choice format for the virtual patient.

- To evaluate student's self-reported treatment priorities within a clinical consultation, immediately before and after exposure to the virtual patient.

- To evaluate the views of students and GPRs towards the style of feedback delivery from the virtual patient.

In all of these aims, the 'virtual patient' mentioned is the one designed for this project. 'Students' refers to undergraduate students of medicine or pharmacy in the United Kingdom.

1. Background

The first chapter provides the background to this research and details the landscape in which it is set. It illustrates the author's perspective and the direction from which the research was approached.

1.1. The Consultation

A healthcare consultation is an interaction between at least two people, a health professional and a patient (Pawlikowska et al., 2002). This interaction includes both verbal and non-verbal communication from both parties (Neighbour, 2005). There is a great deal of research demonstrating the importance of good communication skills for doctors (Ha and Longnecker, 2010). Doctors with better communication skills attain higher levels of patient satisfaction (Clever et al., 2008; Rezaei and Askari, 2014), increased adherence to treatment (Brand et al., 2013), a decrease in the emotional distress of the patient (Roter et al., 1995), greater accuracy in diagnosis and lower levels of stress for the doctors themselves (Maguire and Pitceathly, 2002). Most of this research focuses on medical professionals but good communication is important for all health professions (GPhC, 2017; Hargie et al., 2000; HCPC, 2016; Moore et al., 2018; NMC, 2018). This is especially relevant when consideration is given to the fact that non-medical professionals have moved into roles previously reserved for doctors (Avery and Pringle, 2005; Gerard et al., 2012; Jones et al., 2015; Stone and Williams, 2015).

In the 1970's, Byrne and Long (1976) analysed over 2000 consultations between doctors and patients. They found that there was a common structure applied to the majority of consultations; establish relationship, determine reason for attendance, conduct a verbal/physical examination, consider the condition, detail further management and terminate consultation. Byrne and Long reported that doctors very rarely deviated from this structure and also tended to make the decisions about the patient's care without discussing the options with the patient. This style of interaction is

often described as paternalistic and has been historically quite common (Barry and Edgman-Levitan, 2012; Taylor, 2009). Paternalism is now often viewed negatively as it neglects a patient's autonomy which is a basic principle of bioethics (Beauchamp and Childress, 2001; Will, 2011). Byrne and Long's model was not what they suggested as the epitome of a perfect consultation but constructed in accordance with their observations of real practice.

While not actively promoting it, Bryne and Long's consultation model introduced the concept of involving the patient in thinking about the problem(s) presented in the consultation (Denness, 2013). The introduction of the video recorder in the 1970s gave an insight into the consultations of professionals for the first time and helped establish the importance of communication skills education (Ferreira-Padilla et al., 2015). Through numerous different movements (Elwyn et al., 1999a), the concept of 'patient centred care' (PCC) arose; the Picker/Commonwealth Program for Patient Centred Care is credited with coining the term in 1988 (Barry and Edgman-Levitan, 2012). PCC is about putting the patient at the centre of their care on a more equitable footing with the professional (Richards et al., 2015). Rather than a biomedical view, where a patient is seen as clinical case, PCC is based on a biopsychosocial model (Engel, 1977) which focuses on patients as people and the effect illness has on their lives (Henbest and Stewart, 1990).

The start and progress of the PCC movement can be viewed alongside the development of consultation models. Pawlikowska (2002) constructed a chronological list of some of the key consultation models from 1948 to the turn of the millennium. Prior to Byrne and Long, Balint, a psychoanalyst, wrote about the doctor-patient relationship (1957); in his model he places the importance of communication quite heavily on the first half of the consultation, eliciting the patient's agenda, their reason for attending and active listening to gather information. Balint does not focus, or even touch on, the discussion of management options with a patient. After Byrne and Long constructed their model, other models were created which prescribed a structure to the

consultation. Stott and Davis (1979) had a four-stage model which was based on the biopsychosocial model. They suggest that the first step, management of presenting problems, is the main activity and is based on ascertaining the reason for the patient's attendance and their views about the condition. Like Balint, Stott and Davis suggest that the patient's ideas and expectations should be incorporated into the consultation but with greater focus on the diagnosis and the patient's understanding of it. A few years later, the Pendleton model (et al., 1984) included the notion of involving the patient in selecting management options with phrases like "doctor and patient choose an action" and "involve patient in management". The Balint, and Stott and Davis models suggest that the patient's ideas and expectations should be sought to understand why the patient has come to help formulate and understand the diagnosis; the Pendleton model has a greater focus on sharing the responsibility for decisions about management options.

After the Pendleton model, there were more task-based models published such as the Stewart patient-centred medicine model (1995). This also focused on the importance of involving the patient in the consultation to discuss their ideas, concerns and expectations but with little focus on specifically involving patients in decision-making. Some years later, the Calgary-Cambridge model was developed which focused much more on the decision-making process; the section "explanation and planning" features 14 sub-sections focusing specifically on the conversation about management options and the two-way sharing of information (Kurtz et al., 2005). These task-based models of the consultation show how the proposed involvement of the patient in the consultation has increased overtime from almost no participation, to involvement in the diagnostic stage and finally to involvement in the decisions about management options.

Elwyn et al. (1999a) make a similar observation, that consultation studies have focused far more on the first half of the consultation than the second; understanding the patient's agenda, gathering information to form a diagnosis and discussing the patients understanding. They suggest that

decision-making, the second half of the consultation, has been much neglected. Patients in a 2008 study (Cooper et al.) said that communication was the most important element to them and was closely tied with PCC and decision-making, as well as individual care and organisation. Howie (et al., 2004) regards Wensing's systematic review (1998) as seminal in defining the patients' perspective of the consultation; Wensing found that patients desired "involvement in decisions", "exploring patients' needs" and "humaneness" as well as "competency/accuracy". In 2014 the Health Foundation (de Silva and Bamber, 2014) tried to define quality in General Practice and they found that patient's valued interpersonal skills and being included in making decisions.

There are a variety of models describing the ways in which decision-making happens in a consultation. Paternalistic, informed and shared decision-making are the models suggested by Charles et al. (1999). Prior to this, Emanuel and Emanuel (1992) suggested four models of decision-making; paternalistic, informative, interpretative and deliberative; the first two feature in Charles' classification. The interpretative model involves a professional deciding the treatment plan, but considering the views and feelings of the patient in doing so. The deliberative model involves a discussion of patient values but only those related to health. Each of these individual models is not necessarily discrete as hybrid approaches can be taken (Charles et al., 1999).

Paternalism has already been touched on; a clinician neglects the patient's input and makes the decision themselves (Charles et al., 1999). In an extreme form, a professional will not offer any options to the patient but choose the one they view as best; the professional will also not consider the patients views and values either. Paternalism is now seen as unethical as it neglects patient autonomy (Ha and Longnecker, 2010) which can be seen in changes to the law, specifically, the transition from the Bolam to the Montgomery principle (Coulter et al., 2017). The Bolam principle (1957) established a legal precedent in English law for informed consent. The essence of the ruling was that if a professional decided not to discuss alternative management options with a patient, and

the option they chose was in step with a responsible body of opinion, they would not be ruled as negligent if the outcome was not favourable. The responsible body of opinion referred to the actions of other similarly qualified professionals. The Bolam judgement was later applied to the Sidaway case in 1985 (AC871) involving a surgeon who did not disclose the risk of a particular side effect to a patient, who then experienced that side effect; as Bolam was deemed by the judge to apply to the case, the surgeon was not deemed negligent (Campbell, 2015).

In the more recent Montgomery case, an expectant mother had expressed concerns about complications arising as a result of a vaginal delivery; the mother was diabetic which increased the risk of shoulder dystocia (Campbell, 2015; Coulter et al., 2017; UKSC 11, 2015). The mother was not informed of the risk of shoulder dystocia and it was decided to proceed with a vaginal delivery rather than a caesarean section. During the birth, shoulder dystocia occurred leading to a delayed delivery and the baby developing cerebral palsy. The case was made that the consultant should have raised the risk of shoulder dystocia with the mother and discussed the alternative to vaginal delivery, a caesarean section.

On this case, the UK Supreme Court overruled the Sidaway ruling and stated that a patient must be appropriately informed of the suitable management options and the likely risks and benefits for them to consent to a course of action (Campbell, 2015; Coulter et al., 2017; UKSC 11, 2015). A key difference from Bolam is that just because a professional believes one particular management option is in the patient's best interests, other reasonable options should still be discussed along with the associated risks and benefits. A professional should not provide the patient with information about every risk for every treatment either; the relevant information should be presented in as much detail as the patient desires and decisions made cooperatively between the professional and the patient (Lee, 2017). The Montgomery ruling therefore moves away from the paternalistic model which seemed to underlie the Bolam ruling and towards one that is shared; Montgomery "signaled a move

away from a ‘doctor knows best’ approach to one that focuses on disclosing information to which particular patients would attach significance” (Farrell and Brazie, 2016). Choice of decision-making style can be appropriate or inappropriate as in an emergency situation a patient might not be able to be involved in any decision-making; the Montgomery ruling explicitly states this as an exception.

A second approach to decision-making is informed decision-making which involves the professional acting as a provider of information. Information relevant to the decision is relayed to the patient by the professional and the impetus is then placed on the patient to make the decision (Charles et al., 1999). The assumption behind this model is that a patient knows what they value and prefer so if given all of the relevant information about management options by the professional, the patient can decide for themselves which option(s) they wish to choose (Charles et al., 1997). This has some pitfalls as merely providing a patient with information is not, on its own, a likely route to high quality decision-making; the patient has no help processing the information (Hargraves et al., 2016; Joseph-Williams et al., 2014) and not all patients want to make the final decision about their care (Degner et al., 1997). Closely related to informed decision-making is informed consent; during informed consent, the patient is only deciding on a single treatment option, not from a range as in informed decision-making (Witrz et al., 2006).

A third style of decision-making, shared decision-making, seems to be that which is suggested by the Montgomery ruling, although legal test cases will be required for the full extent of the ruling to be clear. It is based on a congruent partnership between the clinician and patient (Brand and Stiggelbout, 2013), working together to arrive at the ‘correct’ decision for the patient at that time. SDM seeks to combine the knowledge and clinical expertise of the professional with the patient’s values and wishes. Information exchange is therefore two-way between the professional and the patient in shared decision-making (Charles et al., 1999); this exchange is achieved through communication (Bensing, 2000).

1.2. Shared Decision-Making

Shared decision-making draws on two worlds of information, both the clinician's and the patient's. In general terms, clinicians understand the technical elements of care and the patient understands what their own expectations are, their values and preferences (Coulter and Collins, 2011). Through interaction, both sources of information can be combined to yield a solution which is aligned with the patient's values and also informed by best evidence and clinical expertise (Bensing, 2000). Multiple studies set in different contexts have shown clinicians' and patients' hold disparate views, perceptions and expectations about care (Davidson et al., 2011; Fraenkel et al., 2016; Junius-Walker et al., 2011; Lin et al., 2016; Lipton et al., 2005; Moran et al., 2003; Vaz-Luis et al., 2017; Voigt et al., 2010). The professional cannot know what each individual patient values, expects or understands without having a conversation with the patient first (Banks et al., 2014; Harrison et al., 2008; Solomon et al., 2013); these views, perceptions and expectations should be explored within a consultation for SDM to take place. SDM is therefore achieved through conversation between the professional and the patient (Bensing, 2000).

Not all patients will want to make every decision about their care. In a study of women with breast cancer, one third wanted their doctor to decide on the best course of treatment (Degner et al., 1997); it would be incorrect to assume this is not necessarily shared though as it was the patients wish for the physician to make the final choice (Taylor, 2009). If the patient does not make the final decision, the process can still be shared if a professional explores the patient's thoughts and feelings about the possible options. This is nicely put by Kravitz and Melnikow (2001), "Most patients want to see the road map, including alternative routes, even if they don't want to take over the wheel." A 2005 study found that the overwhelming majority (96%) of a sample of American patients wanted to be offered treatment options and involved in the selection of those options but half (52%) of them wanted the doctor to make the final decision (Levinson et al., 2005). It seems that in SDM, one does

not have to fixate on who makes any final decision but instead focus on involving the patient in the process of making that final decision (Edwards and Elwyn, 2006). It is also important to assess the patient's opinions and preferences after a treatment plan is enacted as patient's values and priorities can change over time (Muth et al., 2014). It seems there is a continuum of shared decision-making with each patient desiring a different level of involvement, something which must be established through communication in the course of the consultation (Kon, 2010).

SDM has been shown to improve patient satisfaction (Wiley et al., 2014), reduce decisional conflict and regret (Hong et al., 2017), and reduce cost and increase adherence (Lofland et al., 2017). Systematic reviews on the outcomes of SDM have not shown significant clinical benefits though (Clayman et al., 2016; Shay and Lafata, 2015). This could be due in part to the complexities of measuring SDM and its outcomes (Barr and Elwyn, 2016; Scholl et al., 2015; Weiss and Peters, 2008), but it is also perhaps because that it's not just the clinical outcomes that are relevant. A randomised controlled trial of an approach to improve patient centred care, a concept allied to SDM, failed to highlight improved clinical outcomes (Salisbury et al., 2018); a response to the article suggested that perhaps if patient satisfaction were increased then this alone is sufficient to promote it (Dowrick, 2018). Others seem to take a similar position with SDM, that it is an ethical imperative, not an approach necessarily designed to improve measurable clinical outcomes (Drake and Deegan, 2009; Guadagnoli and Ward, 1998). In relation to ethical issues, SDM has also acquired a basis in law following the Montgomery supreme court ruling (Lee, 2017) which has been discussed above. That said, Elwyn and colleagues propose that encouraging widespread change and adoption of SDM will likely require more than just the ethical arguments (2016).

Research shows that the level of SDM occurring in consultations is not as high as would be desired (Brenner et al., 2018; Couet et al., 2015; Ford et al., 2005; Hoffman et al., 2014; Kunneman et al., 2015; Santema et al., 2017; Stubenrouch et al., 2017; Vaillancourt et al., 2014). The CQC annual

inpatient survey features a question which asks “Were you involved as much as you wanted to be in decisions about your care and treatment?” In 2017, 10% (n=7502) of respondents answered “No” and 34% (n=23919) answered “Yes, to some extent”. This means that just under half of NHS hospital inpatients were not involved in decisions about their care as much as they would wish; this figure has also changed very little in the past 10 years. Even those who answered “Yes” may not have been involved optimally as patients have been shown to require prior exposure to SDM before they value it (Longo et al., 2006); patients unaware of the possibility of greater involvement may be content with what they viewed as sufficient participation.

The literature suggests that inappropriate paternalism is still taking place (Cohen and Britten, 2003; Garrard et al., 2015) and professionals have been noted to use partnership talk as a means to exert their authority and maintain the biomedical model (Robertson et al., 2011); using SDM to support their agenda, rather than the patients (Upton et al., 2011). Paternalism is not necessarily uncaring in nature as both oncologists and physiotherapists have been shown to use paternalistic approaches to get the patient to do what they thought was in the patient’s best interests (Dierckx et al., 2013; Engelhardt et al., 2016). A professional’s recommendations cannot be in the patient’s best interests though without a conversation about the patient’s values and beliefs. A survey of psychiatrists and vascular surgeons reported that both groups were open to the idea of SDM but would become frustrated if patients doubt their recommendations or insist on their preferences (Hamann et al., 2012). This is the point of SDM though, relinquishing control; the very label of *shared* decision-making entails the surrender of control on the part of the professional, allowing decisions to be guided by the patient’s values rather than the professional’s and respecting patient choices. Karnieli-Miller and Eisikovits (2009) and Stevenson (2003) conclude that SDM can be valued philosophically but not necessarily implemented.

So if SDM has both ethical and legal grounds for its promotion, why is it not occurring in practice as much as it might? In 2010, the Health Foundation commissioned the MAGIC programme to explore how SDM could be imbedded in the NHS (Joseph-Williams et al., 2017). The collaboration found several barriers to SDM; these include the erroneous belief that patients do not want SDM, that it is already being done or that it's too difficult to do. These difficulties could be linked to a misunderstanding or misapprehension of what SDM is about as there are many myths and misconceptions associated with it (Legare and Thompson-Leduc, 2014). There are some who suggest that we may not be able to change, that medicine is inherently asymmetrical (Ives et al., 2018; Pilnick and Dingwall, 2011). Others postulate that SDM is a skill that can be developed (Gulbrandsen et al., 2014; Hoffmann et al., 2014; Maskrey and Gordon, 2017).

SDM is suggested to have been largely missing from medical and pharmacy education (Elwyn et al., 1999b; Oswald, 2018) although a lack of data makes establishing a clear picture difficult. An international scoping literature review (Durand et al., 2018) found only a small number of published papers (n=11) focusing on SDM training in the medical curriculum; of those included, most featured a few hours of SDM education. The authors conclude that greater focus on SDM is required in the undergraduate curriculum. SDM is suggested as a skill of communication (Jack et al., 2018) and extensive research shows that the general communication skills of professionals and students can be improved by educational interventions (Aspergren, 1999; Jin et al., 2017). While there has been some success in improving professionals' SDM skills (Geiger et al., 2017), a Cochrane review found that it is unclear whether current interventions are effective due to the certainty of evidence being low (Légaré et al., 2018); Lehman's reply highlights that this does not mean the teaching of SDM is inadvisable, merely that time-limited, simple interventions do not show the full picture (2018). Evidence from the more general communication skills literature supports this idea; a spiral curriculum is required to build and develop skills, not short or one-off interventions (Kurtz et al., 2005). Between 2007 and 2015, Dutch GPs (n=50) were observed during patient consultations and

the level of SDM increased over the 8-year period (Meijers et al., 2018); while the cause is not clear, it seems it is possible to change.

1.3. Evidence Based Medicine

To add another dimension to the consultation, the decisions made should also be based on supporting evidence. Evidence Based Medicine (EBM) is the movement that started this around 25 years ago, promoting the use of the best available evidence to inform decisions (Evidence-Based Medicine Working Group, 1992). 'Best available evidence' means that it is not just Randomised Controlled Trials that are suitable to base decisions on but the highest standard of evidence available; in some instances, this may well be expert opinion or case report (Sacket et al., 1996). Before this 'paradigm shift', a professional's decisions were guided largely by their accumulated experiences in clinical practice and their prior education, what is broadly described as clinical expertise. EBM is about combing clinical expertise with the best available evidence and also the values and preferences of each individual patient to make decisions. An early misapprehension about EBM was that it took the power away from individual clinicians and would make medicine a bureaucratic exercise, nullifying clinical judgement. EBM acknowledges the role of clinical expertise but it asserts that when using their judgement, clinicians inform it with the relevant evidence in addition to the patient's values.

EBM has seen success; after the publication of the British Thoracic Society's evidence-based asthma guideline (British Thoracic Society, 1990), the prescribing of inhaled corticosteroids increased (Majeed et al., 1999) and mortality decreased (Kelly and Capewell, 2004). After the initial popularisation of EBM, a systematic review identified that guideline introduction was correlated with improved clinical practice with all but 4 of the 59 papers included in the study supporting this position (Grimshaw and Russell, 1993). However, in a seminal paper in 2014, Greenhalgh et al. argue that EBM, once hailed as a new paradigm (Evidence-Based Medicine Working Group, 1992), is now a

movement in crisis. EBM was about combing three things in the decision-making process; best available evidence, clinical expertise and patient values (Sackett et al., 1996). Greenhalgh and colleagues explore growing concerns that the patient's values are being neglected from this process and guidelines are being used as rote, fixed pathways which reduce the patient-centred dimension of care (Swinglehurst et al., 2012). Patient centred care should not be devoid of evidence but should allow a patient and clinician to choose together the most suitable, evidence informed, way to proceed for each individual patient (Coulter and Collins, 2011).

There are also concerns about the content of guidelines with misleading statistics (Hanin, 2017), publication bias (von Elm et al., 2008) and participant selection issues (Kahan et al., 2015). Some conditions have multiple but conflicting recommendations (Matthys et al., 2007; Cutchie et al., 2006; Iqbal et al., 2002; Norris et al., 2012) which gives rise to medicolegal concerns (Kachalia and Mello, 2013). There are also issues around how and when these guidelines are released (Hitchen, 2007). Guidelines are frequently based on idealised populations with very few, if any, comorbidities or concomitant therapies considered, a divergence from reality (Dumbreck et al., 2015). EBM could require a realignment to support real-world decisions (O'Hare et al., 2015; Solomon et al., 2013). Guideline development often receives financial support which some suggests leads to a conflict of interests, resulting in biased recommendations (Choudhry et al., 2002; Gale, 2011; Lenzer et al., 2013). Lenzer also makes the comment that merely being aware a guideline is imperfect is itself not sufficient because clinicians may feel they are under pressure to adhere to them.

If some of this data and subsequent interpretation of it is sub-optimal, it is also too voluminous; Allen and Harkins (2005) analysed one acute medical take comprised of 18 patients and found that to read all of the relevant guidelines for the conditions presenting would take 122 hours. This led them to the theory of a critical mass of guidelines above and beyond which the further production of recommendations becomes unhelpful due to the sheer quantity of reading and digesting of material required. They also note that keeping up with the latest guidelines is likely to be the most difficult for

general practitioners who have to keep abreast of developments in all medical fields as opposed to the specialist whose focus is narrowed to a specific area.

1.4. Cognition

The matter of 'information overload' is related to bounded rationality, a theory associated with decision-making (Simon, 1972) that has been applied to clinical contexts (Ferreira et al., 2010). It states that a human being's ability to make a decision is limited by their cognitive abilities (their ability to process information), the tractability of the process and the time available, according to Simon. Unbounded rationality asserts that humans have limitless cognitive reasoning powers and possess all the knowledge needed to make a decision (Todd and Gigerenzer, 2000). Bounded rationality on the other hand ascribes that humans make the best decision they can, with the information available, in the time they have; this decision is rarely optimal but is sufficient to ensure a favourable enough outcome. This behaviour is called satisficing, so dubbed by Simon (1972); a process whereby a human being does not seek out every last bit of relevant information to come to a decision, but they *satisfy* themselves that they have obtained *sufficient* information to make an adequate decision. There is a paradox of sorts in which more information can be either helpful or unhelpful; if it adds clarity, then a better decision can be made more efficiently (Glöckner and Betsch, 2012) but if not, it can just use more time and mental resource without benefiting the quality of the decision (Marewski and Gigerenzer, 2012).

Another theory of decision-making is dual process theory (Kahneman, 2003) which stipulates that when confronted with a new situation (e.g. a new patient) the brain attempts pattern recognition (Croskerry, 2009). If there are features of this new presentation that are recognized as familiar then system 1 is utilised; system 1 is a fast and intuitive way of making decisions based on patterns. If pattern recognition is not accomplished then system 2 is used, the slower, more analytical approach for unfamiliarity. It is not a case of a 'good' and a 'bad' system as we need both at different times. As

an example, when new knowledge is available, system 2 may be required to analyse and appraise it whereas defaulting to system 1 can lead to falling back to old habits (Bate et al., 2012). Illness scripts are a kind of type 1 thinking, where a few classical symptoms from a patient lead the clinician to a subconscious and rapid initial diagnosis (Charlin et al. 2007); these scripts are built after repeated practice and experience. Illness scripts highlight that clinical expertise is not just about in-depth knowledge, or an independent reasoning skill; it is highly specific with experience building on knowledge (Schmidt et al., 1990).

Formative research conducted by Gabbay and Le May (2004) showed that rather than using formal clinical guidelines, GP's in England used what they called 'mindlines' to make decisions. They are a kind of internal guideline and place emphasis on 'knowledge in practice' and 'communities of practice'; it often uses informal ways of accumulating knowledge such as colleagues or previous experiences, leading to intuitive responses as appose to overt searches of evidence or guidelines. Mindlines therefore deviate from rational choice theory in the sense that not every piece of guidance or data is located, appraised and utilised for every decision (Prabha, 2007); similar findings have been reported in another study (Zwolsman et al., 2013). The theory has received criticism which could be due to mindlines challenging the rationalist assumptions of evidence-based medicine or simple misunderstandings (Wieringa and Greenhalgh, 2015).

Heuristics are another influence on decisions but are simpler than mindlines (Gabbay and Le May 2004; Tversky and Kahneman, 1974); the latter is based on the clinician's previous experience and retained learnings from other sources and is deep, tacit knowledge. Heuristics are cognitive shortcuts based on probability and used to infer things during the decision-making process; they are 'the servants to intuition' and form 'rules of thumb' (Cioffi, 1997). It should not be assumed that heuristics and mindlines are always a bad thing; the fact they are unconscious means that a clinician can make a rapid decision and does not have to search for and compute large amounts of data (Gigerenzer and Goldstein, 1996), something that can save lives in emergency medicine (Eva and

Norman, 2005). Heuristics are a feature of all humans and they have evolved because they confer advantages (Kruglanski and Gigerenzer, 2011), leading to the notion of ecological rationality where context is relevant in determining what is rational, a deviance from traditional rational choice theory (Gigerenzer, 2008; Todd and Gigerenzer, 2000).

Biases are a further effect on decision-making; they are cognitive mechanisms that act subconsciously and, unlike mindlines and heuristics, are less helpful as they diverge from the 'true' (Dovidio and Fiske, 2012; NPC, 2011). An example of a cognitive bias is when the fourth patient presenting with chest pain is assumed not to have acute coronary syndrome as you've seen three of those recently; the gamblers fallacy i.e. because something has occurred more than average up to a point in time, it is less likely to occur after that point in time. Another would be missing meningitis in the middle of a flu epidemic; vertical line failure. These are therefore less helpful as they shift the clinician away from what could be a true diagnosis. As well as cognitive biases, there are also affective biases, biases related to the emotions or moods of a professional (Croskerry et al, 2008); negative or positive feelings towards a patient can affect a professional's decisions adversely.

It is suggested that one can debias professionals to reduce or remove the effect of unhelpful biases on decision-making (Croskerry, 2003). There are various strategies for debiasing which range from training an individual's critical reasoning ability to modifying the socio-environmental infrastructure (Kenyon and Beaulac, 2014, 2016). Ludolph and Schulz (2017) break debiasing down into three categories; motivational, technological and cognitive. A systematic review of health-related biases found that although the effectiveness of debiasing strategies has been debated, there was good evidence for the majority of interventions included in the review (Ludolph and Schulz, 2017). It was reported that the cognitive strategies were the least useful, something other authors have suggested (Correia, 2018). One issue identified with the debiasing literature was that most studies were conducted in laboratory settings and will require application to real world settings to establish their ultimate utility.

Perception of patient expectation is an important factor in the clinical decision-making process. Cockburn and Pit (1997) found that, when controlling for the presenting condition, if a doctor thought a patient was expecting medication then they were 10 times more likely to receive a prescription; Ong et al. (2007) made similar findings with antibiotic prescribing. Some doctors have suggested that they have prescribed medicine to preserve the patient-doctor relationship, as a 'bargaining chip' or to 'get rid of the patient' (Bradley, 1992). These two points highlight the issue that professional's decision-making is not always focused on the physiological action of any management options i.e. one can decide to offer a potential management option even though it may not be clinically indicated.

In summary, clinical decision-making does not work according to rational choice theory. Clinicians do not dissolve extraneous context to implement guideline-based rules, resulting in a solution supported by comprehensive evidence (Gigerenzer and Goldstein, 1996; Wieringa and Greenhalgh, 2015). Bounded rationality states that traditional rational decision-making is not possible (Simon, 1972) and making use of heuristics (Marewski and Gigerenzer, 2012) and mindlines in decision-making can result in better decisions (Bechara, 2004; Seo and Barratt, 2007; Gigerenzer and Brighton, 2009). A further abstraction is that any intervention aimed at modifying the decision-making habits of clinicians has to fit within these existing structures, not seek to replace them (Gabbay and Le May 2004). This complex process is also at work in the mind of the patient too.

Taking the discussion presented in this chapter so far, one can see that a consultation is a complex process. There is a difference between complex and complicated (Glouberman and Zimmerman, 2002); a complicated system can be broken down and understood piece by piece, like engineering projects (Snowden, 2002). However, systems involving humans (such as a medical consultation) are complex; we cannot predict the next thing a patient will say or do, or fully grasp a patient's thoughts. Indeed, a reductionist approach whereby a consultation is broken down into manageable pieces has been criticised for not comprehending the complexity involved in building rapport with patients

(Lefroy and Mckinley, 2011). Many areas of the modern world, healthcare included, are devoid of simplistic, one-dimensional solutions and it is erroneous to neglect complexity (Plsek and Greenhalgh, 2001).

1.5. Education

1.5.1. Theory of education

Andragogy is a term often used to describe adult learning with much of the initial and influential work conducted by Knowles (Knowles et al., 2015; Taylor and Hamdy, 2013), although he did not invent the concept (Henschke, 2011). A central idea is that adults learn differently from children, with pedagogy used as the term for the practice of the education of children. An underlying assumption is that adult learners tend to be self-directed with the educator acting as a facilitator; children are dependent on the educator with little self-direction (Knowles, 1980, pp43-44). Experience is important for adult learners and is viewed as a rich source of learning whereas a child's previous experiences bring little to education. Adults are performance-centred while children are subject-centred in their learning. These contrasting positions demonstrate that andragogy and pedagogy are two discrete theories on education whose underlying ideas are in complete opposition to one another.

Some academics argue that a clear distinction between andragogy and pedagogy is based on flawed assumptions with little empirical data to support it (Darbyshire, 1993; Rachal, 2002; Taylor and Kroth, 2009). Part of the reason for this is that there appears to be a cross-over between andragogy and pedagogy as, for example, some children are self-dependent and some adults rely on structure (Merriam, 2001); a strict delineation between adult and child learners is perhaps not correct. Due to this, some suggest 'self-directed' or 'teacher-directed' instead (Rachal, 1983). Work by Perry (1999) showed how undergraduate students in US colleges traverse a continuum during their studies,

moving from duality to multiplicity; duality focuses on right and wrong whereas multiplicity involves accepting that the 'teacher' may not have 'the answer' and a growing comfort with uncertainty. Knowles also made this distinction himself (1980), conceding that his initial conceptualisation of the discrete categories of adult and child learner were not correct; he suggested instead that andragogy and pedagogy are ends of a spectrum and the two models can be used in whichever situations they are most useful. Henschke (2011) critiques the critiques, arguing that much of the debate focuses on Knowles version of andragogy and not on the wider perspective. The andragogy-pedagogy debate is a complex and contentious one that is still ongoing (Holmes and Abington-Cooper, 2000). So what approach does healthcare take to the education of its professionals?

Traditionally, the medical approach to the acquisition of skills was summarised as 'see one, do one, teach one' (Rodriguez-Paz et al., 2009); the supposition was that by seeing one, a student acquires theory, doing one enables application of theory and teaching one consolidates. McGaghie et al. (2011) credit the creation of this three step process to Halsted (1904). It seems quite reductive and the 'do one' practice element was often using real patients, a relatively high-risk and unstandardized strategy. Rodriguez-Paz and colleagues (2009) propose a more refined framework starting with lectures and seminars for knowledge acquisition, followed by repeated practice on simulations, proceeding to performing the task on a real patient and finishing at the evaluation stage where the student can now teach the skill they have acquired. This process is underlined by the assessment of competencies at each stage. The foundation of this approach is known as Miller's pyramid (Miller, 1990); medical students start at 'knowing', moving through 'knows how' and 'shows how' to 'does' (Val Wass et al, 2001). This approach is also the basis of the General Pharmaceutical Councils 'Standards for Initial Education' for undergraduate schools of Pharmacy (GPhC, 2011).

There are numerous models to describe and outline the acquisition of new skills, such as communication or decision-making. One example is the Four Stages of Competence model (Flower, 1999); the origins do not seem clear but Crandall (et al., 2003) credits Howell with its creation (1982).

Learners start at unconsciously incompetent, they do not know what they do not know at this stage. The next stage is then conscious incompetence; they still do not have the skill but they realise this. The third stage is conscious competence and this is where the individual can perform the task but exercising it requires conscious thought and concentration. The final stage is unconscious competence, where the learner has grasped the skill and carrying it out does not require conscious thought or effort. One criticism of this model could be that it implies that to be an expert, the use of the skill must be unconscious, intuitive. However, expert clinicians still use analysis and deliberation as well as instinct (Mamede et al., 2010); something also found in business (Prietula and Simon, 1989) and chess (Gobet, 1997).

The Dreyfus model of the acquisition of expertise provides a progression framework to highlight how an individual can start as a novice and develop to become an expert, through advanced beginner, competent and proficient (Dreyfus and Dreyfus, 1980). It recognises that at the 'expert' stage, the use of conscious thought is only used in novel situations and intuition predominates in settings or contexts which are familiar. It stresses that in the early stage of development, rules or rigid frameworks are followed with little, if any, use of intuition (Pena, 2010); it is a mark of an advanced practitioner to use intuition appropriately (King and Clark, 2002). Aspiring physicians move from causal networks (acquisition of basic science) to abridged networks (extensive effort to diagnose but signs and symptoms are linked to disease labels), to illness scripts (pattern recognition where seeing certain symptoms leads to a diagnosis) and finally to cases (expert level where previous patients are recalled in the mind) in their development (Maskrey et al., 2009). This all takes deliberate practice and feedback (Ericsson et al., 2003), illustrating the continuum that must be traversed to become an expert. Benner (Benner, 1982; Dall'Alba and Sandberg, 2006) built on this model with research applying it to nurses.

Experience is also an essential part of the Kolb experiential learning cycle (Kolb and Kolb, 2005). This theory describes how learning occurs through experience, or rather, by reflecting on an experience

after it has occurred (Zigmont et al., 2011); as experience is the source of learning, the theory is allied to andragogy (Knowles, 1980). It starts with a concrete experience, followed by reflection and abstract conceptualisation and finishing at active experimentation; finishing is perhaps a misnomer as the cycle then continues back around again to concrete experience. Schön advocated reflective practice too but differentiated between reflection "in" action and reflection "on" action (1987); in the former, one reflects on what is happening, while it is happening. This, as Schön himself notes, appears similar to trial and error but reflection in action is more specific; rather than a random trying out of actions, one must reflect critically during the experience.

1.5.2. Methods of education

There are different stages to a health professional's education with some common phases that can be identified. In medicine, there are three main stages; undergraduate, specialty training and continuing medical education (CME) (Kurtz et al., 2005). Education of pharmacists can be broken down into three stages too; undergraduate, pre-registration and post-registration. Undergraduate education is aimed at equipping students with the basic knowledge required (Harden, 2006); while the material taught may differ, it is a stage common to doctors, pharmacists, nurses, physiotherapists and dentists in the UK as all these professions now require a degree.

After completion of a medical degree, doctors undertake two years of foundation training before entering specialty training. Medical specialty training differs in its duration and content depending on which specialty one is training in; trainees in general practice and psychiatry have traditionally received more training in communication than their hospital medicine counterparts, for example (Cooper and Hassell, 2002). After completion of specialty training, doctor's education and training falls under the umbrella term of CME. CME is specific to medical graduates and is often labelled as 'continuing professional education' (CPE) or 'continuing professional development' (CPD) when applied to other professions (Cantillon and Jones, 1999; Salti, 1995); it describes the activities

professionals undertake across the course of their career to update and refresh their skills (Collin et al., 2012; Richards, 1998). After their degree, pharmacy graduates complete a pre-registration stage which is based around a year spent in practice (GPhC, 2018a); after completion of this, one can register as a pharmacist. Post-registration, pharmacists can undertake further formal training including diplomas, MSc and prescribing qualifications but outside of the CPD required for revalidation, there is no mandated education (GPhC, 2018b). As an example of the types of training a pharmacist might undertake, Health Education England suggest that pharmacists should complete foundation training followed by advanced training but both of these are role specific and not nationally standardised (HEE, 2018).

CPD/CME activities generally rely on a professional identifying their own weaknesses and learning needs but it seems that professionals are not adept at doing this (Davis et al., 2006). This is particularly germane when consideration is given to the fact that communication skills, once learnt, can be 'unlearnt' (Craig, 1992; Engler et al., 1981); if communication skills can diminish without professionals being aware then they may struggle to rectify the issue. Communication skills training often resides in the first couple of years of undergraduate study and is often not developed any further afterwards; one reason that communication skills may decline is that communication skills need to be developed longitudinally (Brown, 2012; Laidlaw et al., 2002). Kurtz and colleagues (2005) suggest that the same methods can be used to develop communication skills at any stage but that a continuing programme built upon a helical rather than a linear design is required. There is also a need to teach communication skills alongside technical skills, particularly after the first few years of undergraduate education, as in reality a professional will need to use both skills at the same time (Kidd et al., 2005).

Communication skills were scarcely taught in UK medical schools prior to the 1970s (Ferreira-Padilla et al., 2015). Part of the reason for this was that it was thought that communication skills were innate and could not be taught (Moore et al., 2012). The introduction of video recorders in the 1970s

provided a useful educational method which saw an increase in the prevalence of communication skills education, although the focus was centred on history taking and diagnosis rather than the discussion of management options (Maguire and Rutter, 1976). Through the 80s and 90s there was an increase in communication skills teaching but the education was often not well structured with a lack of suitably trained educators (Whitehouse, 1991). There was some improvement over the next ten years but there was a great deal of variability from school to school (Hargie et al., 1998). The presence of communication skills in undergraduate curriculums has increased further since the turn of the millennium with most UK medical schools having a greater structure to their communication curriculum with more members of staff devoted to this area of education (Hargie et al., 2010; Von Fragstein et al., 2008); the amount of time devoted to communication skills can still be quite low though, varying from 0.15% to 5.5% of the curriculum. This change in teaching can be viewed alongside the development of consultation models highlighted in the first section of this chapter.

Changes in undergraduate education do not seem to have been matched in postgraduate education with even less focus on communication skills in favour of clinical skills (Brown, 2008, 2012; Dacre et al., 2005); certain specialties have performed better in this area than others with trainees in general practice and psychiatry receiving more communication skills education (Cooper and Hassell, 2002). Undergraduate pharmacy curriculums have increased their focus on the communication skills required for a consultation more recently as the role of the pharmacist has changed although research suggests that further increases are required (Cleland et al., 2007; Jalal et al., 2018); significant variation between the outcomes of UK pharmacy schools communication teaching has been reported (Willis et al., 2009).

Kurtz et al. (2005) suggest many of the methods used to develop communication can be used at any stage of development. Hargie et al. (2010) found a multitude of different methods used in UK medical schools and their findings are reproduced in Table 1. They are much the same as those

suggested by Kurtz et al. (2005) with the addition of some newer methods in Hargie's classification e.g. on-line learning material.

Table 1 - Methods used by UK medical schools to develop communication skills; adapted from Hargie et al. 2010

Method	Number of Schools
Role-playing	21
Group discussion	20
Simulated patients	20
Video feedback	19
Lectures	18
Actual patients	14
Self-directed learning	14
On-line learning material	11
Tutorials	10
Workshops	9
Modelling	9
Seminars	8
Interactive video	2

Didactic methods are a traditional method of imparting information to learners and can be a feature of lectures, workshops, tutorials and seminars. Theory and information about the subject are relayed to the learners and information tends to flow one way, the educator teaching the learners. Evidence has shown that didactic methods are not as successful as more interactive methods in developing the skills of clinicians in continuing medical education (Davis et al., 1999; Evans et al., 1989; Forsetlund et al., 2009; Roche et al., 1996). When acquiring communication skills, interactivity is a key feature with

practice and subsequent feedback needed to develop (Maguire et al., 1986; Telio et al., 2015). Didactic teaching may still play a role though by teaching theory before this is demonstrated and practiced (Maguire and Pitceathly, 2002; Rodriguez-Paz et al., 2009).

Modelling, which includes role modelling and demonstrations (Cote and Leclere, 2000), entails a learner observing an educator or facilitator interacting with a patient (Maguire and Pitceathly, 2002); this observation can be in reality or via a video recording. Modelling, like didactic teaching, can occur in workshops and tutorials but also in real clinical practice. Modelling in isolation is not thought to be an effective method for skill development; learners might be able to differentiate between good and bad consultations by observation but they may not be able to identify the skills required and develop them in their own practice (Kurtz, 1990). There is also the issue that if learners observe real clinical interactions, they might not be observing best practice; the start of this chapter outlines that SDM is not occurring to the extent that it ought to and professionals may believe they are engaged in SDM when they are not (CQC, 2018; Joseph-Williams et al., 2017). Modelling can still be useful to help reinforce positive behaviours though (Kurtz et al., 2005) so it therefore has a place in communication skills curricula as a "supportive strategy" but not in isolation (Berkhof et al., 2011).

Maguire and Pitceathly (2002) suggest that didactic teaching can be used first to teach the theory of communication and also highlight the evidence that individuals can improve their skills, that they are not innate. After this, modelling can be used to demonstrate good and bad features of communication skills. They suggest the third step involves practicing communication skills and there are numerous ways this practice can be achieved.

Role-plays entail academics or other students acting as patients with evidence to support this technique (Coonar et al., 2009; Hugo and Couper, 2006; Koh et al., 1991; Mansfield, 1991). An early evaluation of this method found that students were embarrassed doing it, not helped by their peers choosing deliberately awkward/embarrassing conditions to simulate (Meadow and Hewitt, 1972); this drawback is perhaps about the application rather than something inherent in the method. A

structured approach to role-plays delivered very positive results in student evaluations (Nestel and Tierney, 2007). A related technique is drama teaching; this can involve students observing theatrical productions (McCullough, 2012) but also where students themselves take the role of actors in a 'play' (Wasylko et al., 2003). Drama training has demonstrated an improvement over traditional teaching in OSCE results (Lim et al., 2011).

Rather than role-play, actors can play the part of patients to allow learners to practice their skills; these actors are usually referred to as simulated patients (SPs) (Barrows, 1968; Hulsman et al., 2009; Lane and Rollnick, 2007; Whitehouse et al., 1984). SPs are usually given training on how to represent a particular situation or pathology and can then interact with learners as though they were real patients. The actor can present with any ailment so desired, with gender and age being the only confines. Actors are not at risk of being offended in the same way as real patients as they do not have the condition being role-played. The research on SPs seems to be conflicting with some finding that they are indistinguishable from real patients (Baerheim and Malterud, 1995) while others find the opposite, that they feel 'fake' (Yardley et al., 2013). The actors' level of experience and training can be a big factor with a novice or inadequately trained actor providing a poor simulation (Meadow and Hewittt, 1972; Smith et al., 2015). From a sociological stance SPs can be troubling as they do not entail the same power imbalances as a real consultation and could thus give a false impression of reality (Hanna and Fins, 2006); this is something no level of acting can overcome. SPs have been shown to be more effective than didactic methods for improving OSCE results (Madan et al., 1998) but Taylor et al. (2018) found that in a cross-over trial with pre-clinical medical students, volunteer SPs failed to demonstrate superiority over role plays. A systematic review of their use in continuing medical education found few rigorous studies of their efficacy (Wilbur et al., 2018). Lane and Rollnick (2007) argue that while they may be useful, the existence of cheaper and perhaps equitable options, such as role plays, raises questions about SPs utility.

Actual patients can be used to practice one's skills in addition to role-plays and SPs. Firstly, learners can interact with real patients directly in a University or a clinical setting and students have reportedly enjoyed this method due to the realistic nature (Bokken et al., 2009; Rees et al., 2004); students reported negative feelings towards SPs and role-plays as they felt 'fake'. There are a few issues with learning with real patients as if one makes a mistake, they could harm or upset a real patient (Kurtz et al., 2005). They can also be resource intensive and the range of patients that learners can interact with is limited to the patients who are available.

Role-plays, SPs and actual patients can all be used in face-to-face, real time interactions. A facilitator and/or the learner's peers can then provide feedback, perhaps as a group discussion (Lane and Rollnick, 2007). These interactions can also be recorded by either a tape (audio) or video recorder (audio and visual) (Davis et al., 1980; Maguire et al., 1986). After recording an interaction one can then self-assess and reflect on their performance (Beckman and Frankel, 1994); this technique has led to learners desiring to have more consultations recorded which seems to suggest they enjoyed and/or thought they benefited from it (Del Mar and Isaacs, 1992). Recording of consultations has been noted to present something of a threat to learners, causing them to feel worried or anxious (Mannion, 1999). An educator can set up a session and facilitate feedback delivery in a way that reduces these feelings though and learners have subsequently been very accepting of video recording (Cooper and Hassell, 2002; Nilsen and Baerheim, 2005). It is not just self-assessment but also feedback from an educator that is important (Hammoud et al., 2012) as learners have reported finding self-assessment quite difficult (Hulsman et al., 2009). An educator can provide an outside perspective to help break down what the learner did well and what they can improve on. Reviewing a peer's consultations can also be a useful technique for learners, both for the individual doing the reviewing and the learner receiving the peer feedback (Alexander et al., 1977). It is suggested that having a consultation with an SP, analysing the recording of it and also analysing a peer's consultation can all be effective techniques individually but also work in combination (Hulsman et al., 2009). One of the advantages with a learner and an educator reviewing a recorded consultation

together, rather than directly observing the consultation live, is that the video can be paused and replayed any number of times to permit a thorough and objective review (Ozcakar et al., 2009).

Watling and Brown (2007) trialled an intervention with neurology residents which encompassed review of recorded consultations (modelling), group discussion, role play and SPs. They found that accompanying the intervention with reflective portfolios was a key addition to promote learning, highlighting that it is not just the method (e.g. role play, SP) but how feedback and/or reflection are delivered that is also important. Aper et al. (2012) explored the differences between three different approaches utilising a mix of videotaping and SPs. They concluded that the different methods of practice all have strengths and weakness unique to each respective method; they suggest that a combination of methods could lead to the optimum impact on learning as appose to using just one method in isolation.

1.5.3. Simulation

Simulation is defined as "the reproduction of the essential features of a real-life situation" (Medley and Home, 2005) and is a broad field that includes a great many educational methods. Simulated patients, a real human being playing the role of a patient, have already been described so the discussion will move on to two other sub-types of simulation; virtual reality (VR) and Human Patient Simulators (HPSs) (AAMC, 2007; Bradley, 2006; Lin et al., 2011).

HPSs come in different shapes and sizes with one of them being manikins (AAMC, 2007). Manikins are relatively life-like, tactile models of a human and are often used for technical skills, such as CPR (Grenvik and Schaefer, 2004). SimMan is an example of a proprietary manikin which can show a variety of symptoms and allow the learner to triage and treat the 'patient'. The second type of HPSs are task trainers which allow the practice of specific skills, such as sinus surgery (Malekzadeh et al., 2011); they are often sections of manikins, such as the arm, rather than the full body model and train

a specific skill. The AAMC (2007) include VR technology that is designed to develop a specific technical skill, such as laparoscopic surgery (Youngblood et al., 2005), as part of task trainers.

Unlike HPSs, in a VR simulation the entire environment is simulated. This may be via technology such as Oculus Rift (Kleven et al., 2014) where the user views the virtual world via the headset or it can be via simpler applications, such as Second Life (Skiba, 2009), where the virtual world is recreated on the screen of a computer; these sub-types are defined as immersive and non-immersive respectively (Freina and Ott, 2015). Virtual Patients (VPs) are a further sub-division of VR and are defined as "A specific type of computer-based program that simulates real-life clinical scenarios; learners emulate the roles of health care providers to obtain a history, conduct a physical exam, and make diagnostic and therapeutic decisions" (AAMC, 2007, p7). VPs are the specific focus of this thesis and shall be discussed in greater depth in the Narrative Review chapter.

The different categories of simulation are displayed in ***Figure 1***. This simplified classification is one constructed for the purposes of this review but is based on AAMC (2007), Bradley (2006) and Lin et al. (2011).

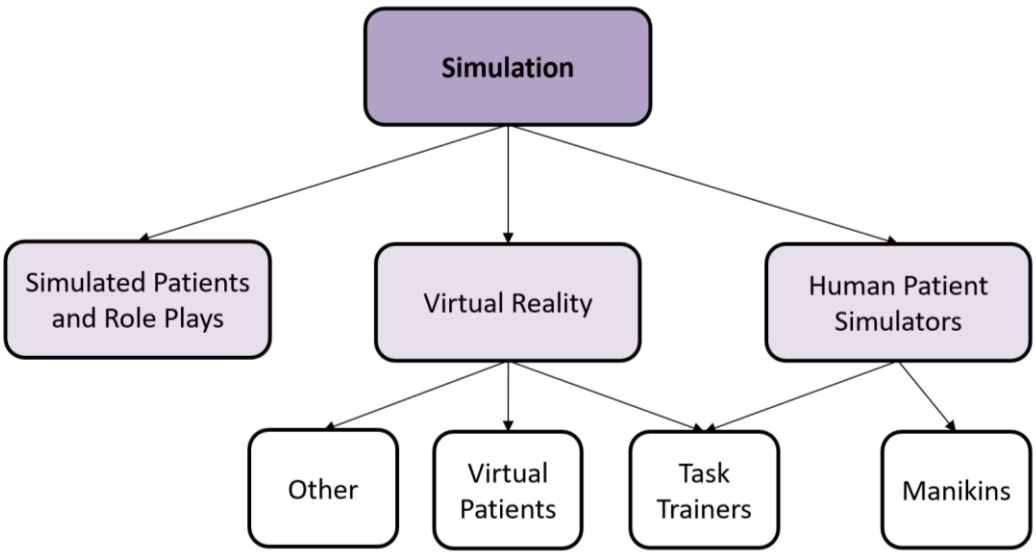

Figure 1 - Types of simulation

Fidelity, how close the simulation is to the real world scenario, is a parameter that is not included in **Figure 1**. Simulated patients and role plays are the highest level of fidelity with the other modalities being of relatively lower fidelity. VPs range in fidelity from low to medium, when compared to simulated patients.

While not defined as simulation, there is a fourth item to touch on; computer-aided instruction or CAI (AMMC, 2007). With these technologies, the role of the instructor is to a certain extent taken over by the computer as it is used to deliver material and explain concepts. CAI is therefore not simulating anything, but focusing on delivery of material, potentially utilising multimedia.

One of the important components of simulated learning has been stated as the "right to make mistakes" (Larbuisson et al., 1999). This notion, practicing a task while ensuring safety, could almost be argued as the raison d'être of simulation learning (Rutherford-Hemming, 2012); Issenberg and colleagues (2005) included a “controlled environment” in their evidence-based list of features for effective simulation learning in medical education. Other inclusions on their list of 10 features were repetitive practice, provision of feedback and curriculum integration. These features are closely related to those suggested by Ericsson (2004) for the acquisition of expert performance through deliberate practice; deliberate practice asserts that one cannot acquire skills through routine clinical practice but must incorporate a practice-feedback loop. It is prudent to incorporate these features into the design of a learning session but not necessarily as part the simulation itself. For example, the feedback element can be provided as part of a debrief after having completed the simulation (Dreifuerst, 2009).

In nursing education, researchers exploring simulation education are not always explicit about their use of learning theories; this is suggested to lead to teacher-centred practice rather than learner-centred (Kaakinen and Arwood, 2009). When theory is referenced though, simulation is often based on Kolb’s experiential learning, that is, learning by doing (Medley and Home, 2005; Kolb and Kolb, 2005). The learning occurs after the concrete experience of the simulation (Zigmont et al., 2011),

pairing it with reflective practice to learn and develop. There are a variety of other theories that educators use to inform simulation learning such as social, cognitive and constructivist theories (Rutherford-Hemming, 2012). Nestel and Bearman (2015) note the variety of different theories that can support simulated education but they also note the diversity of simulation and, seemingly as a consequence, suggest that there is no current singularly appropriate theory.

Evidence shows that simulation-based learning seems to yield an improvement in clinical skills but the integration and context-heavy nature of using the different simulation techniques needs careful consideration (McGaghie et al., 2010; McGaghie et al., 2011). This affects the generalisability of studies and perhaps means that one should evaluate the use of simulation within their own context and setting.

Educators need not choose a single learning method but can make use of a blended approach, using multiple methods (Aper et al., 2012; Draper et al., 2009; Papageorgiou et al., 2011). If simulation were to be applied to teaching SDM, it would be prudent to combine it with other methods, such as those featured in ***Table 1*** (Kurtz et al., 2005; Maguire and Pitceathly, 2002). Different types of simulation can also be used; potentially using both simulated patients and VPs, for example. Using one method in isolation is unlikely to be successful when compared to multiple methods with each increasing in fidelity and complexity as the learner's skills improve (Alessi, 1988; Rodriguez-Paz et al., 2009).

Using a blended approach has been demonstrated to result in positive attitudinal changes (Jenkins and Fallowfield, 2002), a more patient centred consulting style (Oh et al., 2001) and improved OSCE scores (Yedidia et al., 2003). Demonstrating meaningful and robust improvements in real clinical practice as result of any of these educational methods has so far proved largely elusive; this is in part due to the difficulties involved in measuring such a change (Cantillon and Jones, 1999; Nendaz, 2011).

1.6. Summary

SDM is about combing both a health professional and a patient's expertise as part of a collaboration to make decisions about individual patient care. This allows decisions to be informed by both the best available evidence and the patient's preferences and values. Research shows that SDM is not occurring in practice to the degree that it ought to and inappropriate paternalism is still present. While EBM is essential to the process of SDM, it is suggested that EBM has been misinterpreted, leading to professionals neglecting patients' preferences in the decision-making process, focusing instead on the best available evidence. Clinical guidelines can thus be used to dictate the care of individual patients, rather than informing it.

It is a skill for a health professional to effectively engage in SDM with a patient. In order to develop and hone these skills one must receive instruction, demonstration, practice and feedback. Currently, the focus on SDM and communication skills in the education of health professionals seems to be lacking. There are a variety of methods that a health professional can use to practice doing SDM. VPs, a particular type of simulation, have been mentioned as they allow the learner to practice their skills in a safe, controlled environment. The next chapter moves on to a more comprehensive review of VPs.

2. Narrative Review

2.1. Introduction

The first chapter provided an overview to the background topics relevant to this PhD. This was broad in nature to establish the topics and fields upon which this project is built. This particular chapter moves onto a more thorough review of the specific focus of this thesis; Virtual Patients (VPs) for the development of health professionals shared decision-making (SDM) skills.

SDM is a very specific area. If one looked only at research with VPs developing the skills for SDM, that would be a very brief review; in fact, there may not be a single paper incorporated, depending upon the inclusion criteria. The case has been put forward that SDM is achieved through communication between a professional and a patient (Bensing, 2000). Therefore, this chapter widens the net slightly to include closely related topics; VPs for developing the shared decision-making *and/or* communication skills of health professionals, both under- and postgraduate.

2.2. Type of Review

There are many different types of literature review, all with different purposes (Grant and Booth, 2009). Reviews must start by finding relevant literature which is then reviewed or analysed with conclusions drawn from the findings (Kable et al., 2012). The way in which the literature is searched to find publications can be unstructured or it can be more systematic, with the former sometimes labelled as a 'traditional literature review' (Cronin et al., 2008). A systematic search strategy uses defined and specific search terms to interrogate databases in order to find relevant items of interest. Poorly defined search strategies are listed as a common concern for literature reviews (Roundtree et al., 2009). This is because there is a greater risk of bias with an unstructured search strategy as one

could simply cherry pick their favourite papers and not include all the relevant literature; one could select only the papers that agreed with their view and ignore others, what is described as selection bias.

Narrative and systematic reviews are two common types of review that differ in both their aim and their approach to data analysis (Ferrari, 2015; Greenhalgh et al., 2018). A systematic review seeks to answer a specific question e.g. does ibuprofen reduce pain in middle aged patients with osteoarthritis of the knee when compared to placebo. As this is a very specific question, a review should gather all the relevant data and then combine it systematically to arrive at an answer; in this particular example, the answer could be either a 'yes' or 'no', perhaps with an estimate of the size of any effect. The answer could also be 'unsure' as the evidence may be conflicting or of too low quality to draw a firm conclusion. A narrative review does not typically involve answering a specific question; rather than combing the research systematically, the research is discussed in a narrative to appraise and debate it as well as find gaps for future research, although the latter can also be achieved with a systematic review. A narrative review can still use a structured search strategy to gather published research from a particular field, much like a systematic review.

Greenhalgh et al. (2018) suggest that systematic reviews are frequently viewed as superior to narrative reviews, an assertion that Greenhalgh et al. do not support. Stegenga (2011) highlights that meta-analyses, a technique often used in tandem with systematic reviews, have often been viewed as superior to other reviews but concludes that this hierarchy is spurious. Systematic and narrative reviews seem to fall into a similar battle as qualitative and quantitative methods; both are useful, both generate important knowledge or understanding but one is not ultimately superior to the other (McCusker and Gunaydin, 2015). Systematic and narrative reviews have different strengths and weakness and hence different purposes (Collins and Fauser, 2005). As they have different purposes, they both have their respective functions but can be chosen inappropriately for a given task.

As an example, there are some questions that would probably be best answered by a systematic review; for example, do VPs improve medical students' scores on knowledge-based assessments? After using a systematic search strategy, one would screen all the results to find the relevant research and then, perhaps using a meta-analysis, calculate an answer. However, if one wanted to discuss the design of different VPs and highlight the rationale for future inquiry, a narrative review could be more appropriate. Some VP researchers conduct randomised controlled trials while others use phenomenology; papers using these diverse approaches would be difficult to combine in a systematic review but could be discussed in a narrative review.

The purpose of this literature review was to explore the research that had been conducted to review the different VP designs, their educational aims and to find where there were gaps in understanding. This would also help to refine the aims of the research. Due to the emerging nature of both the use of VPs and shared decision making, a narrative review was more appropriate in comparison to a systematic review. The methods used in the VP literature are diverse, as are the VPs themselves, so a systematic review incorporating all of the research of interest would be difficult if not impossible to conduct. Thus, a narrative review with a structured search strategy was undertaken.

2.3. Method

Kable and colleagues (2012) have described a 12-step guideline for literature reviews with a particular focus on the search strategy. This has been used to guide the reporting of this narrative review; Elsevier also have a narrative review checklist which touches on many of the same points as that from Kable (2012).

2.3.1. Purpose Statement

The purpose of this narrative review was to review the published research on the use of virtual patients for developing shared decision-making and/or communication skills of health professionals, both under- and postgraduate.

2.3.2. Databases

The databases interrogated were PubMed, Medline, PsycINFO, CINAHL, EMBASE and BNI. All of the databases were accessed via the NHS Healthcare Databases Advanced Searches.

2.3.3. Limits Applied to the Search

There were no limits applied to the search.

2.3.4. Inclusion and Exclusion Criteria

A VP is defined here as a "specific type of computer program that simulates real-life clinical scenarios; learners emulate the roles of health care providers to obtain a history, conduct a physical exam, and make diagnostic and therapeutic decisions" (AAMC, 2007, p7).

The inclusion criteria were as follows:

- A VP accessed via a computer.
- VPs focusing on communication and consultation skills were included; communication did not have to be the primary focus of the VP but it had to include a communicative interaction between the user and the patient.
- The learners could be undergraduates or postgraduates from any health profession.

- Descriptions, evaluations and reviews of VPs were of interest as were pedagogical discussions concerning their use.
- The papers did not have to define their technology as a VP for it to be included, provided the description matched the definition from the AAMC (2007).

Exclusion criteria were as follows:

- VPs not based on computers, such as Simulated Patients (SPs) or manikins.
- Those developing solely technical skills, such as the fine motor skills required for surgery, were excluded; in accordance with the discussion in the first chapter, these would be defined as task trainers.
- Papers not written in English and no translation was available.
- VPs not focused on human healthcare.
- VPs for assessment as this thesis is focused on teaching and learning the skills for SDM, not the assessment of these skills.
- VPs focused on purely interprofessional communication as it is recognised as a separate skill (Rider et al., 2006).
- Any VPs looking to develop clinical reasoning or decision-making without the involvement of a communicative interaction were excluded.

2.3.5. Search Terms

To establish search terms requires one to review their purpose statement and break down the key concepts (Ferrari, 2015). For this review, virtual patients, communication skills and decision-making are the key concepts but they may masquerade as different terms so synonyms were used. NHS HDAS has a thesaurus function so this was used to create other phrases. The MeSH database was also used for this purpose. The search strategy used is listed in Figure 2.

1.	“virtual patient*”
2.	communicat*
3.	decision making
4.	consult*
5.	2 OR 3 OR 4
6.	1 AND 5
7.	computer simulat*
8.	educat*
9.	train*
10.	teach*
11.	develop*
12.	8 OR 9 OR 10 OR 11
13.	5 AND 7 AND 12
14.	6 OR 13

Figure 2 - Search Strategy

The truncation feature (*) was used to search for multiple variants of a root word; “communicat*” for instance would search for communicating, communicate, communication and communicated. Search line number 7 was different for the PubMed search as it did not include the truncation feature; “computer simulation”, that is. This was because PubMed recognised it as a MeSH term and thus provided a slightly more comprehensive search. For all of the databases, line 12 was combined with line 7 as computer simulation is too wide a search term to use on its own.

2.3.6. Quality Appraisal

One needs to ensure that the items included in a review are of sufficient quality. An issue for this review was that the papers of interest were very diverse; as an example, evaluative studies, such as RCTs, were to be included but so were papers describing the design of a VP. A quality appraisal tool

was required which was sufficiently broad in scope so as to be useful in assessing the wide range of potentially included papers. Morrison et al. (1999) developed such a tool which is designed to appraise reports of educational interventions. The criteria in the checklist are necessarily subjective; as an example, “Is the precise nature of the intervention clear” relies on a judgement by the researcher. The tool thus helped to structure and inform the quality appraisal but was not prescriptive and inflexible. This tool had previously been used by researchers reviewing the VP literature (Thompson, 2018).

2.3.7. Process of Review

A single reviewer was involved in all of the review stages.

During the 1st review, all titles and abstracts were screened. During the second review, those of potential interest were then read in full to establish which papers were to be included in the review. Formal literature searches using the search strategy above were conducted at the outset of this PhD in October 2016, in May 2017 and again in September 2018; extra papers were sourced throughout the PhD but not from formal literature searching. Attendance at conferences, mailing lists and social media were all sources of extra papers. As long as those papers met the inclusion criteria, these additional papers were included in the review in a snowball approach.

The process by which papers were found and included/rejected is summarised in Figure 3.

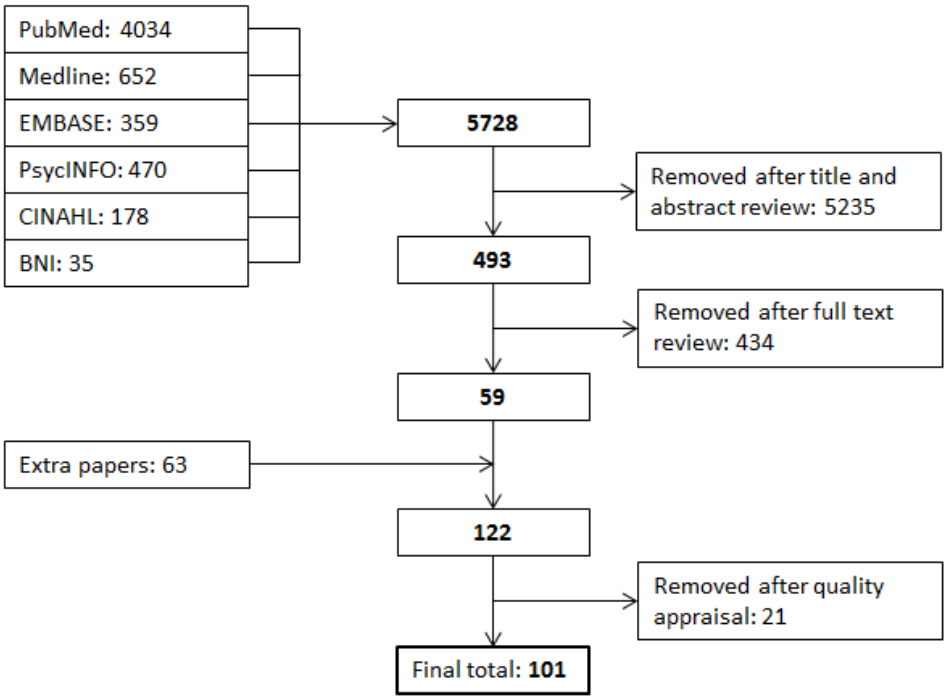

Figure 3 - Process of literature searching

2.3.8. Process of Synthesising Results

All of the papers to be included were tabulated. The table was populated with the relevant information for each paper; title, year, authors, the focus of the VP (e.g. motivational interviewing), the participants/users of the VP, the way the interaction with the virtual patient was achieved, the representation of the patient, study design and a brief summary of the main results and conclusions. From this table the narrative review was then constructed.

During the writing phase, the results were grouped into sections describing particular aspects of the included papers. As an example, a section planned in advance of conducting the review was 'Methods' i.e. what research methods are used in the included papers. Other sections, such as 'Heterogeneity', were not planned in advance but arose during the reading and tabulation of the included papers.

2.4. Results

The papers included are tabulated in appendix 1. Hence forth in this chapter, 'the patient' refers to the virtual patient, unless stated otherwise. These findings are only applicable to the papers included in the review and do not extend to other simulation or VP literature.

2.4.1. Heterogeneity

There was a great deal of heterogeneity among the different VPs included in the review. The ways in which VPs differed included the design, educational topic area, target users, representation of the patient and the way in which communication was achieved. There were two formal definitions of VPs in the literature which are as follows;

- "An interactive computer simulation of real–life clinical scenarios for the purpose of medical training, education, or assessment" (Ellaway and Masters, 2008)
- "A specific type of computer-based program that simulates real-life clinical scenarios; learners emulate the roles of health care providers to obtain a history, conduct a physical exam, and make diagnostic and therapeutic decisions" (AAMC, 2007, p7)

These definitions are ostensibly quite similar. The only significant distinction is the AAMC's greater specificity as they state that VPs are used for history taking, examination and decision-making. Using this definition, a VP simulating a surgical procedure would not be considered a VP as it does not encompass history taking; the Ellaway and Masters definition on the other hand does not exclude task-based trainers. These definitions do not highlight the diversity of VPs; it is perhaps their breadth that results in the diversity i.e. they are somewhat vague and thus many things can be defined as a VP. The definition used for this thesis was the one taken from the AAMC (2007).

Kononowicz et al. (2015), Huwendiek et al. (2009a) and Ellaway et al. (2008) have constructed classifications and typologies for VPs. None of the three completely aligns with the others or with definitions of more general simulation (AAMC, 2007). As none of them are adopted as the universally-accepted classification, there is a certain degree of confusion in the literature; different terms are often used interchangeably and seemingly indiscriminately resulting in no systematic nomenclature (Huang et al., 2007). A survey of dental schools in the US and Canada (Cederberg et al., 2012) found that VPs were used in a variety of ways with a range of definitions; one of the conclusions the authors came to is that the definition of a VP may need to evolve. Berman and colleagues (2016) also hold a similar view, suggesting that current definitions are insufficient. They suggest a loose definition of their own; "multimedia, screen-based interactive patient scenarios". This too though is perhaps not up to task as it does not seem to exclude task trainers.

The lack of a clear definition for VPs was a contributing factor to the most common reason that papers were excluded from the review after quality appraisal. Technology was often described simply as a 'virtual patient' or even more vaguely as a 'simulation'; as the previous two paragraphs detail, this alone is insufficient for comprehensively describing a piece of technology. Therefore, papers had to be excluded if the design of the VP was not clear.

2.4.2. How Communication Is Achieved

Figure 4 summarises some of the main ways communicative interaction is achieved; this has been constructed for this review.

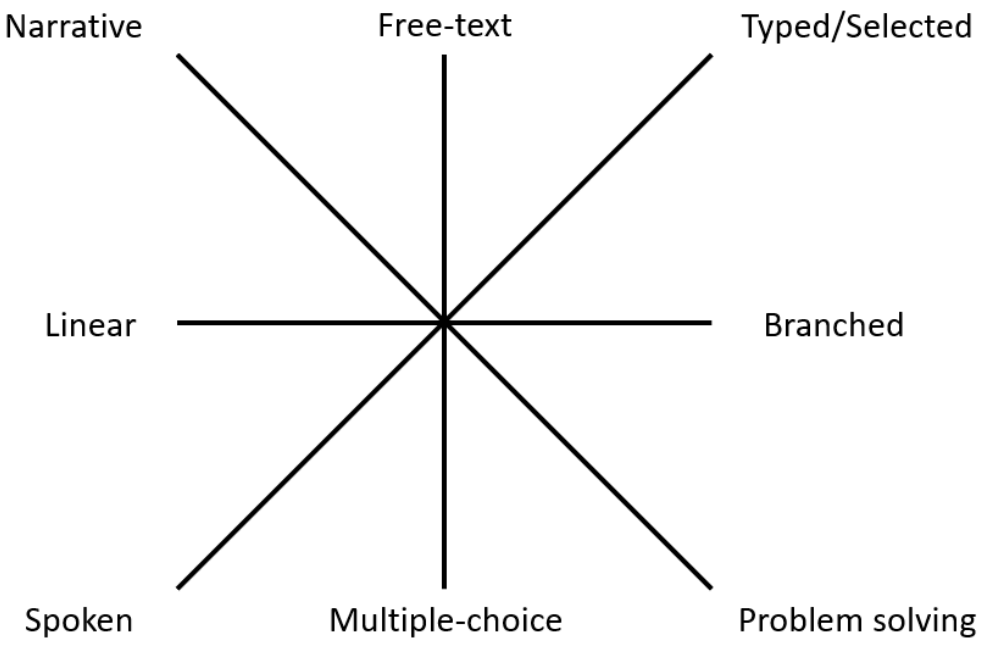

Figure 4 - Potential features of communicative interaction with VPs

Communication skills are suggested to be comprised of a variety of different skills and it seems that some of these sub-skills can be developed by VPs (Bearman et al., 2001). Content of speech, which includes the words used and also the order of the words, may be taught effectively by a VP (Dickerson et al., 2006; Raij et al., 2007). The words that are used, the content of speech, are not the only relevant issue but also the tone which the professionals speaks in; while there was no evidence that any group had attempted this, some suggest it may be possible to measure tone of voice with a VP(Parsons et al., 2008). In addition to verbal communication (content and tone), non-verbal communication is also an important skill when communicating with patients. It is suggested in the literature that body language may be better suited to SPs as it is currently difficult for a computer to read a person's body language. Developments in technology may address the latter point though as the group working with the DIANA VP have used tracking software to measure the body language of the learner (Deladisma et al., 2007; Raij et al., 2007); this technology is still in its infancy. The type of conversation being modelled is an important consideration as it is reported that history taking, a fairly constrained interaction, is easier to model than the wider scope of a rapport building

interaction (Dickerson et al., 2005; Talbot et al., 2012). At present, speech content seems to be suitable for development by a VP, especially within narrowly focused consultations, but the technology is less suited to body language, tone of voice and more complex patient interactions; this carries the caveat that future technology may address this.

Communication with the patient is achieved in a variety of different ways. VPs can be designed to allow the user to interact with either their own words or pre-selected phrases; they are described here as free-text and multiple-choice respectively (Bracegirdle and Chapman, 2010). Free-text allows the user to type or say whatever they wish, in whatever way. These systems have been found to take a substantial amount of time to create (Bergin and Fors, 2003; Zary et al., 2006) and also entail problems with phrase recognition (Deladisma et al., 2008; Foster et al., 2015; Kenny et al., 2008). Not only does a system have to recognise individual words but also the context in which they are said (Maicher et al., 2017). Stevens et al. (2006) found that their VP recognised 60% of the phrases entered which caused frustration for the learners; the learners did also state that this resembled reality as a real patient may not understand what a professional has said which means that the question needs to be repeated or rephrased. Free-text VPs can reportedly 'evolve' with use; the software can log any unrecognised questions and an educator can then input a suitable answer to the database so if the question is subsequently asked by another student, a response is given (Foster et al., 2015; Shah et al., 2012).

Multiple-choice systems present the user with an array of choice of what to say or do and the user selects their desired option. Multiple-choice systems have been noted to restrict learners as they can only choose from certain options (Hurst and Marks-Maran, 2011; Liaw et al., 2000). On the other hand, multiple-choice VPs are easier to create than free-text (Dukes et al., 2013; Yang et al., 2013; Zary et al., 2006). Learners have also reported enjoying being able to select what to say from a list of options, perhaps because of the simplicity although the reasons for this enjoyment were not elaborated on by the participants (Dukes et al., 2013). One variation of multiple-choice VPs is

whether the user selects the exact words they wish to say to the patient or merely choose the sentiment (Cook, 2012) e.g. “ask for more information”. Although there was no formal evaluation of the latter, it seems unlikely that it would develop communication in any meaningful way as neither content of speech nor body language are involved. Schittek Janda et al. (2004) suggest that it is important to iron out the issues with free-text VPs as it is a superior system to multiple-choice. They suggest that this is because free-text involves recall of information whereas multiple-choice only requires recognition of the ‘correct’ phrase, something that alters the learning experience.

Another variation is problem solving or narrative styles (Peddle et al., 2016). Problem solving VPs allow the user of the VP to select questions, usually from lists, to gather a history (Beyer-Berjot et al., 2015; Pantziaras et al., 2015); the questions can be asked in any order and it appears that the patient will often supply complete answers e.g. “what medicines do you take?” would yield the ‘correct’ answer. In reality, a patient may not remember what they take or may require prompting with follow up questions; some VPs have consequently tried to simulate this by generating incomplete patient responses, requiring the user to ask follow up questions (Georg and Zary, 2014). Problem-solving VPs seem to reduce communication to a technical exercise rather than develop the emotional skills such as rapport building; this is thought to be because the patient is treated as a ‘case’ rather than as a person (Peddle et al., 2016). In this way, communication with the patient is viewed solely as an information gathering exercise and does not include the patient’s ideas, concerns and expectations about the issue presenting or management options.

Narrative VPs on the other hand simulate an encounter with a patient over time, although it is not clear what this time period covers (Peddle et al., 2016). Narrative VPs could follow the patient over a period of years (Henderson, 1998) but the definition does not exclude following the patient through a consultation chronologically, step by step. Narrative VPs have been shown to be superior to problem-solving VPs in developing rapport and emotional elements of communication (Bearman, 2003; Bearman et al., 2001; Bearman and Cesnik, 2001). Unlike problem solving VPs, narrative VPs do

not usually allow the user to say whatever they choose at any point as communication flows more naturally.

A third distinction to VPs is branched or linear (Ellaway et al., 2008; Guise et al., 2012). In a linear VP, the learner must get the right answer before progressing to the next section; with a branched model on the other hand, the choices of the learner dictate the outcome. Branched VPs therefore allow the learners to see the effects of their actions which may well be harmful to the patient if the user did not make the optimal choices. The visualisation of the effects of their actions in a branched model is thought to be helpful for learners as it can aid learning (Bearman, 2003; Huang et al., 2007).

A fourth way in which communication is facilitated by VPs is whether the words are spoken or typed/selected from a screen. From the papers included in the review, the majority of the VPs do not use voice recognition, but there are some that do (Bloodworth et al., 2012; Kron et al., 2017). There seems to be a desire for this feature as experienced nurses reportedly would have preferred to use their own voice to speak rather than select from multiple choice options (Dubovsky et al., 2017). In a small pilot study (n=5), Bloodworth et al. (2012) found that nurse participants were frustrated by the system not recognising their speech but still preferred it over a typed or selected response due to it feeling more real; they were not exposed to typed or selected responses during the evaluation. The DIANA group have utilised speech-recognition in tandem with visual tracking (Deladisma et al., 2008, 2007; Dickerson et al., 2006; Raij et al., 2006; Stevens et al., 2006). The afore mentioned speech and phrase recognition issue was noted as causing frustration in most of the papers, but it was also reported as similar to reality (Johnsen et al., 2005) i.e. the need to repeat and rephrase questions for the patient to understand. The DIANA VP was also very well accepted by the medical student participants and while it was noted as different from an SP interaction, it was still a useful learning activity suggesting a place for it in the curriculum.

While all of the technology included in the review involved an element of communication, some authors do not think that VPs can effectively develop communication skills (Botezatu et al., 2010a;

Cook and Triola, 2009; Kleinert et al., 2015). Medical students who used a VP for history taking and clinical reasoning suggested that there was not sufficient emotional involvement in a VP to develop communication skills (Kleinert et al., 2016). It is perhaps because of this that most VPs have focused on developing knowledge, history taking or clinical reasoning rather than interpersonal communication skills (Cook et al., 2010). A 2012 meta-analysis of VPs in medical education (Consorti et al.) concluded that while the effect size is greater for clinical reasoning, VPs do still have a positive impact on communication skills, something other researchers concur with (Sunnqvist et al., 2016). Another reason for doubting the utility of VPs for communication skill development seems to rest on the notion that SPs are superior (Cook and Triola, 2009); Cendan and Lok (2012) and the afore mentioned research with the DIANA simulator both suggest that VPs are useful for communication skills but not as a replacement for SPs.

2.4.3. Place in Education

The context into which a VP is placed requires thought (Cook, 2012; Murphy et al., 2016); this context includes but is not limited to the level of experience of the user, the profession of the user, and other educational methods used in addition to the VP, such as SPs.

Healthcare students tend to start their education learning basic concepts in paper-based, classroom learning and didactic lectures, before progressing to SPs, role plays and real patients. VPs may help students early in their studies prepare for interactions with real patients later on in the course (Gorrindo et al., 2011; Kleinert et al., 2016; Kleinsmith et al., 2015; Kron et al., 2017; Shah et al., 2012; Stevens et al., 2006; Sweigart et al., 2014). VPs are more interactive than paper-based methods (Pantziaras et al., 2012; Pataki et al., 2012) and are also reported to be fun and enjoyable to use (Hortsmann et al., 2009). VPs simulate the features of a consultation in a relatively life-like way, but in a safe and low-stress environment as mistakes do not carry the consequences of upsetting a real person (Botezatu et al., 2010a; Courteille et al., 2014; Kidd et al., 2012). They allow learners to

be exposed to a situation in a way that is less intense than the real thing (Ekblad et al., 2013), thus reducing the anxiety felt before interactions with real humans (Foster et al., 2016; Sunnqvist et al., 2016).

Numerous methods are suggested to be important for developing communication skills which include SPs, role-plays, and video and audio recordings and these methods should be combined strategically as part of a spiral curriculum for optimal development of communication skills (Kurtz et al., 2005). VPs are therefore not designed to completely replace these existing methods but serve as a complementary technique (Bergin and Fors, 2003; Deladisma et al., 2008; Kleinert et al., 2015). Foster et al. (2015) suggest that a specific curricula niche occupied by VPs is the opportunity for repetitive practice. Unlike role plays or SPs, VP technology will not tire and can provide a standardised experience time and time again (Deladisma et al., 2007; Ellaway and Masters, 2008; Phillips and Berge, 2009). Triola et al. (2006) found that using a mix of SP and VP cases was accepted equally well by physicians as SP cases alone; those using 2 VP and 2 SP cases felt more prepared than those using 4 SP cases, leading the authors to suggest that a mix of different methods (VPs, SPs and real patients) can allow learners to see their progression. Hortsmann et al. (2009) come to a similar conclusion, that VPs can be useful to prepare students for interactions with real patients but not as a total replacement. One way in which VPs can perhaps completely replace existing methods is in the simulation of rare or high-risk situations (Hubal et al., 2000; Phillips and Berge, 2009). Consulting with paediatric patients is something that an adult actor cannot do in a realistic way and it is both ethically and practically difficult to use a child actor (Hubal et al., 2003).

There are suggestions from research that a multiple-choice VP may be useful early in one's education and a free-text VP later on as experience accumulates (Carnell et al., 2015; Huwendiek et al., 2009b). This links to work highlighted earlier in this review concerning the difference between recall and recognition (Schittek Janda et al., 2004); perhaps novice learners cannot be expected to recall information as they have not yet learnt that which requires recalling so a multiple-choice VP is a

more prudent choice. However, for assessment or the learning of more experienced professionals, a free-text VP may be better, stressing recall rather than just recognition.

It is not just practice that is required for skill development but also the feedback that follows (Ericsson, 2004); some results included discussion of the feedback stage of VP education (Cook, 2012; Pantziaras et al., 2015; Sunnqvist et al., 2016). Scoring the learners efforts with the VP may not be a desirable feedback approach as in a grounded theory study, Bateman et al. (2013) found that learners tried to chase a score instead of focusing on improving their skills. Pantizaras et al. (2014) found the resident psychiatrists in their study liked that the VP system gave them feedback as they found it more palatable than from a facilitator in isolation. While the specific design of the VP is a little unclear, Edelbring and colleagues (2012) found that different forms of follow up were a beneficial addition to VP learning; the different forms included a seminar given by an educator, a student-led seminar and an amalgamation of the two with the student seminar rated most highly. Linked to this idea, researchers have found benefits in discussing the simulation with learners after its use (Close et al., 2015). Discussion was thought to be important as it allowed learners to link their virtual experience to real world practice (Cook, 2012). Both groups of authors (Close et al., 2015; Edelbring et al., 2012) propose that VPs need to be viewed holistically and from the perspective of overall course design rather than focusing solely on the VP technology itself. As well as a comprehensive follow up discussion, the durability of any learning effect requires consideration. Pantziaras et al. (2015) found that the positive learning effect observed in a post-VP test was not sustained on a follow up test 3 months later, suggesting multiple sessions may be required; the test was a multiple-choice assessment of the participants' knowledge of diagnostic criteria, clinical management and communication theory.

2.4.4. Theory

The majority of the papers included in the review seemed to take an a-theoretical approach to VP education; or, if they do use theory, they are not explicit about it. Those who do use theory often base their VPs on Kolb's experiential learning cycle (Kolb and Kolb, 2005; Kleinert et al., 2016; Pantziaras et al., 2015); this is an approach common to simulation learning in a wider sense (Kaakinen and Arwood, 2009). The Kolb cycle provides a framework for experiential learning where one learns from experiences via a four-step reflective cycle (see Figure 5); this makes the Kolb approach a constructivist one where learners learn by attaching meaning to an interaction (Rutherford-Hemming, 2012). The VP is thought to provide the first step of the cycle, the concrete experience required to reflect on. The rest of the cycle is then achieved in different ways; as section 2.4.5 discusses, a group discussion or debrief can be used which is purported to help learners think and reflect on their experience. Few VPs incorporate this formal style of debrief. Another theory on reflective practice is Schön's (Argyris and Schön, 1997) which Henderson (1998) links with Kolb's theory to create what they name the 'virtual practicum' to base VP education on. Whether Schön or Kolb, it seems that reflective practice is an approach common to those papers included which discussed theory.

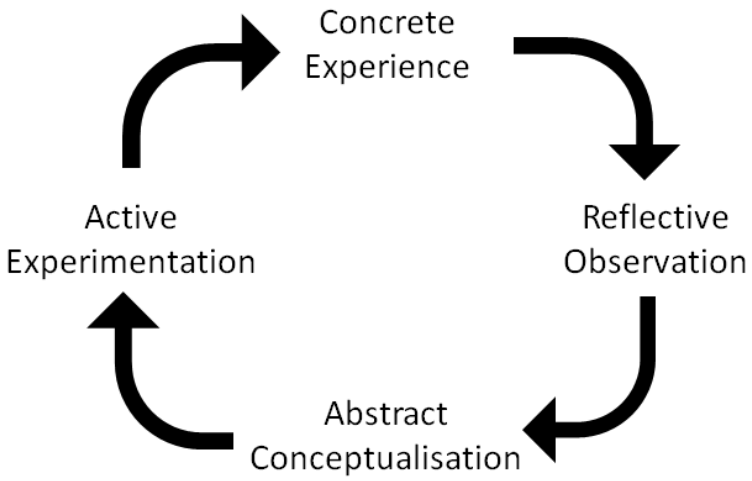

Figure 5 - Kolb cycle; adapted from Kolb and Kolb (2005)

2.4.5. Shared Decision Making

From the papers included in this review there was only a single VP which sought to develop SDM (Schoenthaler et al., 2017). This VP was based on a patient with a sore throat who wished to receive antibiotics. It utilised a branched multiple-choice style and did not seem to focus solely on SDM, but more on motivational interviewing, patient centred care and empathy; these are all areas associated with SDM. The system differs from other VPs as it was designed to be used prior to a real consultation by both the physician and the patient; the intention was to place both parties in frame of mind conducive to a SDM consultation, priming them for the forth coming interaction. Among the 35 professionals and 34 patients, there was a small gain in provider attitude to SDM ($p=0.01$) and an increase in patient antibiotic knowledge ($p=0.001$). Self-reported scores of SDM did not change after using the VP for either patients or professionals. Albright et al. (2018) used the same platform as Schoenthaler (Kognito) to focus on motivational interviewing. Nurses and doctors rated the simulation as useful for their practice and reported that it enhanced their knowledge and skills. When comparing pre-simulation and 3-months post simulation, the participants self-reported

frequency of screening behaviours increased ($p<0.05$). The authors noted that real humans (SPs) can display more nuanced behaviour than a VP but they cite their positive findings as evidence of the utility of VPs.

Other VPs touch on elements related to SDM such as patient centred care; Deladisma et al. (2007) set out to develop empathetic responses in medical students which included measuring their body language. The study found that this resulted in statistically significant ($p<0.05$) differences between an SP and a VP with the SP liberating greater empathy from the participants; the VP was concluded to be useful but not as a replacement for SPs. Hayes-Roth et al (2004) developed a VP for motivational interviewing which utilised a free-text system. Medical and nursing students trained using the VP achieved better SP assessment scores of their motivational interviewing than did those trained using an e-book or a no training control; there was no statistical analysis of this change. While these examples demonstrate VPs aimed at improving skills related to SDM, none of them seeks to improve SDM itself, apart from the Schoenthaler example.

The majority of other VPs are often focused on obtaining a history rather than building rapport or a discussion of treatment options (Abbey, 2002; Beyer-Berjot et al., 2015; Botezatu et al., 2010c). In the majority of the VPs, the learner also decides the treatment plan at the end of the simulation without any discussion with the patient (Abbey, 2002). This would not seem to help with developing the skills needed for SDM as it could be viewed as reinforcing the antithesis of SDM; the application of a treatment plan to a patient without any discussion, paternalistic rather than shared decision-making.

2.4.6. Second Life

Some VPs are developed from commercial software that was not designed for the health professions in the first instance but for leisure; one such example is Second Life. Second Life is an online world occupied by user-created avatars interacting with other people's avatars and the virtual world

(Phillips and Berge, 2009). There are public spaces which any person can access via an internet connection but there are also 'islands' which can be created for educational purposes and closed off to the wider public.

From the papers included in this review, Second Life is particularly prevalent in nursing and dental education. It can be used for a variety of purposes including content provision, interaction and communication, and patient simulation (Ahern and Wink, 2010); it can therefore be targeted at developing technical and/or emotional skills. Second Life has been shown to be well accepted by students (Kidd et al., 2012) although, as for other VPs, it was suggested as a supplemental technique (Papadopoulos et al., 2013; Phillips and Berge, 2009), helping to smooth the transition from 'classroom to clinic' (Sweigart et al., 2014).

Second Life was the chosen platform for several of the VPs included but there are concerns which stem from issues other than pedagogy (Smyth, 2009). Due to Second Life being an open access, online world, the content of the wider system is not always controllable. There are concerns about learner exposure to pornography (Mennecke et al., 2007), child abuse (Meek-Prieto, 2007), illegal gambling (Kaplan and Haenlein, 2009), and the potential for money laundering & terrorism (Irwin et al., 2014).

2.4.7. Representation and Response of the Patient

The patient can be represented in a range of different ways. Firstly, still images, either computer generated (Foster et al., 2015) or photographic (Schittek Janda et al., 2004), can be used. These images can be accompanied by descriptions of the patient's body language or reactions to try and increase the realism (Sunnqvist et al., 2016).

Video clips of actors (real people) can be used to demonstrate body language and sound (Triola et al., 2006) or this demonstration can be animated (Albright et al., 2018). A focus group study of medical

students who had all experienced VPs in their education suggested that VPs should be made as realistic as possible to create a superior simulation (Huwendiek et al., 2009b); the realism of VPs is thought to be important for learning to create a more immersive experience (Deladisma et al., 2008; Raij et al., 2006). There is a caveat to this though which is that the learner's experience requires consideration (Alessi, 1988; Rodriguez-Paz et al., 2009). Putting a novice into a high-fidelity simulation is postulated to be unwise as they will learn much less compared to a lower fidelity simulation; the opposite of this is also true.

The speech of the VP can be delivered using either text (Hurst & Marks-Maran, 2011), pre-recorded speech from an actor or synthesised speech (Hubal et al., 2003). It was reported that the pre-recorded speech is more realistic, as would be expected, but that the synthesised speech had its uses earlier in the curriculum (Dickerson et al., 2006). A step-wise series of simulations all with gradually increasing levels of fidelity could smooth the transition of learners from 'classroom to clinic' (Sweigart et al., 2014).

Finally, most VPs are autonomous, that is, their speech and interactions are controlled by the software so they can be used without input from a facilitator. A minority relied on someone to play the part of the patient, replying on behalf of or moving the patient to correspond to what the learner has said or done (Andrade et al., 2010; Sweigart et al., 2013). Pan and colleagues describe this as a "wizard-of-oz method" (Pan et al., 2016, 2018); a facilitator controlling the virtual patient during an interaction. These VPs, if they can be defined as such, are therefore like SP sessions but with the face to face interaction replaced by a computer animated interface; the resources involved are a significant drawback as both SP and software development costs are incurred. One potential benefit is that the stress of a face to face interaction is removed but study participants reported that the computer element was not additionally beneficial (Lowes et al., 2001).

2.4.8. Methods of Inquiry

There are a variety of methods and approaches employed in the included papers. Some of the papers were not measuring an outcome but simply describing the process of creating a VP and the particulars of its design (Guise et al., 2012; Hubal et al., 2003). Of those that went beyond describing the technology, one of the most common methods was the questionnaire, typically used to gather the opinions and views of the learners (Kidd et al., 2012); this is described as the 'reaction' to the intervention (Kirkpatrick and Kirkpatrick, 2006). The questionnaires were often paired with another method providing a mixed methods approach to the research; these additional methods included interviews (Bergin and Fors, 2003; Dukes et al., 2013; Stevens et al., 2006), focus groups (Bergin et al., 2003), learner observations (Courteille et al., 2014; Dickerson et al., 2006; Raij et al., 2006) and SP assessments (Borish et al., 2014). Both grounded theory (Bateman et al., 2013) and phenomenology (Bearman, 2003) have also been used to research VPs and the learner's perceptions and experiences of them.

In the papers that evaluated a VP beyond the learners' reaction to it, assessments were used to ascertain whether there had been a change in the knowledge, skills or practice of the learners. These assessments include knowledge-based examinations (Kleinert et al., 2015; Pantziaras et al., 2015; Yang et al., 2013), interactions with SPs (Bearman et al., 2001; Hayes-Roth et al., 2004; Turner et al., 2006) and interactions with real patients (Schittek Janda et al., 2004). The studies using knowledge-based tests or exams measured the acquisition of knowledge relating to a technical element of care or about the theory of communication. These VPs were often trying to simulate the whole process of care from history taking through to management and the communication element seemed to be treated as a peripheral issue, viewed as a technical exercise to get information (Botezatu et al., 2010b, 2010c).

One problem encountered in some of the papers is that VPs are often embedded in workshops or curriculums. Depending on the study design, this sometimes made it difficult to draw any firm conclusions because one cannot establish which element of the workshop or curriculum led to any of the changes observed (Detering et al., 2014). A 2016 landscape review of multimedia medical education (McCoy et al.) lead the authors to conclude that there was a dearth of studies employing a sufficiently rigorous methodology to make any clear findings; the review included lots of technology that would not meet the definition of a VP. When testing VPs some researchers use active comparators, such as a lecture (Boynton et al., 2007), group discussion (Fleetwood et al., 2000) or SP (Chaikoolvatana et al., 2003); a minority of studies used a comparison group receiving no education (Albright et al., 2018; Fleming et al., 2009). This affects the respective results as VPs are often used within curriculums where they are complementary techniques; comparing a VP to no education could be of questionable benefit. Both of these studies (Albright et al., 2018; Fleming et al., 2009) allowed those who were randomised to the no education control to use the VP after the study.

The majority of the studies are based on a relatively small sample size; VPs were often used with a single class or cohort so the sample size is predicated by the respective group size. Using a small sample size may be a necessity because it may not be prudent to even try and generalise findings from VP research due to the context-laden nature of their use in education. Some groups explore their technology from different perspectives and in different contexts e.g. those developing the DIANA (Lok et al., 2006) and Justin/Justina VPs (Kenny et al., 2008; Parsons et al., 2008; Pataki et al., 2012). These papers highlight the development of the technology, the initial testing and refinement and build upon one another to construct a holistic view of the VP.

A significant drawback to almost all of the VP research is that those evaluating VPs are also the designers, introducing a potential bias. Some papers are written by employees of companies that would seem to gain financially from the success of the VP (Albright et al., 2016). All of these studies may be victim to conscious and/or subconscious biases making transparency and appropriate

research design of paramount importance. In addition to the biases of the researchers, the biases of the participants require consideration. Some researchers provide financial incentives to encourage participants to take part in a study; Fleming et al. (2009) for example paid participants to the value of several hundred dollars. This seems to be a significant amount of money which could in turn bias the participants and alter their attitude or responses. On the other hand, this payment would also need to be weighed against the requirement for participants i.e. if the reward is required to recruit participants, then it may have been the only option.

2.5. Discussion

2.5.1. Communication and Decision-Making

Some of the papers included in this review did not view VPs as useful for communication skill development. The VPs included encompassed a myriad of different designs and communication with the patient was achieved in different ways. Given this wide variety of VP designs and the emerging nature of the evidence base, it seems inappropriate to suggest that all VPs are ineffective for developing communication skills. Additionally, one reason for doubting a VPs utility for communication skills education is the assumption that SPs are superior. This reason does not seem to take into consideration the numerous drawbacks associated with using SPs; SPs are not standardised between learners and poor-quality acting can negatively affect the experience (Smith et al., 2015; Yardley et al., 2013). SPs do not entail the same power imbalances as a real consultation either which cannot be resolved by a good actor (Hanna and Fins, 2006). Furthermore, as communication is comprised of sub-skills one need not suggest a single method for developing communication skills but welcome the use of multiple methods (Kurtz et al., 2005).

All of the results were VPs involving communication; this was an inclusion criterion for the review. The majority of these papers did not focus on discussing treatment options with the patient which is

central to SDM; some papers touched upon areas allied to SDM, such as motivational interviewing. The majority of VPs approach communication as a task of history taking to formulate a diagnosis rather than a conversation about management options; most of the VPs entail the selection of a management option with no discussion with the patient at all. Not only do many VPs not focus on the discussion of management options with a patient, but many also seem to reduce communication to a technical exercise with questions only asked about symptoms, not a holistic, patient centred conversation incorporating the patient's ideas, concerns and expectations. These two features, the reduction of communication and the application of a treatment plan, seem to be anathema to the development of the skills required for SDM. There is therefore a gap in the literature. While VPs have been studied relatively extensively for history taking and clinical reasoning, they have not been explored for their role in the development of SDM.

2.5.2. The Acquisition of Skills

The acquisition of a skill, such as the communication skills required for SDM, occurs across multiple steps; instruction, demonstration, practice and feedback (Ericsson, 2004; Maguire and Pitceathly, 2002; Rodriguez-Paz et al., 2009). The instruction phase is concerned with learning the fundamental knowledge required and can be delivered by a lecture or textbook. The second stage is demonstration which involves observing the skill being carried out. The final two steps are paired together in a cycle where one practices the skill, followed by feedback on their efforts before practicing again and so on.

The practice step can be broken down even further when one considers the different methods for practicing communicating with a patient. Firstly, VPs, one of the methods for practice, are not a homogenous group; the way communication is achieved and the representation of the patient are two points of variation. How can the different VP designs be used to help learners practice communication? One answer for this is based on the fidelity of the different VPs (Alessi, 1988;

Rodriguez-Paz et al., 2009); it is proposed that learners learn best by starting with lower fidelity methods and progress to higher fidelity ones as their skills and knowledge improve. Indeed, experts are thought to gain little from low-fidelity simulation and novices are in turn thought to gain little from high-fidelity methods.

Combing the results of the review with the skill acquisition literature (Ericsson, 2004; Miller, 1990; Rodriguez-Paz et al., 2009) can lead one to the conclusion that certain VPs may be suitable for different learners at different stages. Less experienced learners may have only recently experienced the instruction and demonstration phases of education; their knowledge and skills are somewhat abridged so a multiple-choice, low-fidelity VP may be more suitable as they practice the skill for the first time. Linear VPs may be more appropriate at this stage too as the learner assumes a passive role in dictating the outcome; linear VPs can thus be seen as halfway between demonstration and practice. As the learner engages with the practice-feedback loop and improves their skills, they may be able to progress to using a free-text, branched narrative, high-fidelity VP.

So far, this discussion has focused on the practice element of the practice-feedback loop but feedback also requires consideration. The results suggest that follow up with an educator and/or peer(s) is a useful addition to the VP experience; using the VP in isolation or with only automated feedback is not as beneficial as allowing the learners to discuss their experiences. This also links to the theoretical considerations and stage of the learners. Kolb's theory of reflective practice was identified in the results as being a common base for VP education; the learning occurs after the VP experience when the learner reflects critically upon it. If one is basing VP education on the Kolb theory of reflective practice then a follow up session could help one reflect and think about their experience by discussing it. More experienced learners will have a greater context within which to set their learning as they have more experience than a novice (Knowles, 1980). While a feedback discussion could be of use to undergraduates and those with less experience, it could be of even

greater relevance for experienced learners who have to incorporate new learning within the framework of their acquired experience.

The design of the VP and its subsequent place in the curriculum is therefore linked to educational theory. It is very difficult to identify a universal theory for VP education because VPs have different aims and contexts envisaged for their use (Nestel and Bearman, 2015). Additionally, educational theory is often discussed in relation to simulation which is a big collection of approaches; applying the same theory to all of them may not be wise. Therefore, one can use different theoretical approaches depending on the context in which a VP is used. The Kolb theory would seem to be suitable for the branched narrative VPs as the user's choices dictate the outcome of the scenario. This may not be the case for a linear VP though as the learner's choices do not decide the outcome so their role is more passive. Thus, the design of the VP, the stage at which one uses it and the underpinning theory are all linked. More research is required to explore this further.

2.5.3. Second Life

There are concerns that the use of Second Life could lead to learners being unintentionally exposed to a range of undesirable features; these include child abuse and terrorism (Irwin et al., 2014; Meek-Prieto, 2007). While these obstacles may well be viewed as so contentious as to make the technology not worth pursuing, some highlight the worth of computer games in education and highlight how they can be made safer and more secure (Trusky, 2016). Others argue that it is not feasible for the creators of Second Life, Linden Lab, to control the virtual world themselves and assistance will be required from governments and regulators (Smyth, 2009). On the other hand, one can also prepare students for virtual worlds and make them aware of the potential dangers as one may do if taking them on a field trip (Bugeja, 2008). Health students are sent out on placements where they may encounter any number of disturbing or upsetting scenes; perhaps students can be prepared for Second Life in a similar fashion to the preparation for placement? These seemingly important issues

do not appear to have been addressed in the VP literature to any great extent (Ahern and Wink, 2010).

2.5.4. Methods

The Kirkpatrick model comprises four levels for evaluating an educational intervention; reaction, learning, behaviour and results (Kirkpatrick and Kirkpatrick, 2006). The research included often focused on the learner's reaction to the VP, what is described as level 1 in the Kirkpatrick model. The higher levels in the Kirkpatrick model (behaviour and results) have not been explored to the same extent so the real-world outcomes, such as patient satisfaction, are largely elusive. One might imagine that going straight to level 4 might be a good strategy, measuring real word outcomes straight away but this is not advisable according to Kirkpatrick and Kirkpatrick (2006); they suggest that one should start at level 1 and build up from there to gain a holistic view, citing it as a 'serious mistake' to bypass levels 1 and 2.

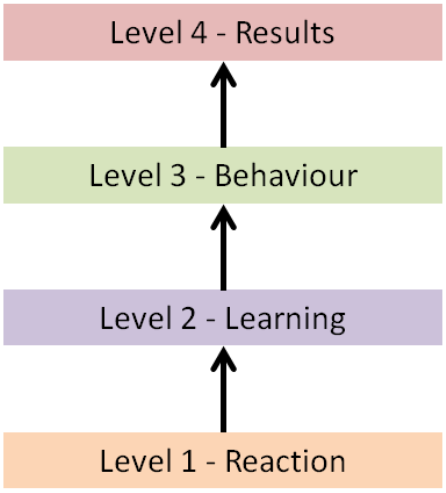

Figure 6 - Kirkpatrick model; designed for this thesis in line with text from (Kirkpatrick and Kirkpatrick, 2006, p21)

A modified Kirkpatrick model breaks both the second and fourth levels down into two separate parts (Morrison, 2003). Level 2, learning, is broken down into modification of attitudes (2a) and acquisition

of knowledge and skills (2b); level 4, results, is broken into change in organisational practice (4a) and benefits to patients or clients (4b). The results from this review suggest that, while it may be wise to start at the lower levels, subsequent research needs to focus on the higher Kirkpatrick levels and evaluate real world outcomes; this suggestion was also present in a review focusing on more general simulation, not just VPs (Blackmore et al., 2018).

2.5.5. Limitations of the Review

With a vast number of published research articles, there is always the possibility that relevant articles were missed by the review. Articles could be accidentally overlooked in the review stages or not identified by the search strategy in the first place. By using a comprehensive search strategy and searching the reference lists of the included papers, it is hoped that the vast majority of the relevant publications are included.

There were a significant number of included papers located from sources other than the primary search strategy. Firstly, this could mean that the search strategy was not designed effectively to capture all of the relevant literature. Secondly, there is no systematic nomenclature or single accepted definition of a VP which means that designing a search strategy is difficult as researchers often use a range of different terms to describe the same types of technology. It is the second explanation that seems more likely as broadly similar search terms have been used for another review on a similar subject (Cook et al., 2010).

2.6. Conclusions

VPs are a diverse collection of learning technologies but few focus on SDM; indeed, many entail the paternalistic, dogmatic application of treatment regimens to a patient. Future work could explore the use of VPs for the development of communication skills in general but more specifically, SDM.

The context in which VPs are set is noted as very important because VPs are often imbedded within curriculums so lots of different variables need to be considered. There is already research exploring free-text vs multiple-choice VPs and their relative merits. There are still unanswered questions in this area though, such as at what stage in one's career are the different styles suitable, if indeed they occupy discrete points. What are the strengths and weakness of the different styles with reference to their effects on learning? How does the progress of technology affect this debate; if free-text were to become better developed, eliminating the phrase recognition issues, would it replace multiple-choice completely, as some seem to think? With lots of different variables affecting the success of a VP, and lots of variables to each VP, which are all likely to differ from setting to setting, small scale evaluations may be the norm rather than large, multi-national trials.

Despite feedback being identified as crucial for VP education it seems from this review to be an under researched area. How should feedback be delivered? Can the software itself give appropriate feedback or is a facilitator required, or a combination of the two? How useful is peer discussion? Some tentative answers to these questions are present in this review but other than the notion that feedback is important, it does not seem to have taken a central role in inquiry, with a few notable exceptions.

3. Methodology

Research is an activity that adds to human knowledge, but is only one way of 'knowing' (Mertens, 2015). Unlike accepting the word of an authority figure or personal insight, scientific research is systematic; it is systematic in the way that it collects, analyses, interprets and uses data. It is this systematic and progressive nature that makes scientific research 'scientific'. Science can cover many different areas and fields each with their own traditions and approaches to research. What follows in the ensuing chapter is a discussion of the methodology relating to this project.

3.1. Research Philosophy

3.1.1. Philosophy

When researchers undertake a piece of academic work, they view it through a set of philosophical assumptions, whether they are aware of this or not (Wahyuni, 2012). For others to understand their work, it is essential that these assumptions are clearly articulated so that the approach that has been taken is clear, enabling appropriate critique and understanding. Therefore, this section will focus on the range of possible philosophical approaches that can be taken.

The first item to consider is that of the 'paradigm' which has different meanings within the scientific literature (Morgan, 2007). It is defined in this section as a way of viewing the world and is consequently described as a "worldview" (Creswell and Clark, 2011). It defines what one views as the nature of the world, the researcher's position in it and the nature of their relationship to other features. As Guba and Lincoln (1994) comment, one's paradigm cannot be said to be correct as there is no way to establish the absolute truth of any given worldview.

A paradigm can be viewed as an umbrella position, under which there are three main philosophical considerations for a research project; the ontological, epistemological and methodological (Creswell

and Clark, 2011; Guba and Lincoln, 1994; Mertens, 2015). In addition to these, Mertens also suggests the axiological. When research philosophy is discussed within the literature, it is acknowledged that there are a multitude of terms used by different scholars in different ways (Mackenzie and Knipe, 2006; Rawnsley, 1998). This chapter only provides a very brief overview; it is by no means the only interpretation and is therefore used to articulate some of the broad approaches available before honing in on the specific position of this particular project. In the words of Rawnsley (1998), "Confining even a synoptic examination of these terms into the length of an essay is roughly analogous to condensing English literature from Beowulf to Virginia Woolf within the format of a book review."

Ontology describes one's assumptions about the nature of reality and what it means to exist. Aristotle is credited with the advent of the concept of ontology in his work *Metaphysics*, although he did not use the term himself (Arneson, 2009a). Aristotle discussed the idea of ontology as coming before other things in that it examines what is common to all that 'be', the being of being. In a similarly succinct way, Quine (1948) suggests that the ontological question can be asked in three words "What is there?"

Epistemology is the branch of philosophy concerned with knowledge and it explores the relationship between the known and the knower (Mertens, 2015). The epistemological stance affects the claims that can be made about knowledge and how we know what we know. Depending on one's position, knowledge can be viewed as an objective truth that we can endeavour to establish or it can be seen as something that we build ourselves, creating our own meanings (Arneson, 2009b). This has clear ramifications for how we discuss the findings of research; it links to ontology as the stance taken on reality affects what knowledge can be 'discovered' or learnt (Guba and Lincoln, 1994).

Axiology relates to values and how we evaluate them (Hart, 1971). While the study of values can be traced back to the 5th and 6th centuries BC, in modern times the study of values has been separated from those of fact; this is seen in the split between the natural sciences (fact) and philosophy (value)

(Arneson, 2009c). Axiology is broken down into different parts including ethics and aesthetics, the former dealing with what is 'right' while the latter deals with the notion of 'beauty'; for this project, it is ethics one is interested in, not aesthetics. There is also an epistemic component concerning what type of knowledge is valued but Mertens (2015) focuses their discussion of axiology on ethics and how we judge whether a given work is 'right'.

The last two topics are methodology and method. The terms 'method' and 'methodology' appear to be closely related simply by the structure of the two words and indeed they are. There are important differences and the two terms, for the purpose of research, are not interchangeable. The method answers the 'what' questions i.e. what was undertaken. For example, a focus group is a method and it describes what one did to reach their findings. Methodology on the other hand deals with the 'why'; why was a focus group conducted? Method can therefore be viewed as relatively simple because while the method itself may be complex, it simply states what the researcher(s) did. The methodology of the research on the other hand will describe and justify why this approach was taken and the assumptions underlying the method. Method and methodology are thus tightly bound and Kothari summarises this as follows;

> "Thus, when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others." (Kothari, 2004, p8)

As can be seen from this brief discussion, these questions, the ontological, epistemological, axiological and methodological all intertwine (Guba and Lincoln, 1994). There needs to be a cogent and consistent approach taken throughout a project to ensure philosophical and methodological congruence. As an example, if one assumes reality is a singular element, external to humans, then knowledge relies on objectively measuring that reality by removing confounders and bias.

Having laid out some of the broad philosophical considerations required, what are the different paradigms used in research? Again, this is no easy topic to discuss in relatively brief terms (Mackenzie and Knipe, 2006; Rawnsley, 1998) and this section is not set forth as a complete, unquestionable classification; other researchers may suggest variations. The four paradigms or worldviews put forward are those proposed by both Creswell and Clark (2011) and Mertens (2015); post-positivism, constructivism, participatory/transformative and pragmatism. Teddlie and Tashakkori (2009) suggest the same with the addition of positivism as well as post-positivism; the difference between the two is discussed in the section 'Paradigms'.

3.1.2. Paradigms

Positivism avows that there is one reality that is external to humans that can be measured. It is based on empiricism which is the advancement of knowledge via the study of the observable. Due to this, validity of research is predicated on removing bias and confounding factors (Guba and Lincoln, 1994); the researcher is seen as exerting no influence in a well conducted piece of positivist work. Post-positivism came into being in response to the positivist assumption that only the observable world can be studied (Mertens, 2015); post-positivism still adheres to objectivity and generalisability but the understanding of 'truth' is shifted from certainty to probability. The two are closely related and both terms are seen in the literature. Some authors argue that positivism is "an outmoded and rejected philosophy which should cease to significantly shape inquiry" (Clark, 2002). Hall argues that there is so little difference between positivism and post-positivism that the two can hardly be separated into two paradigms, advocating post-positivism as the successor to positivism (Hall, 2012). There is discussion of both in the literature though (Wahyuni, 2012) so this seems to be open for debate.

Constructivism can be viewed as the other end of the spectrum to post-positivism, an anti-positivist approach. It asserts that there is no true, singular reality but that individuals construct their own

reality by interacting with the world around them. A simple way of illustrating the difference between post-positivism and constructivism is to consider a tree (Crotty, 1998). A constructivist view would say that a tree only becomes a tree when a human comes across and interacts with it, we build the meaning ourselves. On the other hand, a post-positivist would say that a tree was always a tree, that is, it has an essential 'tree' quality; the key difference being that reality is singular and external to the human in a post-positivist approach but multiple and constructed in a constructivist one. This is true of research too with constructivists acknowledging that their views, biases and assumptions have an effect on the research, a marked contrast from a pure positivist stance. The effect of the researcher on the research is not a weakness in constructivism as it is for positivism; it is inherent in the approach and if handled appropriately, can improve the research (McKay et al., 2008).

The participatory/transformative paradigm arose due to difficulties with the dominant dyad of post-positivism and constructivism, as well as the realisation that many theories supporting the dominant paradigms were the result of power structures such as race, gender and sexuality (Mackenzie and Knipe, 2006). Some of the theories associated with the paradigm are 'feminist theory', 'critical race theory' and 'queer theory' indicating the cultural dimension to the paradigm and its basis for social change. The paradigm is related to constructivism as its ontological assumption is that there are multiple realities which are socially constructed (Mertens, 2007).

Pragmatism can be considered as separate from both post-positivism and constructivism to a certain extent as it doesn't concentrate on the notion of reality, like the former two do. It views what is true not in relation to reality but to what works in practice (Johnson and Onwuegbuzie, 2004). It is therefore an inherently problem-solving approach. A pragmatic view doesn't remove itself from the issue of reality but tends to suggest that reality is constantly changing and that there could be singular or multiple realities (Feilzer, 2010). Pragmatism disrupts the traditional knowledge

philosophy, asserting that knowledge need not be defined in relation to reality but actions and beliefs instead (Morgan, 2014).

The paradigm, or worldview, of the research affects the claims that one can make about knowledge i.e. what is known and how it is known; this also affects the methods which are used. Post-positivism tends to work in the quantitative realm (Teddlie and Tashakkori, 2009); statistics show the reliability of average measurements across a population or cohort. Constructivism however looks more at individual experience, tending to use interviews and other methods to access the depths of individual experience. This is another key difference between the different views, whether they access individual experience (constructivism) or seek to generalise and average results (post-positivism). As pragmatism neglects the reality debate, or rather it shifts the focus away from it, it often uses a mixed method approach as the correct method is deemed to be the one that works in answering the research question.

It is important not to state that one's standpoint is 'correct' or the absolute truth, to do so would be short-sighted as well as intellectually disrespectful to the research built upon each (Mertens, 2012). What is required is an awareness of the approach a particular piece of work has taken and the specific considerations required. As an example, if studying women's experience of first-time motherhood in a constructivist manner, feminist theory could be of interest; a related question is whether a man can be a feminist and subsequently undertake feminist research (Letherby, 1983). This same issue of gender influencing research is perhaps irrelevant if analysing prescribing patterns of blood pressure medicines within a post-positivist paradigm. The philosophical approach of the research affects the way that research is discussed and critiqued, each having its own standards and conventions.

3.1.3. Paradigm Wars and Pragmatism

It can be argued that there is incommensurability between the different paradigms, that they are not comparable (Goles and Hirschheim, 2000). Some suggest that the different paradigms are fundamentally different and therefore cannot be equitably discussed (Poropata, 2000). According to Philips (1975), Kuhn conceived paradigms as completely incommensurate, closed systems; it should be noted that Kuhn's definition of a paradigm differs slightly from that of a 'worldview' and shall be touched on later (Kuhn, 1996; Morgan, 2007). Philips refines Kuhn's viewpoint and argues that while there may indeed be a degree of incommensurability, this doesn't mean that two theories from different paradigms cannot be discussed. This seems to suggest a degree of permeability, acknowledging the distinct traditions and assumptions of the different paradigms and theories, but with the ability to discuss certain elements. Goles and Hirschheim (2000) discuss the work of Burrell and Morgan (1979) and the subsequent developments of Gioia and Pitre (1990); they suggest that there is some permeability and a lack of rigid borders between paradigms with religion given as an example; Christianity, Islam and Judaism are separate religions but can be discussed alongside one another.

The incommensurability between the positivist and constructivist traditions of research is one of the reasons for the arrival of pragmatism; a 'paradigm war' (Bryman, 2006) arose with positivists on one side and constructivists on the other (Maxcy, 2003). Methods tended to be restricted to each paradigm, neglecting the use of multiple methods which could help answer research questions in ways that other methods can't (Teddlie and Tashakkori, 2003). Maxwell (2016) argues that these 'conflicts' were maybe social constructions though and are not necessarily a result of the difficulties of integrating qualitative and quantitative methods.

To put it briefly, quantitative work is associated with numbers and statistics; objective, positivist research has tended to lie in this domain (McCusker and Gunaydin, 2015). Calculating a

mathematical average across a population moves the focus away from an individual and their experience as this is not the point of interest; indeed, individual experience may be seen as irrelevant if reality is viewed as singular and external to the participants in a study. Qualitative work on the other hand has often been the domain of constructivists and this often uses words as its data to gather individual experience; a constructivist stance sees reality as constructed by the individual and groups and thus potentially different for each participant or within different communities.

Historically, these two positions were seen as opposite sides in the 'paradigm war' (Bryman, 2006). On one side were positivists who used quantitative methods and on the other were constructivists who used qualitative methods (Johnson et al., 2007). Both allow exploration of problems in different and valuable ways; the topic of erectile dysfunction is an example. Quantitative research could tell us how many men are affected, the average age at which they first notice symptoms and the average efficacy of each treatment option. What qualitative work can add is a rich, deep description of what it is like for a man to experience something which could be said to be embarrassing or subject to stigma (Braun et al., 2000; Potts, 2000). Both of these types of knowledge are valuable as they approach the topic in different ways and thus provide different perspectives and types of account. Researchers have recognised the value of the different methods by valuing quantitative and qualitative methods in mixed methods research (McCusker and Gunaydin, 2015).

Mixed methods research therefore arose as a potential resolution to any conflict between qualitative and quantitative research, allowing the judicious use of the different methods in one piece of research (Johnson et al., 2007). Mixed methods research is not well defined as it can mean different things to different scholars with a variety of studies sitting under the umbrella of mixed methods (Tashakkori and Creswell, 2007). Johnson et al. (2007) concluded that a common theme in definitions is the use of both quantitative and qualitative methods in a single project, regardless of how this is specifically achieved. While not all mixed methods research may be described as such, this was the definition used for this project.

As the paradigm wars resulted from perceived incompatibilities between quantitative post-positivists and qualitative constructivists, under which paradigm does mixed methods reside? There a number of possibilities including an a-paradigmatic stance, multiple paradigms, singular paradigms or a substantive theory approach (Cameron, 2011). Pragmatism is described as being philosophically partnered with mixed methods research (Johnson and Onwuegbuzi, 2004) and is mentioned a great deal in the mixed methods literature. Some argue that pragmatism is insufficiently developed as a paradigm and is simply "positivism dressed in drag" (Giddings, 2006). Biesta (2010) argues that pragmatism cannot offer the philosophical underpinnings to mixed methods research but that it is none the less a useful tool. Greene and Caracelli (2003, p96) suggest that researchers can take one of two distinct and directly apposing pathways when considering paradigms and mixed methods research;

1) Yes, paradigms do matter significantly when making inquiry decisions.
2) No, paradigms are not critically important in the making of inquiry decisions.

They suggest that the pragmatic stance follows the second of these two paths. When viewed in this way, pragmatism is as an "anti-philosophy" (Johnson and Onwuegbuzie, 2004), setting aside the philosophical claims of the dominant paradigms (Glogowska, 2011) to use the research question(s) or theory to justify the methods used (Feilzer, 2010). Patton (2002) seems to concur with this, setting pragmatism not simply as a third option, but as an alternative to the dominant paradigms, shunning orthodox, one-sided philosophies, as they describe them.

James, Dewey, Mead and Peirce are noted as the early protagonists of pragmatism (Cherryholmes, 1992). As mentioned, pragmatism was born out of the potentially irreconcilable differences between the positivist and constructivist ways of thinking; it concentrates on the practical consequences of actions rather than the dualisms of value vs fact, or realism vs antirealism (Feilzer, 2010). The difficult notion of truth is dispensed with and what works is defined as true, working towards workable solutions to the question or problem at hand. A pragmatist believes that the research question

should drive the study and not the paradigm or underlying philosophy but does acknowledge the social, historic and cultural contexts of the research (Andrew and Halcomb, 2007). Morgan (2014) in particular has discussed pragmatism as not just being concerned with practicality but also its disruption of the traditional knowledge philosophy; Morgan discusses Dewey's views that knowledge does not have to be defined in relation to 'reality' in a pragmatic approach, as it does in constructivist or post-positivist ones.

According to Morgan (2014) one doesn't have to justify their knowledge claim in relation to reality but instead base it on the beliefs and actions of the researcher. Pragmatism thus requires the discussion of methodology as a justification of method e.g. why was this method used? Greene and Caracelli (2003) put it thusly; "…inquiry decisions are made not for their congruence with particular sets of philosophical assumptions but rather for their ability to further the substantive agendas of the inquiries. In this stance, the nature of the concepts being studied leads the inquirer's field decisions." Pragmatism does not suggest that post-positivism and constructivism are redundant but that the researchers within each of those paradigms share a common set of beliefs which then influences their actions in the choice of method; this description from Morgan (2007) is an interpretation of another definition of a paradigm previously touched on from Kuhn (1996). Conceptualised in this way, Morgan argues that pragmatism is a type of paradigm; a group of researchers all sharing common beliefs and assumptions which in turn affect the actions they take in inquiry.

3.2. Potential Methods of Inquiry

The philosophical considerations required for a project have been discussed in this chapter thus far. Three broad classifications of methods have been touched on; qualitative, quantitative and mixed methods. The narrative now explores these different methods in more depth and how any data collected might be analysed. It is argued one should not work in a vacuum, devoid of any ties to previous work in the respective field; this is the underlying theme of Newton's 1675 quote "If I have

seen further, it is by standing on the shoulders of giants". Therefore, when discussing the array of potential methods for this project, they will be discussed with reference to the existing work on VPs and the methods used therein.

3.2.1. Methods

Some VP researchers take a post-positivist approach, carrying out Randomised Trials (Triola et al., 2006; Turner et al., 2006) or cohort studies (Botezatu et al., 2010c; Boynton et al., 2007) for example. This approach is useful for hypothesis testing studies e.g. does this VP improve examination scores? RCT's and cohort studies usually seek to find numerical results, such as the average increase in exam score, and generalise the results. There are some practical issues associated with these methods relevant to this particular project. To demonstrate an improvement, one needs a reliable measure of the variable under investigation. If the VPs educational aim was to improve knowledge then a set of questions, the same for every participant, could be administered. By doing one set of questions before and one set after the VP intervention, any change in exam scores could be measured and an increase suggestive of an increase in knowledge and hence the success of the VP (Pantziaras et al., 2015).

For this project, how would one have reliably measured whether each participant was practicing SDM more effectively or not? Defining quality in a consultation is a difficult task (Howie et al., 2004), not least because patients and professionals may have different views of what constitutes quality (Maskrey and Gordon, 2017). Any assessment is also usually reliant on observations of interactions with SPs or patients by a more experienced person, the assessor, which carries a host of issues (Harasym et al., 2008; Reinders et al., 2011); how objective can one assessor be? Are multiple assessors needed? Do these types of assessment, an Objective Structured Clinical Exam (OSCE), test real professional communication skills (Atkins et al., 2016)? If these observations are instead made during real clinical practice, as appose to a simulated assessment, there are ethical issues as well as

logistical and methodological ones. These issues are by no means insurmountable but the methodological issues entailed would require significant thought.

Grounded theory is another method used in VP research but one which tends to work with words rather than numbers (Bateman et al., 2013). It was first pioneered by Glaser and Strauss (1967) and it seeks to build theory directly from data, as opposed to testing an a priori hypothesis as RCT or cohort studies do (Charmaz, 1996). It is inherently empirical as one collects and analyses data first before building theoretical constructs; the literature review is usually done last, not first to try and ensure that the theory has indeed been grounded in the data and not informed by previous reading. Grounded theory can be suitable for both qualitative and quantitative methods although tends to work more often with qualitative methods such as interviews (Glaser and Strauss, 1967). It is often located within a constructivist paradigm (Charmaz, 1990) but the origins are often viewed as compatible with the assumptions of positivism (Charmaz, 1996) as the research sought to find an objective truth.

Phenomenological studies are an example of research from a constructivist view point (Bearman, 2003; Edelbring et al., 2011). Phenomenology looks at the lived experience of a phenomena and attempts to describe the core commonality and structure of the experience (Starks and Trinidad, 2007). It does not simply describe the participant's reaction to the experience or phenomena but what it was like to live it, the lived experience (Mapp, 2008). Phenomenology can be considered as a methodology, often using interviews and observation as its method (Ajjawi and Higgs, 2007); Starks and Trinidad (2007) describe phenomenology as a method and Connelly (2010) describes it as both a philosophy and a method.

Phenomenological and grounded theory are not the only approaches which use qualitative methods. Both focus groups (Botezatu et al., 2010a; Huwendiek et al., 2009) and interviews (Bergin and Fors, 2003; Ekblad et al., 2013) are qualitative methods used within VP research although they can also be used as part of phenomenology or grounded theory. Interviews are, in essence, a conversation

between a researcher and a participant(s) (Longhurst, 2016). They vary in their purpose and hence their design (Britten, 1995; DiCicco-Bloom and Crabtree, 2006). A structured interview functions like a questionnaire with the researcher reading off specific questions for the participant to answer (Campion et al., 1988); follow up questions are not usually asked by the researcher if something unexpected was said by the participant. A semi-structured interview often starts with a list of questions but unlike a structured interview, there is some flexibility whereby the researcher or participant can go off script i.e. they can ask other, usually related questions and the discussion is not confined to a list of a priori questions. Finally, there are depth or unstructured interviews; these may start as a conversation, rather than with a list of questions. DiCicco-Bloom and Crabtree (2006) suggest that an interview cannot be completely unstructured but can be akin to a guided conversation. With a greater degree of structure, one will risk closing off relevant information from the participant but with too fluid or no structure, there's a risk that a conversation develops that is of no interest to the research question(s). Interviews can be conducted face-to-face, over the phone, via an instant messaging service or email (Opdenakker, 2006).

A focus group shares some similarities with a group interview as a facilitator meets with participants to discuss and talk about the research topic (Kitzinger, 1995). The main difference is the number of people present as a focus group is usually 6-12 participants strong (Longhurst, 2016), although this number can vary (McLafferty, 2004; Rabiee, 2004). Rather than an interviewer asking questions as in an interview, a moderator is used to facilitate the group's discussion with most of the talking being done by the participants themselves (Greenbaum, 1998). This means that a focus group tends to be quite non-directive as the interaction between the participants is often what is desired (Kitzinger, 1994). One particular limitation is that quiet or shy participants may be talked-over or ignored (Lunt, 1996); if a researcher were claiming to have established a consensus position from a focus group then there are epistemic ramifications as any such construct may be a single participant's view that the other participants did not want to challenge. Focus groups can be seen as a way of gathering the views of numerous participants at the same time, improving efficiency when compared to interviews.

But do focus groups allow the harvesting of individual views or are they are a simulation of social relations; if the latter is the case then the social-political makeup of the group requires thought (Robinson, 1999) e.g. if senior and junior staff from the same organisation are present in one group, how would that affect the discussion?

The questionnaire is another method common in virtual patient research (Bloodworth et al., 2012; Horstmann et al., 2009; Kidd et al., 2012) often using multiple-choice and free-text entry fields to generate both qualitative and quantitative data in what appears to be a pragmatic or a-paradigmatic approach. This demonstrates how researchers are not always explicit about their paradigmatic perspective (Hall, 2012; Wahyuni, 2012). Questionnaires as a method can also be used as part of survey methodology (Cederberg et al., 2012; Groves et al., 2009). Surveys involve a population with a section of that population completing the survey; the aim is to then use statistics to generalise the results to the whole population. As an example, hospitals in the UK survey their inpatients (CQC, 2018); not all the patients complete the survey but, using statistics, the researchers could claim that the opinions and views expressed are generalizable to all of the patients. This saves time because getting every single patient to complete the survey is not feasible. A survey can include the entirety of a population as opposed to just a selection and this is referred to as a census (Groves et al., 2009).

Questionnaires can also be used to gather views from small populations, not just from tens of thousands of people as in the inpatient survey example. VP research uses questionnaires to gather data from single year or study groups (Horstmann et al., 2009; Sunnqvist et al., 2016). As well as using questionnaires with a group of learners exposed to a VP, some researchers use an additional method, such as a focus group (Bergin et al., 2003) or interview (Courteille et al., 2014; Ekblad et al., 2013; Stevens et al., 2006) to address the research topic in a mixed methods approach. Questionnaires and interviews are suggested as common methods for educational research more generally (Morrison, 2003; Zohrabi, 2013).

3.2.2. Analysis

All of the methods described above allow one to collect data for a project. To be of use, this data requires analysis and there are a variety of analytical techniques available.

Focus groups, interviews and other qualitative data could be analysed by Thematic Analysis (TA). TA involves, broadly speaking, spotting patterns in the data to construct themes that are relevant to the research question under examination (Braun and Clarke, 2006). Some researchers point out that these themes are not obviously present in the data but are created in the researcher's mind (Boyatzis, 1998). Indeed, 'spotting patterns' is perhaps misleading as it implies that the pattern was there awaiting discovery; this is the way a positivist may view thematic analysis, trying to establish the 'truth' of the transcript. Braun and Clarke illustrate the issue by using the metaphor of an archaeologist and a sculptor (2013). For them, many see TA like an archaeological dig, finding what is there to be discovered i.e. there is one 'truth' in the data which awaits the researcher to come across it. They prefer to see TA like a sculptor, who finds what he will in the block of marble he starts with. This links to the idea of reflexivity (see section 3.3.4); different researchers may well construct different themes from the data due to their different perspectives. This is not a weakness of the analysis but a part of it.

Content analysis (CA) is another approach to qualitative data analysis and can take many different forms (Hsieh and Shannon, 2005); there are a variety of conflicting views about the terms used and a range of different styles and traditions (Graneheim and Lundman, 2004). Depending on the precise definition of both TA and CA, the two processes can be viewed as very similar (Elo and Kyngäs, 2008; Vaismoradi et al., 2013). Indeed, the boundaries between them seem blurred with a clear distinction lacking. For the purpose of this thesis, CA was viewed as a much simpler technique than TA. In accordance with Vaismoradi et al. (2013), CA involves coding the data and then combining these codes into categories. TA on the other hand groups codes to form themes which are then checked

for their congruence with the data, a more iterative approach involving multiple cycles. A theme is a more complex construction than a category and also involves a central organising concept, which a category may not (Braun and Clarke, 2013). Thus, both CA and TA can start in a similar way, by coding the data, but the manner in which the codes are treated differs.

Framework analysis (FA) is a third approach to the analysis of qualitative data which also involves coding the data (Srivastava and Thomson, 2009). It has its origins in policy research as it helps to overcome some of the difficulties in that particular research area (Ritchie and Spencer, 2002); these issues include a short time span and the fact that policy research may be done in teams, not by an individual researcher. One starts with a theoretical construct which provides the thematic framework; the initial themes are thus a priori for FA, not derived from the original data. The theoretical framework is then indexed to the data before the data is removed from the transcript in the charting phase to organise it. Themes can be added to the initial ones to allow new themes to emerge, or be constructed, from the data. Due to the themes not being derived from the data initially, FA favours topics where research has already been conducted to provide the a priori themes to identify in the data (Ward et al., 2013).

Grounded theory has been discussed as a method; often interviews will be used to collect data in grounded theory and this data will then be analysed in a manner specific to grounded theory (Charmaz, 1996; Corbin and Strauss, 1990). In grounded theory, transcripts or data sources will be coded to start with before comparisons are made between the events observed in the data; constant comparison is a key feature of analysis in grounded theory. Much like in TA, patterns are sought in the coding as well as variations; these patterns and processes can then be built into a theory. Throughout the analysis, theoretical memos are made to keep track of one's thoughts in the development of a theory.

The type of analysis required for quantitative data varies depending on the type of numerical data that one has. In general terms, there are four categories of quantitative data; nominal, ordinal,

interval or ratio (Stevens, 1946). Nominal is comprised of discrete categories with no order to them; gender is an example of this. Ordinal data has, as the name suggests, an order to it but the gaps between the points are not standardised. An example of this could be 'How happy are you?' as, for each individual participant, a 4 is happier than a 3; what one cannot say is that if their happiness changed from a 2 to a 4, they are necessarily twice as happy. Interval data is different as there is the order that is present for ordinal data, but there is also an equal difference between each point; temperature for example is interval as a change from 2^{o}C to 4^{o}C is defined as a two-fold increase. Finally, ratio data has an order with standardised gaps like interval data but also has a true zero; body mass is an example. The type of data determines the type of analysis one can conduct.

3.3. Research Quality

3.3.1. Quality Criteria

The first section of this chapter discussed the different philosophical approaches that can be taken which were followed by the discussion of methodology and methods. As the first section started to explore, qualitative and quantitative methods differ in their historic philosophical allegiances. Due to this, the standards of quality for qualitative and quantitative research are different with the criteria for qualitative research being harder to define than quantitative (Mays and Pope, 2000). Traditionally, quantitative work has been tested on validity (how truthful the research is, does it measure what it says it measures) and reliability (how accurate is the representation, closely linked to reproducibility) (Bryman et al., 2008; Golafshani, 2003). It is argued whether these criteria apply to qualitative work or not, especially reliability, as they are rooted in positivism. The ideas behind these terms can be applied to qualitative work in a different way; validity is equated to truthfulness and reliability to trustworthiness (Noble and Smith, 2015). Mays and Pope (2000) detail several features to improve the quality of qualitative work including triangulation, reporting, reflexivity, member

checking and negative cases. Rolfe (2006) also focuses on reflexivity and raises the idea that the quality of qualitative work lies in the reading of it, that the report, in contrast to quantitative work, is where the judgement of quality lies. Kitto and colleagues (2008) discussion of quality touches on many of the same issues and they are touched on throughout this thesis.

Quality criteria are difficult to define for mixed methods research as there are different methods with different criteria for quality. Feilzer (2010) argues that both the rationale for using mixed methods and the way in which methods have been mixed should be justified. Creswell and Clark (2011) detail some ways in which methods can be mixed in research; convergent, sequential, embedded and multiphase are the four designs they suggest. In addition to the comments from Johnson et al. (2007), this serves to illustrate that mixed methods research is not a singular enterprise but is a variety of techniques and strategies that should be used judiciously. As an example, in a sequential approach, a qualitative study may follow a quantitative to one to help explain or explore the numerical results. Mixed methods research should not be quantitative and qualitative studies occurring in parallel with no coming together of the results; the findings should complement one another in some fashion (Greene et al., 1989; Venkatesh, 2013). Feilzer (2010) describes this type of poor mixed methods work as juxtaposition; running both a qualitative and quantitative study in isolation and presenting the findings separately with no integration.

3.3.2. Triangulation

Triangulation is suggested as an inherent quality of mixed methods research (Johnson et al., 2007). Fielding (2012) describes it as 'convergent validity', where multiple streams of data come together (converge) about the same phenomena; the idea of triangulation is said to stem from work by Campbell and Fiske (1959; Jick, 1979). Jick gives an example of a political leader to illustrate triangulation. One could interview said leader, analyse their policy decisions and observe their interactions, thus using three different methods to build up a more complete picture of the focus of

inquiry (1979). Triangulation can occur across different methods or within method; to revert to the Jick example, one could interview a leader's advisors, constituents and parliamentary colleagues to build up a more complete picture (Mertens, 2015). Morse (1991) makes the distinction between simultaneous and sequential methodological triangulation i.e. do the different methods occur at the same time or in an order?

Problems can arise with triangulation; what if two methods each deliver contradictory results? Which method's results are 'right'? How are disputes between said results managed? The comments from Feilzer (2010) about juxtaposition are particularly pertinent here; if one finds conflicting results, the conflicts needs to be resolved in some way and not left without discussion.

3.3.3. Reporting

The approach and design of a project must be clearly described to permit a critical review of the project; one way to do this is to use a reporting guideline and there are a variety of such specific tools available (Moher et al., 2015; Runeson and Höst, 2009; Schulz et al., 2010). There appears to be a dearth of mixed methods reporting guidelines when compared to the quantitative and qualitative domains, perhaps due to the fact that the mixing of methods is a relatively new development (Johnson and Onwuegbuzie, 2004). Rather than fixed reporting directives, the mixed methods literature tends to suggest loose guidelines for quality (Creswell et al., 2011; Schifferdecker and Reed, 2009). One issue that faces mixed methods research and subsequent appraisal of it is that the criteria for quality in qualitative and quantitative methods are often very different (Wisdom et al., 2012).

Venkatesh and colleagues (2013) suggest that while both qualitative and quantitative data should be intertwined within mixed methods work, the two groups of data can be appraised on their own merits i.e. using qualitative guidelines for the qualitative section of the data. This is the conclusion that the majority of guidelines come to, according to Wisdom and colleagues (2012). Issues common to both qualitative and quantitative methods, such as those pertaining to paradigms for example,

should also be discussed in a manner specific to mixed methods work (Sale and Brazil, 2004; Schifferdecker and Reed, 2009).

Buus and Agdal (2013) suggest that reporting guidelines should not be used dogmatically as qualitative studies can be varied and undertaken from different theoretical positions. Reporting guidelines should be, as the name suggests, guides not rigid checklists. Some qualitative methods are quite generic (Kelly, 2009) and thus there are generic qualitative reporting guidelines. The British Medical Journal uses the COREQ, a 32-item checklist for interviews and focus groups (Tong et al., 2007). It touches on three different domains; research team and reflexivity, study design, and analysis and findings; it is the favoured reporting guideline of the British Medical Journal, at the time of writing.

3.3.4. Reflexivity

Reflexivity can mean different things to different people but is, at its core, about the interplay between the researcher and the research in a qualitative study (Finlay, 2008). In discussing reflexivity, Patton (2002, p63-66) stresses the importance of self-awareness and ownership of our own perspectives, summing it up neatly in a single sentence; “A human being is the instrument of qualitative findings.” It was a human being who designed the study, collected the data, analysed it and discussed the findings; they brought their own biases, perspectives and backgrounds to the work so the researcher(s) must be discussed in a piece of qualitative work. Gender, culture and socioeconomic status are but three broad features of a researcher that can affect the findings (Creswell, 2014). This interplay between the researcher and the researched is a stark contrast between quantitative and qualitative work; in the former, the aim is to reduce or, ideally, completely nullify the impact of the person(s) doing the research on the research itself (Braun and Clark, 2013).

Qualitative work and a researcher’s relationship to it can be complex (Pillow, 2003) to the extent that Ellingson (1998) uses a ‘confessional tale’ as part of their write up to describe how they, the

researcher, 'contaminated' the findings. Finlay (2002) describes this as 'outing' the researcher to enhance the trustworthiness of the research; they see this as coming clean about the influence of subjectivity on the research but also to improve it. There are a variety of different ways of thinking about reflexivity (Finlay, 2008) but it involves being aware of ones biases and relationship to the research and the participants (Richards, 2014). While one should be aware of these ideas, any reflection on them should also aid in the interpretation of the results and bring new insights (Finlay, 2008). Reflexivity is linked to reflection and it is suggested as a personal, individual activity with many different ways of doing it (McKay et al., 2008).

3.3.5. Member Checking

By asking a participant to check a transcript and/or some of the findings, you could argue that one establishes a participant's true feelings; they may suggest that what they said in the interview did not properly articulate their position so a transcription check allows them to clarify this or add depth to their response (Creswell, 2014). This activity is often called 'member checking' and it is suggested to be a way to enhance the trustworthiness of research (Birt et al., 2016). It does carry with it several issues (Emerson and Pollner, 1988; Bradshaw, 2000); which is the participants true view, what they express in an interview or what they express afterwards? Do participants participate in member checking in a useful, productive way? How does one manage any disagreements between the transcripts and the participant's new position? Birt et al. (2016) suggest that member checking is not a singular process but a variety of techniques which can be used for different purposes within different epistemological perspectives. They propose that returning the interview transcript is a positivist technique while member check interviews, focus groups and checking of the synthesised analysed data are all allied to constructivist/interpretivist perspective. Aside from the returning the transcript, all of the methods involve follow up interviews/interaction with participants so entail additional time and resource commitment from both the researcher and the participants.

3.3.6. Sample Size

The means of determining a sample size are another difference when comparing quantitative and qualitative work (Malterud et al., 2015). Quantitative research often uses statistics including power calculations to decide the sample size that is required, depending on various parameters. For qualitative interviews, it is data saturation that decides the sample size (Mason, 2010). Data saturation is said to be "the point in data collection and analysis when new information produces little or no change to the codebook" (Guest et al., 2006). The paper that that definition is from found that, in their particular example, saturation occurred within 12 interviews but meta-themes were present after 6.

Many suggest that a pragmatic approach is required to establish saturation as it varies depending on many different issues and as a consequence, a degree of judgement is required (Baker et al., 2012; Robinson, 2013; Sandelowski, 1995). It is suggested that as more interviews are conducted, less new codes are discovered (Marshall et al., 2013); it is not just the number of interviews that are important but the data that one gets from them (Fusch and Ness, 2015). There is also the issue of both code and meaning saturation; the former being "we've heard it all", the latter "we understand it all" (Hennink et al., 2017); code saturation was found to occur after 9 interviews but 16-24 was required for meaning saturation in that particular paper.

3.4. Project Design

This chapter has so far illustrated the different approaches that can be taken in research starting with philosophical considerations and moving through to methodology, method and the quality criteria. This highlights the range of positions and pathways that one could take for a project. The particular approach taken for this project shall now be considered. As has been touched on, there are not right and wrong methods, merely contexts in which they can be used appropriately or inappropriately. It is therefore necessary to review the aims of this project to establish which approach was the most suitable here.

The overarching aim of this PhD was;

- To evaluate the use of a virtual patient for developing the shared decision-making skills of undergraduate medical and pharmacy students, and General Practice Registrars.

Alongside the primary aim, there were secondary aims;

- To evaluate students and General Practice registrars' perceptions of at which stages of development the virtual patient for shared decision-making is appropriate.

- To evaluate students' and General Practice registrars views of the multiple-choice format for the virtual patient.

- To evaluate student's self-reported treatment priorities within a clinical consultation, immediately before and after exposure to the virtual patient.

- To evaluate the views of students and GPRs towards the style of feedback delivery from the virtual patient.

In all of these aims, the 'virtual patient' mentioned is the one designed for this project. 'Students' refers to undergraduate students of medicine or pharmacy in the United Kingdom.

When evaluating an educational intervention, Kirkpatrick and Kirkpatrick propose four levels one could explore (Kirkpatrick and Kirkpatrick, 2006); reaction, learning, behaviour and results. For novel interventions, they suggest that starting at the early stages of reaction and learning is more appropriate than jumping ahead to the later stages of assessing behaviour and results (Kirkpatrick and Kirkpatrick, 2006); this is to enable one to attain a holistic understanding of the intervention. Prior to this project, very few VPs published in the literature had aimed to develop communication skills outside of those required for history taking and diagnosis; communication was frequently reduced to a single question-answer format. There was also not a single VP aimed primarily at developing shared decision-making skills at the outset of this project; the intervention under evaluation was therefore a new application of VP technology.

Due to this, the aims of the project were evaluative and not theory-testing in nature, focusing on the first two levels of the Kirkpatrick model. Firstly, an understanding of the participants' views of the VP was sought. This is what Kirkpatrick and Kirkpatrick describe as a level 1 evaluation (2006); the learners reaction to the intervention. Secondly, an attempt at measuring level 2 on the Kirkpatrick scale, which is 'learning', was undertaken. This was done by evaluating whether the participants priorities in a consultation changed after using the VP. Morrison (2003) describes this as level 2a.

To explore the participant's reaction to the VP, mixed methods were thought to be most appropriate as it provides different perspectives on a problem, exploring the issue in different ways (Zohrabi, 2013). The quantitative data was gathered first by using both pre- and post-questionnaires. The pre-questionnaires gathered mainly demographic data, exploring the participants' expectations of the VP, and technology in more general terms. The post-questionnaire evaluated the participant's views of the VP after they had used it. The questionnaires were not purely quantitative but also featured

free-text qualitative sections to allow participants to give their views without constraint of multiple choice and tick box questions.

After the questionnaires had been administered and the participants had used the VP, the participants were invited to take part in a semi-structured interview. This was firstly to evaluate the VP from a different perspective by using a different method; this was a convergent element to the design (Creswell et al., 2011). Secondly, the interview data helped to explain some of the quantitative questionnaire data, a sequential explanatory element. The participants for interviews were to be recruited by purposive sampling, deliberately selecting participants with diverse views and opinions about the VP. The order to the data collection is summarised in Figure 7.

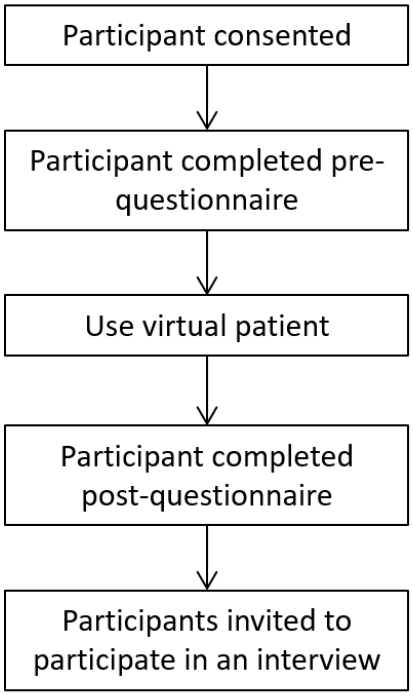

Figure 7

The level 2a research, exploring learning, was achieved with the pre- and post-questionnaires; one question featured on both pre- and post-questionnaires which permitted a comparison of the participants' priorities in a consultation to evaluate whether the VP had any impact on them.

An issue with using a mixed methods design is deciding on an appropriate paradigmatic approach. Cameron (2011), Mertens (2012) and Shannon-Baker (2016) urge that we do not advocate a correct paradigm for mixed methods work but welcome the use of multiple approaches as long as there is an explicit choice or rationale. Of the suitable perspectives mentioned for a mixed-methods approach, Shannon-Baker advocates that pragmatism is useful for intervention-based work, much like this project. By taking a pragmatic view, the aims drive the selection of the method(s).

In summary, a pragmatic, mixed methods design was used for this evaluation utilising questionnaires before semi-structured interviews in a sequential explanatory approach with an additional convergent element.

3.4.1. Population

Having laid out the broad approach to the project, the participants and the way in which they were recruited shall now be described. There were three main strands to the data collection with each focusing on a different group; pharmacy undergraduates, medical undergraduates and General Practice Registrars (GPRs). Data was collected with each of these groups and analysed separately before a combined discussion to bring the findings from each strand together. The data was gathered in sequence; pharmacy students first, then medical students and finishing with GPRs. The rationale for this sequence order was convenience.

Pharmacy Undergraduates – while SDM is not referenced explicitly, the standards for the initial education and training of pharmacists' touch on several of the themes included in SDM (GPhC, 2011); section 10.2.4 in particular includes supporting patients to select management options. There have also been recent calls in the pharmacy press for more focus on SDM in the undergraduate curriculum (Oswald, 2018). The VP would therefore seem to be well targeted at pharmacy undergraduates.

The specific population for the pharmacy undergraduates was third years during 2017/2018 at Keele University. The VP was used as part of a workshop on clinical decision-making. A service evaluation of the VP section of the workshop was carried out; recommendations were made as a result of the findings to improve the workshop for the next year's cohort.

Medical Undergraduates – SDM is described (although not explicitly named) in the GMC Good Medical Practice guidelines (GMC, 2014); "You must work in partnership with patients, sharing with them the information they will need to make decisions about their care". SDM is also a recommendation resulting from a recent landmark court case, the Montgomery ruling (Coulter et al., 2017). It is therefore important to develop the SDM skills of future medical professionals.

The Manchester Medical Research Student Society (MMRSSoc) runs an annual conference for medical students. A virtual patient workshop was run with the conference delegates to evaluate medical student's views of the VP.

General Practice Registrars (GPRs) – GPRs have to pass a Consultation Skills Assessment (CSA) in order to register as a GP; as the VP simulates a common activity in the day to day practice of a GP, it was thought to be well targeted at GPRs who are still honing their skills. There are also the legal (Coulter et al., 2017) and regulatory reasons (GMC, 2014) described for the medical undergraduate strand.

Neal Maskrey, second supervisor of this PhD, led a workshop with GPRs in which the VP was used. The workshop was similar to that of the pharmacy undergraduates.

Academic Pharmacists and Doctors – a population was required to pilot the VP and research instruments with. The ideal population would be both convenient to access and prudent target users of the VP. The Schools of Pharmacy and Medicine at Keele University employ pharmacists and doctors who were convenient to access. In addition, the background chapter states that SDM is not occurring in practice to the degree that it ought to. While nothing was known about this population's

clinical practice, it seemed reasonable to assume that the academic pharmacists and doctors might benefit from using the VP. Therefore, academic pharmacists and doctors from the Keele Schools of Pharmacy and Medicine were the population for the pilot.

3.4.2. Nurses

Nurses were a relevant profession with which to evaluate the VP. They are recognised as a key group for whom consultation and SDM skills are important and sharing treatment decisions features in the NMC code (NMC, 2018); “encourage and empower people to share in decisions about their treatment and care”. Only so much work can be completed during the course of a PhD so it was only feasible to conduct so many evaluations. Due to the existing professional networks of the supervisory team and PhD candidate (pharmacy and medicine), no recruitment from this population was attempted.

3.4.3. Unsuccessful recruitment strategies

The initial plan to explore the views of undergraduate pharmacy and medical students was to recruit participants via email from the final years of the Pharmacy and Medicine courses at Keele University; recruitment emails were sent to the mailing lists for these cohorts. The students would have completed pre- and post-questionnaires and used the VP in their own time; there would also have been some follow up interviews. This strategy was not successful as from the roughly 300 students, only 7 students consented to take part and 4 of those dropped out.

Postgraduate pharmacists enrolled on a course at the Keele University School of Pharmacy were also approached for recruitment. They were approached via email in the same way as for the undergraduates but only 3 participants consented and 2 of those dropped out.

In the first instance, local links within the West Midlands Clinical Research Network (CRN) were utilised to recruit GPR participants via email. The GPRs would have completed questionnaires, interviews and used the VP in much the same way as for the undergraduates and pharmacists. Unfortunately, despite the large recruitment pool, this only resulted in 2 participants completing the study.

These activities were undertaken with full ethical approval from Keele University; general discussion of the ethical issues is featured in the section Ethical Considerations. As a result of their failure, the three strands evaluation approach was taken instead. None of the approaches in section 3.4.3 were taken forward and are not discussed in the rest of the thesis.

3.5. Data Collection

Data was collected by two means; questionnaires and semi-structured interviews. The process of data collection is summarised in Figure 7. The COREQ-32 reporting guideline was used for this thesis to describe the qualitative approach taken but it is not reproduced dogmatically as a checklist.

3.5.1. Questionnaire Design

Questionnaire design should be purposeful to ensure the questions are clear and address the aims of the study (Boynton and Greenhalgh, 2004; Starr, 2012). One must ensure that the questions are understandable to the envisioned participants, not just in the content of the questions but also the layout (Krosnick and Presser, 2010). This was achieved by piloting the questionnaires but prior to that, the text by Krosnick and Presser (2010) was used as a guide to writing the questionnaires.

3.5.2. Semi-Structured Interview Design

An interview guide was used for all of the interviews. The interviews were semi-structured which allowed the participants and researcher to be spontaneous so questions were not always asked in a rigid, pre-defined order. The participant's responses also gave rise to new questions so additional and supplementary questions were asked. The interview guide therefore evolved throughout the course of the interviews as new ideas came to light through discussion with each participant. As the interviews for the three strands were run in sequence, not parallel, the interview experience from the previous strand informed the guide for the next strand. The guide was not pilot tested but for the second and third strands of data collection (medical students and GPRs), the experience of the previous strands was informative. All interviews were audio recorded and were via telephone or Skype with the verbal and written consent of the participant. No repeat interviews were conducted and there were no non-participants present in any of the interviews, as far as was ascertainable. The recordings were transcribed by a single transcription service using two different transcribers.

3.6. Data Analysis

3.6.1. Quantitative Data

Likert data was a feature of both pre- and post-questionnaires (Likert, 1932). Likert items are individual questions whereas Likert scales are a collection of items (Brown, 2011), with six suggested as a minimum (Bishop and Herron, 2015); Likert items were used in the questionnaires. There is some discussion in the literature as to what type of data is produced from Likert data, ordinal or interval (Allen and Seaman, 2007; Jakobsson, 2004; Vigderhous, 1977). As the questions were asking how useful the participants found the VP, for example, this was probably best described as ordinal data; a rank is formed but the intervals are not standardised. Some have argued that parametric

tests (e.g. t-tests) cannot be applied to ordinal data but that one should use non-parametric tests, such as Mann-Whitney U test or χ^2 tests (Sullivan and Artino Jr., 2013). Winter and Dodou (2010) argue that for a five-point Likert item, both t-test (parametric) and Mann-Whitney-Wilcoxon (non-parametric) have similar power. Norman (2010) conducted a review of the subject within medical education research methodology and concluded that parametric tests are not only acceptable for use with ordinal Likert data but are indeed more robust than non-parametric assessments; Norman does acknowledge that there is much debate about this topic and that this is likely to continue.

Some researchers suggest Likert items and scales should be treated differently with some advocating that item data should be treated as ordinal, and scale data as interval (Boone and Boone, 2012; Subedi, 2016). That said, researchers in the field of pharmacy undergraduate education have used parametric tests for Likert-item questions, utilising t-tests and mean calculation (Richardson et al., 2013); they did not aggregate the individual items into scales.

Jamieson (2004) notes the significant variation between specialist texts and actual practice in the area of Likert data analysis. They suggest that one should state what tests they did but also why they did them; they highlight that some researchers who have used parametric tests for ordinal data don't seem to realise that this could be contentious. They also suggest that for the evaluation of medical education, Likert data may often be highly skewed, further stock to the idea that non-parametric tests should be used. Table 2 has been reproduced from Boone and Boone (2012) and it highlights the analytical tests to be performed on the Likert item data (Likert-type data) from the questionnaires.

Table 2 - Reproduced from Boone and Boone (2012)

	Likert-Type Data	Likert Scale Data
Central Tendency	Median or mode	Mean
Variability	Frequencies	Standard deviation
Associations	Kendall tau B or C	Pearson's *r*
Other Statistics	Chi-square	ANOVA, t-test, regression

As well as Likert data, there were also questions generating other data. These generated a mix of nominal and ordinal data so were analysed in the same way as the Likert-item data; presenting frequencies and modal or median values, descriptive statistics.

A feature of both the pre- and post-questionnaires was a question attempting an attitudinal measurement. This question asked participants to rank four predetermined items in relation to their priorities within a consultation with a patient; these priorities are from the work of Barber on prescribing (Barber, 1995). The same question was featured on both the pre- and post-questionnaires and the responses of each participant were compared; a Wilcoxon-rank test was conducted using SPSS was used to determine whether there was any statistically significant change in the rank position of "Respecting Patient Choices"; while this item is not analogous to SDM, it was used as a surrogate for the participants priority for involving patients. The literature shows that practicing professionals often don't involve patients in decisions or respect their choices (CQC, 2018; Garrard et al., 2015; Hamann et al., 2012).

3.6.2. Interview Data

The analytical technique chosen was thematic analysis. Thematic analysis was ideally suited to this work as it is not related to any single epistemological school of thought and thus can be used with

different theoretical frameworks, offering flexibility while still providing a detailed account of the data (Braun and Clarke, 2006). It is also a method which is appropriate for those new to qualitative work as the technique is not perhaps as demanding as others, such as grounded theory. Framework analysis was considered as an alternative due to its simplicity and transparency but, while there are other VPs, most of them are not similar to the one used in this project; this makes the a priori themes difficult to define. Additionally, time restrictions and multiple researchers were not issues for this project.

Thematic analysis (TA) is itself a broad and widely used term (Boyatzis, 1998). To provide a more complete account of the analysis it is important to specify the type of TA conducted. One descriptor lies in how the researcher treats the words of a transcript. The words can be taken at what might be called face value, or their underlying influences and assumptions can be analysed; the former strategy is dubbed semantic while the latter is latent TA (Braun and Clarke, 2013). What was conducted here was semantic TA as the constructs and conceptualisations of the words were not of the most importance but the interpretation of meaning in the data was conducted by theorising about pattern significance (Braun and Clarke, 2006). The codes were derived from the raw data, not from pre-existing theory or driven by prior research (Boyatzis, 1998). The rationale for this was that the technology was novel and there was perhaps not a clearly appropriate theory to guide data analysis (Nestel and Bearman, 2015). If the wrong theory was applied to inform the coding then the results could have been negatively impacted..

The work of Braun and Clarke (2006) has been extensively cited and is a key paper for researchers, especially junior ones, who wish to conduct robust and accountable TA. Within their paper they detail a six-part process for conducting the analysis;

Part 1 – Familiarising yourself with the data

Part 2 – Generating initial codes

Part 3 – Searching for themes

Part 4 – Reviewing themes

Part 5 – Defining and naming themes

Part 6 – Producing the report

This process highlights a stark difference between the analytical approach to qualitative and quantitative data; TA is an iterative process with analysis occurring alongside data collection in a recursive fashion to ensure the codes, and subsequent themes, captured are true to the data and nothing is missed. Quantitative data is collected and then analysed in a linear, terminal fashion. Whilst conducting interviews, Simon made rough notes to remind him of any follow up questions to ask and to prompt his analysis of the data.

To start with, the transcripts were read while listening to the original recording and then re-read afterwards (part 1); this was to check the accuracy of transcription but also to familiarise one with the data. Following this, each transcript was read through in order and codes added to the relevant sections upon finding something of interest (part 2); complete coding was used, not selective (Braun and Clarke, 2013). At times, it was obvious what a particular section of the data represented and what code to assign. At other times, it was clear that something of interest was being said but it wasn't clear what the code should be. To try and avoid the imposition of an inappropriate code, some codes were left blank initially; they served as a label to highlight an interesting piece of talk. After completing the analysis of that particular transcript, the unlabelled codes were then revisited and coded.

After all the transcripts had been coded, there began a rather complex and time-consuming stage involving several different activities. To start with, all of the codes were printed off and cut into pieces; this resulted in many words and phrases on individual pieces of paper, each representing a code. The codes were then moved around and placed into groups. There were several iterations

were codes were moved around multiple times. This stage was the generation of the initial themes (part 3) and required a substantial amount of time for critical thought and reflection.

After some initial themes had been created, the transcripts were re-read (part 4). This was to check how well the candidate themes reflected the data; initially, due to preconceptions perhaps, themes were applied a little forcefully to the data. When re-reading the transcripts, it was sometimes found that a theme was a little simplistic or not reflective of the data. After this stage of multiple iterations, the themes became better defined and named (part 5). The write up of the results could then commence (part 6); even at this stage, as supporting quotes were re-read again, there were minor adjustments to themes highlighting the non-linear approach to TA.

The software package NVivo 11 was used to manage all the coding for the TA.

3.6.3. Qualitative Questionnaire Data

The qualitative questionnaire data was analysed using a basic content analysis (CA). At the outset of the project, the plan was to use TA to analyse the questionnaire data. In accordance with the description from Braun and Clarke (Braun and Clarke, 2006, 2013), a theme is not simply a category or a heading to cluster similar codes together. A theme should have a central organising concept and go beyond a mere summary of the content of the data. The questionnaire data was found to liberate quite brief answers to the questions and these answers were very superficial. Thus, it was reflected that perhaps CA would be more suitable than TA for the analysis of the qualitative questionnaire data due to it lacking the deep richness required for TA.

Conventional content analysis (Hsieh and Shannon, 2005) was the particular method chosen for the qualitative questionnaire data, a data driven rather than theory driven approach. Firstly, every individual participant response was coded in the same way as for TA. After coding all of the data, some of the codes were combined as they overlapped or described the same idea. These codes were

then reported with corresponding frequencies to describe how common each code was. If a code was assigned a frequency of 6, this meant that 6 participant's questionnaires featured that code at least once i.e. it wasn't mentioned by the same participant, six times. These results, the codes, were discussed briefly but were used primarily to prime the interview guide. The codes provided an initial insight into each workshop cohort's thoughts which could then be followed up in the interviews.

The frequencies for CA were not used to assess validity i.e. if one code were three times as common as the others, it would not necessarily mean that it was a more valid or important finding. They were used to describe the data more completely and could be used to guide how representative the codes were. As an example, if code A was 'fun' and had a frequency of 10%, it would not necessarily mean that the remaining 90% of the participants did not find it 'fun'; they may not have but they may also simply not have reported finding it 'fun', even if they did. Therefore, the numbers assigned to the codes required careful interpretation.

Rather than NVivo 11, Google Sheets was used for this stage of analysis, adding the codes in the column next to the each participant response.

3.6.4. Coding

Both forms of qualitative analysis used in the project, CA and TA, involved coding of data. This could involve one or multiple different researchers to code each transcript. By using two independent coders it could be claimed that the validity of the themes is improved i.e. two people have found the same thing so therefore the result is valid. Under some philosophical positions this could indeed be the case but it seems to suggest that there is a 'truth' to be found within the data and by using two coders, one removes the issue of bias from the process to find this 'truth'. The position of this research, and indeed of pragmatism, is that there is perhaps not a singular truth but that the researcher will affect the story that is found within the data. Therefore, there was only a single data coder involved in the coding of the transcripts. This was not due to the issue of resources but a

methodologically active choice. The qualitative results from this project are hence not put forward as the singular truth but merely a robust interpretation of the data, with other interpretations acknowledged as possible.

A second coder may well check to see that there is a certain intra-code agreement, that a code with an agreed meaning applies equally well to two different sections of text labelled with that code (Creswell, 2014). This is a different way of involving a second coder but is perhaps still laden with some of the issues that have just been discussed. The themes and codes were discussed with the supervisory team; this provided a forum for the discussion of ideas which is described by Mertens (2015) as progressive subjectivity.

3.7. Ethical Considerations

A foremost issue in the mind of any researcher, regardless of discipline, should be research ethics (Resnik, 2015). Unethical work can harm people, harm society, harm institutions and harm the reputation of science as a discipline. It is particularly relevant in the health sciences as living human beings are often involved and their mental and physical health could be compromised if the research doesn't go to plan or worse, is conducted in a careless fashion (Loue, 2000). The British Psychological Society (BPS) maintains a Code of Human Research Ethics which is referenced in Keele University's research ethics guidance; this code rests on four principles (BPS, 2010, p7);

1. Respect for the autonomy and dignity of persons
2. Scientific value
3. Social responsibility
4. Maximising benefit and minimising harm

The code also touches on risk, valid consent, confidentiality, giving advice, deception and debriefing. All of these issues must be considered (where relevant) and the ethical deliberations for this work

are presented in the following sections. The scientific value and consequent benefit to society of the work is extensively detailed in the background and narrative review so is not discussed here. Axiology, as discussed in the Research Philosophy section of this chapter, is the study of values and ethics. How does one define what is ethical? Biddle and Schafft (2015) discuss how pragmatists could engage with axiology but do not proffer solutions, finishing with a question; "what should the standards be?" There seems to be a large amount of debate around the topic with little in the way of clarity. Mertens (2015) discusses the axiological thoughts of the early pragmatists, James, Dewey and Mead and the importance of 'care'. As this project involves human participants, 'care' in terms of reducing the likelihood of harm seems appropriate and features in the BPS standards (BPS, 2010).

3.7.1. Ethical Issues

This study posed relatively few ethical issues. Some examples of VPs in the literature simulate medical emergencies and battlefield triage; these situations are potentially emotionally difficult and stressful so would need to be dealt with in the research process. Participants may need to be forewarned of the nature of the technology and a system to support them put in place, should the simulation upset them.

The VP did not simulate anything likely to be emotive or upsetting; it was not an emergency situation and the discussion did not relate to anything likely to be distressing for the participants. As this VP was not thought likely to induce any strong emotions from the content of these cases, these support mechanisms or forewarnings were not required. That said, if any participant was upset or reacted to the content of the simulation, the participants were given the opportunity to speak to Simon, and Steve or Neal who were present in the workshops.

Depending on the study design, a study looking at an educational intervention could cause embarrassment for a participant. If the participant was being measured on their abilities in an assessment, they may worry about scoring low marks and thus being judged as an inferior student or

practitioner by the researchers. This study did not measure any of the participants' skills in a formal way. That said, the feedback provided by the VP made a judgement on the participants practice as it suggested what they did well and not so well. If a participant received feedback suggesting they needed to make lots of improvements, this could have upset them. To try and mitigate this effect, it was stressed in all three of the data collection workshops that there is no single way to conduct a consultation correctly. Simon and other educators were on hand to explain to the participants using the VP why certain choices they made resulted in negative feedback, using evidence where appropriate; this hopefully made it clear to the participants that the feedback was not just the VP designer's opinion but was informed by evidence.

It is possible for the software to record the 'route' that the participant took through the consultation but this information was not recorded for technical reasons; to do this would require the setup of a login system and the generation of user accounts. It was thus not feasible to explore the individual participant's decisions.

3.7.2. Informed Consent

The project posed very few risks to the participants; the technology is not likely to be upsetting and the data collection methods ask only about the participants' experience of the technology. No formal assessment of the participant's capacity was undertaken; all the participants were either healthcare students or healthcare/academic professionals so it was assumed they would have capacity to consent. All participants were given an information sheet with the details of the study and had the opportunity to ask questions; the information sheet detailed the aims of the study, what was expected of the participants and the risks to them. Those who decided to participate were asked to sign an electronic consent form. They 'signed' by giving their email address and ticking a box to agree to the terms of the research. A prolonged period between reading the information sheet and consenting to the study was not felt to be necessary due to the low risk nature of the research.

Should any participant have wanted to withdraw from the study, the information sheet held the details of how they could do this. They had to either email or phone Simon who would remove their details from the research. After completing the post-questionnaire and interview, the participants had a week to withdraw their data. After this time, analysis would have started so removing it at that stage would not have been practical; this was explained in the information sheet.

3.7.3. Data Storage and Security

The data needed to be stored in a way that was both accessible and secure. All data was stored on Google Drive, a password protected, cloud storage system. This meant there were no paper records with confidential information on them which could be lost; the same is true of hard drives and USB sticks. Google Drive also allows the data to be shared and transferred securely. To maintain security and reduce paper consumption, all other study data was gathered electronically; the questionnaires were administered by Google Forms and this data was stored on Google Drive. All the data was thus protected under Googles stringent security systems while still remaining accessible.

The Keele ethics panel decided that for the pilot study, the data also needed to be backed up to a Keele computer. This requirement was only made for the pilot study and was complied with.

The data was to be kept for a period of five years. This period was decided on as it allowed an appropriate amount of time to analyse the data with a margin allowed for any unexpected delays. There was a clause that the data would be deleted earlier, when the research was completed; this was anticipated to be well before the five years. Data was not to be used for any other purposes or passed onto to any other individuals or organisations.

3.7.4. Patient Involvement

Laypeople (patients) were involved in the design of the VP. Patient and Public Involvement and Engagement (PPIE) activities do not require ethical approval as the laypeople are not research participants. The PPIE team at Keele University were consulted about the involvement of patients and they confirmed that their involvement in this study was not deemed a research activity and so did not require ethical approval. This was also confirmed by the Health Research Authority (HRA).

3.7.5. Clinical Research Network

There is a national group of Clinical Research Networks (CRN), divided into regions, to support local research. If a study is registered with the National Institute for Health Research (NIHR) portfolio then it is eligible to receive support from the relevant CRN(s). An application was submitted to register the GPR portion of this project with the NIHR CRN portfolio; this application was successful.

Any work that is accepted onto the portfolio must be of sufficient quality so an assessment was undertaken. This included peer review which was undertaken by a member of academic staff in the Keele University Medical School with a background in decision-making research and an academic based in Amsterdam, also with experience of decision-making research. Both of these reviewers were suggested by Neal Maskrey. During the process of submitting ethical approval documentation, the West Midlands CRN, the local CRN for this work, provided advice and support as to what documentation were required.

The CRN's main role in the project was to provide advice about study set-up and to facilitate recruitment.

3.7.6. Ethical Approval

The Keele University ethics panel was contacted to determine when a piece of work would be defined as a service evaluation. The conclusion from the chair of the committee was that if the only

additional item the participants were exposed to was the evaluation (questionnaires and follow up interviews in this case) then that work would be labelled a service evaluation and not require ethical approval, provided the participants knew that they were taking part in a service evaluation. The work with pharmacy undergraduates fit this criterion; whether the potential participants consented to take part or not, they would still be using the VP and the evaluation resulted in recommendations for the workshop for next year's cohort. In line with good practice recommendations, and the advice of the ethics panel, information sheets and consent forms were still used for the service evaluation; these consent forms and information sheets were very similar to those used in the rest of the study, apart from minor and specific wording changes. The potential participants were also told that they were being invited to take part in a service evaluation, as was stipulated on the information sheet, consent form and orally on the day of the workshop.

All of the other work required ethical approval. As no patient participants were involved, ethical approval could be granted by the Keele Ethical Review Panel i.e. approval from an NHS ethics committee was not required. As the GPRs were approached through GP surgeries in the first instance, Health Research Authority (HRA) approval was also required, as was confirmed by the West Midlands CRN.

Ethics approvals were started in February 2017. Initial ethical approval was received on the 1st March 2017. Five amendments to the study were submitted during 2017 and 2018 to alter the recruitment population, subtle alterations to the questionnaires and to apply for a time extension. HRA approval was received on the 17th July 2017. Confirmation of the studies acceptance onto the NIHR CRN portfolio was officially confirmed on the 23rd January 2018. The pilot study also required ethical approval and this was granted on the 5th May 2018 by the Keele Ethical Review Panel.

3.8. Summary

There are a plethora of different ways to think about and design a research project. This project followed a pragmatic, sequential explanatory, mixed methods design incorporating both questionnaires and semi-structured interviews. In addition to a pilot study, data was gathered from three workshops; a service evaluation with pharmacy students and one workshop with medical students and one with GPRs.

4. Virtual Patient Development

Sections from this chapter are published in: Jacklin S., Maskrey N. and Chapman S., 2018. Improving Shared Decision Making Between Patients and Clinicians: Design and Development of a Virtual Patient Simulation Tool. *JMIR Med Educ*, 4(2): e10088.

4.1. Introduction

The chapters thus far have suggested that Shared Decision-Making (SDM) is not occurring in practice to the extent that it ought to (Couët et al., 2015; CQC, 2018; Kunneman et al., 2015). SDM is based on communication (Bensing, 2000) and communication skills can be taught and developed (Aspergren, 1999; Jin et al., 2017). To develop these skills requires one to repetitively practice to improve (Ericsson et al., 1993). While the focus on communication skills in both undergraduate and postgraduate curriculums has increased since the 1970s, there are suggestions that this increase may not be sufficient (Hargie et al., 2010), particularly in postgraduate education (Brown, 2008, 2012; Dacre et al., 2005). It is also suggested that the amount of time spent teaching SDM specifically is limited (Durand et al., 2018; Elwyn et al., 1999a, 1999b; Oswald, 2018). Additionally, the literature on Virtual Patients (VPs) for developing the communication skills required for SDM is very sparse. Therefore, the purpose of the VP designed for this project was to allow learners to practice a consultation in line with the principles of SDM.

Since the setting of the VP was a primary care consultation (see 4.3.5.) one of the principles to address at the outset of the design phase was what exactly is SDM? This was then followed by what constitutes a good SDM consultation? After this was established, the virtual patient simulation could be constructed in line with these ideals. Chapter 1 touched on the top-level, general features of a

good consultation, such as patient centeredness, communication, partnership etc. It also described the hallmark features of SDM; two-way information exchange, discussion of benefits and risks, alternative treatments and the option to do nothing (Charles et al., 1999; Coulter and Collins, 2011). What it did not do was instruct one on how to undertake a consultation.

Unlike some other aspects of medicine, a good consultation is very difficult to define (de Silva and Bamber, 2014; Howie et al., 2004). If blood pressure control was the variable being measured then it is very simple to measure by how many mm/Hg the patient's blood pressure is reduced by at different time points; consultations though do not have a simple numeric value to measure their quality. 'Good' also depends on the patient with each patient desiring different levels of involvement (McKinstry, 2000). Patients present with different issues, some medically complex, some less so; modern healthcare is not broken down into clear right and wrongs, we have fuzzy not rigid boundaries resulting in an inherently complex system (Plsek and Greenhalgh, 2001). Therefore, it was not realistic to draw up a list that touches on everything required for an ideal consultation; there was no blueprint for perfection. The next step was to look at consultation models to gain an insight into the process of conducting a good consultation.

4.2. Consultation Models

Consultation models provide a way of understanding the consultation (Pawlikowska et al., 2002). It is suggested that they should not be treated like rote scripts but can instead provide a structure or rough framework to a consultation. Some of the most common include Helman's Folk model (1984), Pendleton (et al., 1994), Neighbour (2005), Byrne and Long (1976) and Calgary-Cambridge (Kurtz and Silverman, 1996). They are all different with some being patient-centred and some clinician-centred (Denness, 2013); some provide a framework to give a structure to the consultation while others

provide points for thought or reflection. Some, like the Calgary-Cambridge, are quite general but others are more context specific.

These models go some of the way to helping with an understanding of how a consultation should run in an ideal world. They are not however a panacea; Neighbour, who has also created a consultation model, raises reproach of treating them like rote scripts (2005) as does Haslam (Millett, 2016). Glouberman and Zimmerman (2002) use the light-hearted analogy of an inebriated person looking for their keys under a lamppost to satirise models;

"Oh, where do you think you lost them?"
"Down the block near my car," he says.
"So why are you looking for them here?"
"Because the light is better."

While a little facetious, the important point they make is that models, while providing clarity, may not provide a true reflection of a complex system. The statistician George Box asserted that all good models can be illuminating and provide a useful approximation but can never represent the complete truth (Box, 1979). A consultation model could provide a loose structure to help guide the scripting of the VP.

So which consultation model is best suited to the needs of designing a virtual consultation? Veldhuijzen et al. (2007) applied the AGREE criteria to clinical communication models. The AGREE criteria (Agree Collaboration, 2001) are usually used for evaluating the development and reporting of technical guidelines but the authors felt that they could be applied to communication models. The 23 AGREE criteria include clarity of presentation, evidential support, stakeholder involvement and applicability; of the included models, the Calgary-Cambridge scored highest. There were caveats to

the findings though; they only included guidelines used locally in the Netherlands and there is uncertainty as to how well the AGREE criteria apply to communication guidelines. Consultation models are derived in different ways and for different purposes; Byrne and Long, for example, observed 2500 consultations via tape recording (1976) whereas Neighbour's is based largely on his prior experiences and knowledge, as well as Neuro-Linguistic Programming (Neighbour, 2005). This makes it rather difficult to say, with any degree of rigour, which of the plethora of consultation models is "best". The UK Clinical Communication Council's 2008 Consensus Statement (Von Fragstein, 2008) does not choose a best model but lists several and welcomes the use of multiple models including Bird's three functions, the SEGUE framework (Makoul, 2001), Neighbour, Pendleton & Tate, MAAS criteria (van Thiel et al., 2000) and the Calgary-Cambridge.

A 2015 study found 86% of responding UK medical schools (n=21) used the Calgary-Cambridge model in their teaching (O'Neil, 2015). Some used it alone while others added additional ones taken from health psychology. A slightly older study made a similar finding with 18 out of the 20 medical schools reporting that they used a consultation model, using Calgary-Cambridge (Gillard et al., 2009). So, it seems that Calgary-Cambridge, while not conclusively stated as the best, is the most ubiquitous. The model was initially designed at the Calgary medical school, Canada (Riccardi and Kurtz, 1983), and then built on over an 18-year period in collaboration with Cambridge University, hence its name (Kurtz and Silverman, 1996). It features 73 individual points grouped under five main titles; initiating the session, gathering information, physical examination, explanation and planning, and closing the session (Figure 8). "Providing structure" and "Building the relationship" are two additional sections which run throughout the consultation. It forms what is in essence a checklist of things to do or achieve in a consultation with no requirement to use all of the points e.g. not all patients will require a physical examination.

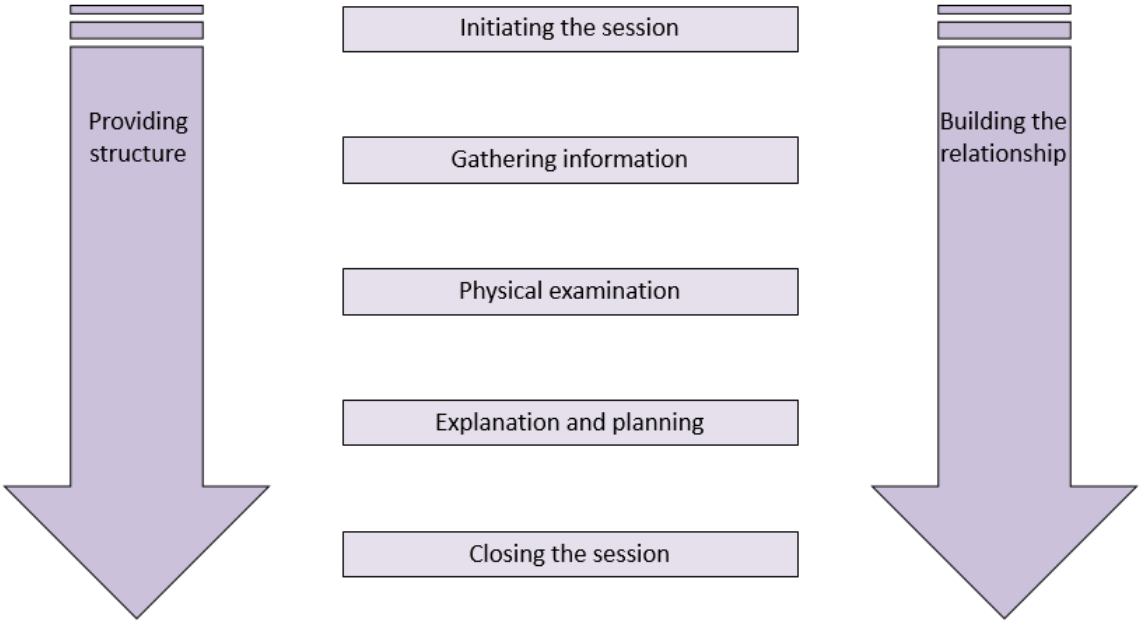

Figure 8 - Basic framework of the Calgary-Cambridge model; adapted from Kurtz et al., 2005, p40

The Calgary-Cambridge model is evidence based and works across different specialities and cultures (Draper et al., 2002; Greenhill et al., 2011). The accompanying textbook for learning communication skills features chapters based on the sections of the model, one chapter for each section (Silverman et al., 2013). In each section, each sub-skill is explained with reference to the corresponding evidence from the literature. As an example, the section "Building relationship", sub-section "Developing rapport", point 28 is "Accepts legitimacy of patient's views and feelings; is not judgemental". As the book describes, this is based on prior research showing that this type of behaviour is effective for developing rapport (Briggs and Banahan, 1979; Schibbye, 1993; Steilhaug et al., 2012). This evidence-based approach is taken throughout the guide to all of the 73 points. The Calgary-Cambridge model was the basis of the first entirely evidence-based textbook on medical communication skills (Suchman, 2003); this approach has led to the guide receiving international praise for its scientific underpinnings and could be one reason for the Calgary-Cambridge's popularity (Veldhuijzen et al., 2007).

The Calgary-Cambridge model was thus chosen as a suitable model for informing the design of the VP.

4.3. Design of the Virtual Patient

The following were those involved in the design and creation of the VP.

Simon Jacklin – The PhD candidate and chief designer of the VP tool. Simon had overall responsibility for the entire design and construction of the VP; this includes the patient profile, the script, patient involvement and digital side of the project. The following individuals and groups supported Simon in this task.

Stephen Chapman – Simon's primary academic supervisor who has clinical, virtual reality, evidence-informed decision making and educational expertise. Stephen provided general advice with his understanding of the three main elements; clinical, simulation and education.

Neal Maskrey – Simon's secondary academic supervisor with clinical, educational and evidence-informed decision making expertise in addition to their application in national and local policies about medicines. He primarily advised on the writing of the script, drawing on his experience as a GP and of teaching GP specialists in training.

Digital Development Team (DDT) – The team is based within the Keele School of Pharmacy and is comprised of digital animators and software developers. They are all non-clinicians so their input was to the virtual reality side of the project i.e. writing the code for the program and animating it.

4.3.1. VP Platform

There were two platforms considered for the VP; an app or a website. The former appears very professional, like a commercial product and was also slightly easier for the programming team to

work with. An app does not require an internet connection once downloaded, which a website does. On the other hand, an app has to be sold (for no charge, in this case) through an app purchasing marketplace, such as Apple's App Store. The difficulty with this is that to update the app requires the approval of the vendor, which takes time. Apps are also only available on certain devices, such as smartphones. A web link was chosen due to greater control and versatility. The advice about the platform capabilities was provided by the DDT.

4.3.2. A Note on Gamification

"Gamification" is "the use of game design elements in non-game contexts" (Deterding et al., 2011). This has been applied to the education of health care professionals (Ahmed et al., 2015; Day-Black et al., 2015; Shawaqfeh, 2015). There are those who view VPs as educational games (McCoy et al., 2016) but in accordance with the definition of game design from Deterding, the VP described here was not designed using game elements or principles; there was no competitive element, no score to improve or particular end goal to achieve (Kerfoot et al., 2014). This was a deliberate choice as it was feared that if a score was given, the users of the VP would focus only on improving their scores to perfection, potentially instilling an attitude of rote script learning i.e. I must select these options to conduct the perfect consultation. The VP could perhaps be considered a "serious game" (Deterding et al., 2011; McCoy et al., 2016) but it was not designed using game principles.

4.3.3. Design Process

The structure of the design process was based on the procedure used by DDT and was mapped out at the start of the process. The DDT use this process to develop all of their scripts for VPs so as they would be animating the VP, this process was followed. The design and creation of the VP spanned around 9 months in total, from start to finish. The following were the main stages of development.

1. **Creating a patient profile**

A patient was created and a background written for him along with medical and social history. They were not based on any one real patient; any resemblance to persons living or dead is purely coincidental.

2. **Drafting a script**

In line with the patient profile, current best-available evidence relevant to the clinical topic, and the Calgary-Cambridge model, a script of the consultation was written. This outlined the different options a user could select and corresponding patient responses. This script was drawn up as a flow chart, or decision tree.

3. **Technical review of the script**

After drafting a script, this was reviewed with the DDT to ensure there were no obvious deficiencies or technical impossibilities.

4. **Layperson review**

The script was discussed with laypeople and their comments and suggestions integrated into the script and profile.

5. **Creation of a mock VP**

The programming team mocked up the script into a VP package, minus the animations and sound. This allows it to be used as an educational tool so it can be reviewed as a prototype.

6. **Initial prototype testing of the VP**

The prototype VP was reviewed by Simon and his supervisory team.

7. **External review of the VP**

Three experienced primary care consulters were asked to use and review the prototype to critique the script and the feedback given. This phase formed the expert peer review.

8. **Amendments to the script**

Comments and suggestions from testing were used to improve the VP.

9. **Voice over recording**

A voice over artist was recruited from a local amateur dramatic society. The actor recorded the VPs verbal responses with direction from Simon and the DDT.

10. **Animation of the VP**

After testing and amendments to the prototype, the VP was animated by the DDT; this was not done for the prototype as it is very time consuming and making changes after this stage would have been possible, but impractical.

11. **Final technical test**

The finished VP was tested to ensure that each option gave the appropriate corresponding patient response.

12. Finished product

A fully animated, interactive, low to medium fidelity VP software package was delivered.

4.3.4. Target Population

As for any educational tool or activity, the end user (i.e. the learner) must be considered. As mentioned in the narrative review, VPs do not seem to have a clearly defined niche in terms of where they sit within the curriculum, if indeed there is a single point. Therefore, it was difficult to pick a single stage or profession for which this intervention would be most appropriate. SDM is a high-level skill which draws on multiple different sub-skills (Elwyn, 2004), so it was thought to be quite ambitious to try and develop it for early-year undergraduates. Drawing on Millers pyramid (Miller, 1990) and the research about how expertise develops (Maskrey et al., 2009), putting novices into a situation simulating an advanced skill could be educationally inappropriate.

Middle to later-year undergraduates were thought to be a better target group as they have, or should have, already acquired some of the basic skills required. As is suggested by Perry (1999), upon graduation from Higher Education (University, in UK health career terms) an individual has not completed their educational change; while a great change in skill and attitude occurs across the undergraduate curriculum, change still occurs post-graduation so early-postgraduates were also thought to be a good target for the intervention as they are still acquiring and developing their skills. These groups are often preparing for assessments too, such as Royal College examinations.

As for which professions were to be the target of this intervention, medical doctors and pharmacists (students as well as practicing clinicians) were thought to be the most appropriate. This was because

the discussion simulated is centred on pharmacotherapy and whether to initiate a statin or not. It was not all medical doctors that were the target of the intervention but a more specific group; General Practice Registrars (GPRs). GPRs are doctors training to become GPs thus the consultation is a central activity of their practice (Baird et al., 2016; Davies, 2016). To become a GP, GPRs must pass numerous assessments of their consultation skills; the Consultation Observation Tool is used to assess a GPRs performance and performance criterion 11 is "The patient is given the opportunity to be involved in significant management decisions." The ability to conduct SDM in a consultation is therefore important for GPs which means that those training to be GPs were an ideal target population.

The target populations chosen for the intervention were middle to later-year undergraduates of medicine and pharmacy (third year onwards), as well as early career pharmacists and GPRs. While nurses could make a suitable user of the VP, they were not the specific target group for this thesis.

4.3.5. Case Outline

The scenario was based on the decision to prescribe a statin for primary prevention. The rationale for this based is based on numerous considerations. Firstly, this decision is very common in primary care in the UK as many patients are prescribed statins for primary prevention (Homer et al., 2015; O'Keeffe et al., 2016). Secondly, there is a good evidence base for statins for primary prevention at a population level (NICE CG181, 2016b). Thirdly, the decision to start a statin is highly preference sensitive making SDM especially pertinent to explore the patient's values and preferences (Hayward, 2017; Yerrakalva and Griffin, 2017). Additionally, there are concerns that healthcare professionals may struggle to effectively communicate information about risks and benefits to patients (Barrett et al., 2016; Gigerenzer et al., 2010). Therefore, a tool which allows one to practice a consultation involving a shared decision about the potential initiation of a statin for primary prevention could be useful and well targeted.

The VP case focuses on treatment as opposed to diagnosis; SDM can occur during diagnosis too, not just treatment (Berger et al., 2017). The history of the field focuses largely on SDM in treatment though (Elwyn et al., 1999a) and therefore, so did the intervention.

The case simulates a primary care consultation with an 84-year-old male called Brian Smith; the patient attends the consultation on his own. The user of the program has no information as to why Brian has come to see them and has never met Brian before. This means they must greet Brian, introduce themselves and make Brian feel comfortable, as per the first section of the Calgary-Cambridge model (Kurtz et al., 2005). They must elicit the patient's reason for visiting, both those overt and hidden, and then work to a resolution of those issues in partnership with the patient. The patient was designed and scripted to be slightly withdrawn, with traditional views of the doctor-patient relationship. He was not assertive and would not spontaneously tell the user what he wanted to do vis-à-vis treatment decisions; rather he required the use of some consultation skills to elicit his agendas and his values and preferences about them.

The patient's primary agenda was his referral for potential initiation of a statin, with a hidden agenda concerning his diuretic therapy increasing urination and interfering with his mid-morning routine. If handled appropriately, the user will learn that the patient does not want a statin as he is not interested in the uncertain potential of preventing cardiovascular disease; if handled incorrectly they will prescribe him a statin and fail to identify his hidden agenda. There are multiple strands within the consultation depending on the options selected by the clinician and therefore many different ways to reach the point of deciding to prescribe or not prescribe the statin.

4.3.6. Patient profile

The initial idea for the profile was to create a multi-morbid patient exhibiting inappropriate polypharmacy; this patient was then to attend a treatment review as the basis of the VP. Quite early

on it was decided that this was technically very challenging and the DDT advised against designing something akin to that; this is because the decision tree becomes more complex as more medicines and/or conditions are discussed. The compromise settled on was to make the VP with multiple conditions and medicines but rather than 15 medicines, many inappropriate, 5 were used treating 3 different conditions. The consultation also focused on whether to initiate a new medicine, a statin for primary prevention, rather than reviewing all of the patient's medicines. This would then meet the two criteria of realism and technical possibility.

The following points highlight the rationale for the patient profile;

Age

- The patient is 84 meaning that he is potentially more interested in quality rather than quantity of life.

Gender

- It was thought that a male would perhaps be less forthcoming with his healthcare needs (Himmelstein and Sanchez, 2016), the stereotype of men not seeking help. There was also a secondary, practical reason as the DDT has a bank of avatars available for character adaptation with more males than female ones.

Occupation

- Retired, a likely position given his age.

Social status

- Widowed, not unlikely again, given his age. He feels he would like to 'enjoy the time he has left' as he misses his wife.

Clinical status

- He is clinically fairly stable with LFTs and renal function in range; putting these out of range would add a degree of complexity to the case which was thought unnecessary and could shift the focus away from SDM to more technical issues.

Morbidity

- Reduced left ventricular ejection fraction secondary to myocarditis 6 years ago, gout, Benign Prostatic Hyperplasia (BPH) and sub-clinical depression are the patient's medical conditions. These are chosen due to their commonality and plausibility. Due to his age, he is more likely to be multimorbid than a younger patient (NICE, 2016a). At the time of script writing, he was also indicated for a statin as per his QRISK2 score (NICE, 2016b).

Therapy

- The medicines are matched to the patient's morbidities.
    - Ramipril 5mg once daily – Heart failure
    - Bisoprolol 10mg once daily – Heart failure
    - Furosemide 40mg every morning – Heart failure
    - Finasteride 5mg once daily – BPH
    - Allopurinol 300mg once daily – Gout

In the UK, the National Institute for Health and Care Excellence (NICE) write and update clinical guidelines on a large array of subjects based on the evidence available; these guidelines are the gold standard for care in the UK. They were used as the evidence base for the therapeutic regimes and recommendations in the case.

According to NICE CG181 (2016b), a patient with a 10% or greater 10-year risk of developing CVD should be offered atorvastatin 20mg for primary prevention of cardiovascular disease; the risk score should not be the sole driver of care but should be set within a holistic assessment of the patient. As the patient has a risk exceeding 10% in this virtual case, the conversation about statins and primary

prevention should be introduced. It is suggested in the literature that this recommendation to discuss the potential of starting a medicine, a statin in this case, has actually led to professionals dogmatically prescribing them (Greenhalgh et al., 2014; McCartney et al., 2016). Guidelines should not be rigidly adhered to in order to dictate care but be used to inform it alongside the patient's values and preferences (Chew-Graham et al., 2016; Coulter and Collins, 2011). Point 1.3.12 from CG181 states that "The decision whether to start statin therapy should be made after an informed discussion between the clinician and the person about the risks and benefits of statin treatment, taking into account additional factors such as potential benefits from lifestyle modifications, informed patient preference, comorbidities, polypharmacy, general frailty and life expectancy." NICE CG138 (2012), "Patient experience in adult NHS services", states that patients and clinicians may perceive risk differently and that a patient's preferences are an important component of decision-making. Thus, the optimal way to approach this virtual patient consultation is to have a discussion with the patient about the risks and benefits of a statin, communicating this information in a way the patient understands, but also ascertaining what the patient's values and preferences are.

If the simulation were to be handled 'correctly', the patient should be adequately informed of the risks and benefits and decide that he does not wish to be prescribed a statin at this time; the patient's preferences were determined at the first stage of the design process. The reason that the patient was scripted to prefer not to take the statin was that, as mentioned, there are fears that guidelines are being applied dogmatically to patients (Greenhalgh et al., 2014). Therefore, the expectation was that a user of this VP would see Brian was a candidate for a statin and therefore seek to prescribe it without proper discussion, believing they were doing the right thing. The patient is nearing the end of his life so a long-term prevention strategy is perhaps not what he needs most; this preference should be explored with the patient and not just assumed due to his age. While he is at risk of cardiovascular disease, the patient's preferences should guide the decision as to whether to prescribe or not.

The patient's hidden agenda is, as he describes it, his waterworks. As part of his heart failure treatment he is prescribed 40mg furosemide each morning of which increased urination is a side effect due to the diuresis induced (Joint Formulary Committee, 2018). As he takes it in the morning, he needs to go the bathroom shortly after which interrupts his trip to the newspaper shop. To resolve this requires a simple case of individualising care by moving the diuretic to mid-morning rather than early morning, thus not interfering with his walk but also achieving its therapeutic aim (Aronson, 2007). Due to his age and his description of the symptoms, it is also important to check whether it was an issue with the diuretic or more serious pathology of the lower urinary tract (NICE CG97, 2015). This highlights that SDM and patient centred care must be based on technical competence.

4.3.7. Script

The first draft of the script could not be developed by Simon in isolation; while a pharmacist, he was newly qualified and did not have primary care consulting experience of the kind simulated with the VP. Neal Maskrey was an experienced GP and GP tutor so supported Simon in script writing, providing advice from both his clinical and educational expertise. The Calgary-Cambridge model was used as the basis for the structure of the consultation. It is a checklist style model so lent itself well to becoming a scaffold for a virtual consultation script. What the Calgary-Cambridge model did in particular was provide an outline to help construct a virtual patient script. The model worked much like a skeleton, a structure on which to hang the main body of the consultation. Along with Stephen Chapman's medicines optimisation and simulation expertise, this helped guide the writing of the script. The review processes were designed to subsequently improve the accuracy, realism and usefulness of the script.

The VP was best described as a branched multiple choice design (Ellaway et al., 2008). The technology was multiple-choice with options presented on screen each time for the user to pick what

to say. Each time 3 options were presented, one was optimal, one was not optimal, and one was acceptable but not optimal. Each of these categories is relative and what is deemed optimal at one point in the consultation may not be optimal at another. Once the user clicks their desired option (e.g. “How can I help?”) the patient responds with both pre-recorded speech and animated body language (e.g. “The nurse thinks I might need a statin”). After the patient responds, three more options are presented and the consultation branches from there. At some points the options presented express the same sentiment, such as saying “hello”, while at other points the option selected means the consultation moves on into different territories.

It was important to make all the suggestions plausible and not too obvious or the tool would be too easy to navigate. This was a particularly difficult task; it was easy to provide each juncture with one clearly good option, a very poor option and a hybrid of the two. The difficultly lay in making none of the options obviously “good” or obviously “bad”. As an example, the following section in **Table *3* - Scripting example**Table 3 (not from the script) shows two sets of options which would be too obvious to choose from.

Table 3 - Scripting example

Example 1	**Example 2**
Hello	What do you know about warfarin?
Alright	I think I’ll prescribe warfarin for you to reduce the risk of blood clots
What do you want?	You’re going to take warfarin

In both examples, the first-row option is clearly the most appropriate, the bottom one is an example of poor practice and the middle is possibly acceptable but by no means best practice. If the options were too obvious, as in Table 3, the fear was that the user would not be challenged at all as the

'path' through the consultation would be clear and require no thought. The aim was to make the users of the VP think about the different options and why they may lead to different outcomes.

VP research notes that individuals have their own consultation styles and the technology needs to try and incorporate this into the design (Parsons et al., 2008). At a few junctions, there were two good options which allowed the user to choose the order in which they undertook the consultation; as an example, there were two issues to discuss (waterworks and statin) and these could be discussed in any order. The script was therefore designed to be non-linear, that is, one could take a variety of routes through the consultation and still end up with an outcome that met at least some of the requirements of shared decision making and was correct from a therapeutics perspective. This reflected the reality that different people may conduct a consultation differently but this divergence is not necessarily negative; professionals may have their own personal style. Whilst any style should be flexible and attempts should be made to adapt to the different ideas, concerns and expectations of different patients, the VP was designed to not punish someone for taking different, but acceptable pathways through the consultation.

4.3.8. Feedback

Feedback, as touched upon previously, is essential for improvement (Hewson and Little, 1998; Ericsson et al., 1993; Wood, 2000). The Kolb theory of experiential learning and the four stage reflective cycle (Kolb and Kolb, 2005) are cited as suitable for simulation and VP learning (Kleinert et al., 2016; Pantziaras et al., 2015; Zigmont et al., 2011). Under this theory, a simulation is designed to provide the concrete experience to start the cycle. After the reflection, the cycle continues as the user can use the simulation again to put their learning into practice. The Kolb cycle is just that, a cycle, so the learner can use the simulation, reflect on the experience and then use the VP again to put the learning into practice and so on.

The literature suggests that a VP system should provide feedback itself, rather than relying purely on a facilitator (Pantziaras et al., 2014). In addition to this, self-assessment by the learner is identified as important which links to the Pendleton feedback rules where the learner reflects on their own performance before receiving formal feedback (Chowdhury and Kalu, 2004; Howells et al., 2006; Pendleton et al., 1984). The literature also suggests that providing a score for the simulation can be undesirable as it can lead to learners chasing improvements in their marks at a detriment to their learning (Bateman et al., 2013). Outside of the VP literature, real patients providing feedback on interpersonal issues have been shown to improve GPRs skills (Greco et al., 2001).

Feedback was based on the Kolb experiential learning cycle (Kolb and Kolb, 2005). After the concrete experience of the simulation, there was a pause so the learner could reflect on their learning, allowing self-assessment. The formal feedback was then delivered when the learner chose. The formal feedback was broken down into two parts, the patient feedback and the text feedback. Firstly, the virtual patient, Brian, told the learner how he thought they had done, how they had made him feel; this is described here as the interpersonal feedback. After this, the text-based feedback was given as a series of bullet points; they were colour coded with green for positive and red if improvement was required or suggested. The text-based feedback included suggestions of phrases or techniques to try when using the simulation again as well as the feedback Brian had given. It also featured specific feedback on the prescribing of the statin, if the user prescribed the statin. No score was provided by the VP.

Not every point in the simulation generated feedback; the reason for this is that if it did, the feedback could be gratuitous, with a possible 40+ feedback points; too much feedback is identified as problematic (Hewson and Little, 1998).

4.4. Outcomes of the Review

The aim of the VP was to improve each learner's communication skills, specifically, the communication skills required for SDM. Due to the feedback proposing how the learner could improve their consultation, it was of vital importance that it did indeed represent a good consultation. The script was based on existing evidence as to what would constitute a skilled consultation fitting this particular patient and his values and preferences. Whilst it was written with expert advice, validation was required. Therefore a two-step review process was implemented. The first step involved lay people, real patients, while the second involved experienced consulters.

4.4.1. Lay people

The rationale for involving lay people in the research was to improve the authenticity of the design to make it more realistic. A secondary reason for doing it was that it was not the norm in VP research so it was intriguing to see what benefit lay people could bring. Thirdly, most consultation models have been designed through observations of real consultations and focused on what the clinician should be doing to improve the consultation (Pawlikowska et al., 2002). Therefore, patient involvement has been missing in determining what is desirable for a consultation framework so was included in the design validation.

A small collection of laypeople were contacted through their links with the Keele School of Pharmacy to collaborate on this project. Three people agreed to help and they were each met individually to ensure they were able to communicate their views and opinions without being talked over by someone else. All of the laypeople were of a similar age to the VP, a conscious decision. Each was given a brief introduction to what VPs are and the more specific aims of this particular VP including the patient profile and background. Comment on any area was welcomed but in order to direct discussions, each of the laypeople were shown sections of the script which were deemed to be

sensitive or pivotal points. Each person was met with once for between one and three hours. None of the laypeople received any remuneration.

Table 4 contains the comments and subsequent action from the sessions with the laypeople.

Table 4 - Layperson feedback

Layperson Comment	Action
Patient age is not relevant to this case; a patient of any age may want to reduce the burden of tablets and mention of age could offend	The 'good' option at this section had the age of the patient removed
As the patient is 84 he may well have some form of hearing impairment so checking his understanding is vital, especially as the timing of his diuretic may have been changed	An extra (good) option was added to allow the user of the VP to ask the patient to say when they would take the diuretic; if the patient does this then they are actively engaged and are also confirmed to have understood
The clinicians previous relationship with the patient should be stated as this affects the style of communication	The fact the user had not met this patient before was added to the introduction
Patient background was said to be important as different demographics affect the style and approach of the consultation	The background was made a little more comprehensive but it was tried to be balanced against reality; medical notes with fully comprehensive details of a patients social history was felt to be unrealistic
The softer approach of discussing risk/benefit of treatment with less numbers was favoured and should occur more within the script. Flexibility was also felt important as if the user jumped	The available routes through the simulation were made more circuitous to allow learners to make imperfect choices but then recover later on and vice versa

straight into numbers, they should be able to get themselves back on track with a 'softer' explanation to clarify	

It was pleasing that the laypeople were using language that had been included in the script; this happened before they had seen the script. They commented with words to the effect of 'I think doctors should be saying…' with these phrases already featured.

Involving patients in the design of a VP is something that did not feature much in the papers included in the narrative review, chapter 2. Patients are involved in designing curriculums and in other areas of education (Brett et al., 2014; Towle et al., 2010) so it seemed a reasonable assumption that they could prove useful in VP design. When embarking upon the involvement of laypeople in the design, it was unknown what the outcome would be. Would they be able to understand the purpose of the simulation? Would they feel comfortable contributing? Would they be able to articulate their views in a constructive way? The answer to all of these questions was yes. It was not known in advance what the contribution of the laypeople would be but this seemed to be the very point of involving laypeople; they helped to spot things that the rest of the design team had missed due to their different perspectives on the issue.

4.4.2. Experts

At numerous points in this thesis thus far, the lack of a simple metric to measure consultation quality has been highlighted. Therefore, to try and ensure that what had been designed was pedagogically and clinically appropriate, expert review was incorporated. The prototype version of the VP, the finished product minus the animations and voice over, was sent to three reviewers so they could use it and provide constructive feedback to improve it. All three reviewers were primary care clinicians involved in consulting with patients in very much the same style as modelled in the VP i.e. within a

GP surgery around general, rather than specialist issues. Two of the reviewers were GPs while the third was a primary care pharmacist. All three of the reviewers were professional contacts of Neal Maskrey and this is how they were brought into the project, through Neal. None of the reviewers either asked for or were offered any remuneration.

All of the feedback provided by the reviewers is presented in the table below. The left hand column lists each individual point from the reviewer; the right hand column is the action resulting from that comment. Where the word 'technical' is given as an outcome, the reviewer's suggestion was not incorrect or irrelevant but pertained to a technical feature of the VP. These were potentially interesting things to explore but were not currently possible for the DDT to implement. This was because they would require more funding and/or more time or may not even be technologically possible. These ideas were still fed back to the DDT so that they could potentially inform future designs.

Table 5 - Expert clinician feedback

Expert Comment	Action
No option to use a patient decision aid (PDA)	The option to use a PDA was included
Very specific language used at certain stages e.g. different between 'something vs anything'	There is evidence to suggest subtle adjustments in language can have profound effects (Heritage et al., 2007; Schoenborn et al., 2017)
There could be the option of a middle ground when presenting risk; current options are too distinct	A middle ground option was included so the choice of risk explanation language is not so dichotomous
If the case is handled very poorly, there is little feedback	More feedback was added in the event that a user handles the simulation very poorly
Feedback at the end is given too quickly	A pause was added between points and a written summary provided at the end

Whether the statin is for primary or secondary prevention is not clear	The patient's medical history was amended to make it clearer
The supposed red flag symptom is not clear enough	A further bit of dialogue is added making the urinary symptoms more explicitly a red flag
Needs to be clear to the patient that we cannot predict whether they will or will not have a cardiac event	A line was added to stress that we cannot predict in advance whether any one person will have an event
No feedback for missing a potential red flag	Additional feedback was added
Wording of feedback could be more constructive	Rather than stating a negative piece of feedback outright phrases such as 'It was good you tried to…..but……' were added to make them more constructive
Medical notes not available from the start	Amended so the notes can be viewed at any given time
Might be useful to have a print out of the feedback for use in development portfolios	This function was added; a PDF of feedback can be downloaded each time the simulation is used
Technical Comments	
Feature a clock to show how long the consultation has been running, increasing the realism	
The ability to go backwards in the consultation, re-trace steps	
Have feedback given instantaneously, as the user goes along	

4.5. Digital creation

The Digital Development Team took the script provided to build the finished, fully animated and voiced VP tool. The team of animators and programmers used an array of computer programmes, shown in Table 6 to build the VP.

Table 6 - Computer programmes used in the design and construction

Script Writing	Google Sheets and Docs, draw.io
Audio editing	Adobe Audition and Premiere Pro
Character/Environment modelling, rigging, animation & rendering	Maya 2014
Character/Environment texturing	Adobe Photoshop
Compositing	Adobe After Effects CC
Server-side scripting language	PHP

To illustrate the quality of the graphics involved, Figure 9 features a screenshot of the software.

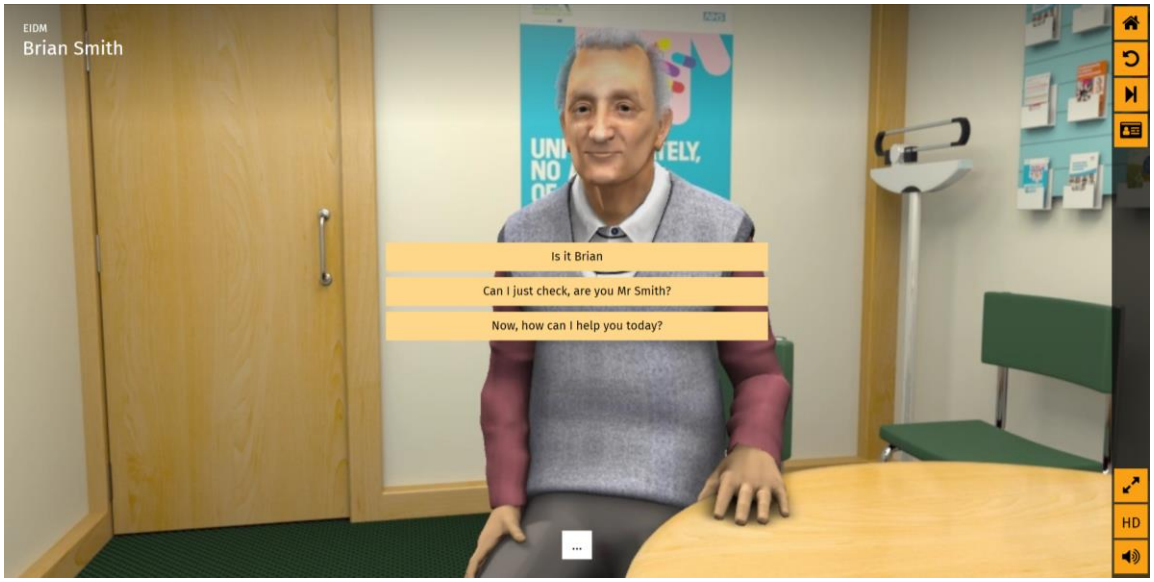

Figure 9 - Screenshot of the Virtual Patient

The voice of the VP was recorded by a professional voice over artist; the audio response was also subtitled. Simon worked alongside the team when recording the voice over for the patient, providing direction to ensure the correct tone was used. The case was the same for the animation, with Simon directing how the patient should react at given stages to portray accurate body language. The building of the VP took 6 weeks. This included the recording of the voice over, the animation and drawing it all together.

A particular difficulty was the final testing of the simulation. It was important to run through all the possible permutations to ensure that each option resulted in the correct patient response (both subtitle and audio), that the next set of options presented was correct and that the appropriate feedback was given at the end. This process was both time consuming and somewhat tedious so any innovation that would expedite this process would be potentially beneficial in reducing the testing period of the VP.

4.6. Summary

The purpose of the VP was to allow learners to practice SDM within a primary care consultation. The VP was designed using a multi-stage process. The process started with the creation of a patient profile followed by initial script writing with the Calgary-Cambridge model providing a structure. Both lay person and expert review stages were incorporated to improve the script before the final animation and technical testing phases. The result was a branched, multiple-choice VP simulating a primary care consultation concerning the potential initiation of a statin for primary prevention; a secondary but hidden patient agenda was an issue with the patient's lower urinary tract.

5. Pilot Study

Sections from this chapter are published in: Jacklin S., Maskrey N. and Chapman S., 2018. Virtual patient educational intervention for the development of shared decision-making skills: a pilot study. *BMJ Simulation and Technology Enhanced Learning*.

5.1. Introduction

Pilot and feasibility studies are two varieties of study that can be undertaken prior to a main study; they can be combined into one study or either of them completed in isolation (Billingham et al., 2013). The terms are often used interchangeably (Arain et al., 2010) and it is suggested that this indiscriminate use is inappropriate (Whitehead et al., 2014). This is because pilot and feasibility studies have different aims and when done separately, can look quite different. As for any research, the design and structure of a study should be appropriate and relevant to its aims.

A feasibility study is aimed at establishing whether a full study is possible by looking at important parameters such as the number of eligible participants, follow-up rates and the willingness of clinicians to recruit (Arain et al., 2010). Therefore, a feasibility study might look very different to the full study, if indeed a full study is found to be possible. Clinical trials of medicines frequently use feasibility studies (Thabane et al., 2010), not least because a full clinical trial can cost a great deal of money (Hind et al., 2017). If making a large investment both researchers and funders would desire assurances that the study would be able to recruit successfully; a feasibility study can be useful to decide whether a full trial is possible.

Like feasibility studies, pilot studies are an often-crucial step before starting a bigger, main study (Tickle-Degnen, 2013; Whitehead et al., 2014). A pilot study can be defined as ‘a small-scale test of the methods and procedures to be used on a larger scale’ (Porta, 2008, p215). As mentioned above,

they can incorporate a feasibility element but can also be 'just' a pilot. As is alluded to in that description, a pilot should look quite similar to the main study which is not necessarily the case for a feasibility study (Smith et al., 2015). The reason for this is that a pilot is aimed at testing both the processes and the methods involved in the study (Thabane et al. 2010) so the pilot and the main studies should be very similar. As an example, if piloting a clinical trial for a new hypertension treatment, one could run a pilot study in a single clinic; this would follow the same protocol as for the main study and with the same patient groups, but with fewer participants than a large multi-centre trial. In this way a pilot can be likened to a dress rehearsal, following the same steps and methods but on a smaller scale to test that the methods work appropriately before implementing them on a larger scale.

A pilot study thus enables the researcher(s) to test their study design. Is it practical? Is the documentation clear and understandable? Is it logistically possible? Does it return meaningful data? Can the participants answer the questions? This is by no means an exhaustive list with many different aims possible (Leon et al., 2011). As Hertzog (2008) describes; 'Pilot studies thus range from relatively informal trying out of procedures on a handful of participants, to efficacy studies, or to small-scale clinical trials of interventions.' A point of debate appears to be to what extent these types of work can test hypotheses and evaluate the size and significance of any effect (Lancaster, 2015; Whitehead et al., 2014). Some conclude that pilot studies should be mainly descriptive in nature and that it is inappropriate to use pilot studies to test hypotheses (Arain et al., 2010; McGrath, 2013; Thabane et al., 2010).

Issues of feasibility were not to be explored within the pilot for this project. Funding and ethical approvals were already in place for the main study and should recruitment with the desired populations have failed, this would not cost a great deal of money or time with alternatives also available. Therefore, a feasibility element was not required for this work. To go back to the words of

Hertzog (2008), this pilot study was a 'relatively informal trying out of procedures on a handful of participants.

5.2. Aims of the Pilot

The first aim was to check that the technology worked. The pilot also gathered data on aspects of the evaluation and the participant's views of the VP. This data was useful as it provided information about the functionality of the evaluative method; for example, if it was found that answers to a particular question were responses very different to the topic envisaged with that question, then perhaps the question was worded incorrectly. The aim of the pilot study was;

- To trial the study process and virtual patient for use in the main evaluations

5.3. Method

A pre/post methodology was employed. Questionnaires were completed by the participants before and after using the VP. These questionnaires generated a mix of quantitative and qualitative data by using Likert items, free-text and multiple-choice questions. The questionnaires are appended in appendix 4 & 5 and they are discussed in chapter 3 also. Unlike the three main strands to the project, no interviews were planned for the pilot.

5.3.1. Population

There were two feasible and convenient populations for the pilot; academic health professionals or students from Keele University. As outlined in the Background chapter, there is a need to develop the ability of undergraduate students to engage in SDM in a consultation (Durand et al., 2018; Oswald, 2018). At the time the pilot was being planned, final year medical and pharmacy students were going to be approached as part of the main study. This did not necessarily exclude them as an

option for the pilot population (Leon et al., 2011) but it could affect recruitment to the main evaluation so they were decided to be less opportune. There was also the possibility that the students in the pilot would send their colleagues (non-pilot participants) the materials and hence bias the main evaluation; this could also have affected recruitment. This risk also exists if earlier year students were approached, the sharing of the study materials or biasing of opinions. Thus, students at Keele University were not a suitable population for the pilot study.

It is not just undergraduates that may benefit from an intervention to develop the skills for SDM; registered health professionals may also benefit. Research shows that experienced professionals may not be engaged in SDM and could thus benefit from further practice (CQC, 2018; Joseph-Williams et al., 2017; Oswald, 2018). Keele University has both a medical and pharmacy school staffed by medical and pharmacy professionals. Academic health professionals from these Schools were an appropriate population for the pilot study. The population was relevant to the VP, convenient and the risk of cross-sharing of information was thought to be diminished; this group could have passed on study materials to participants in the main study but this was envisaged to be unlikely. Academic health professionals at Keele University were thus chosen as an appropriate population for the pilot study.

To be included in the study, a potential participant had to be a member of staff and come from a clinical background; they did not need to be currently practicing or registered but had to have a history or background in clinical practice. The participants had to be a member of staff at either the Keele University Schools of Pharmacy or Medicine. The only members of staff who were specifically exempt were the two involved in supervising the research (Prof Steve Chapman and Prof Neal Maskrey). There were no other exclusion criteria. The sample population therefore met the criteria of being relevant to the intervention and also convenient and practical.

5.3.2. Sample Size

The use of sample size calculations for preliminary work is frequently debated in the literature (Billingham et al., 2013; Hertzog, 2008; Johanson and Brooks, 2010; Lancaster et al., 2004; Leon et al., 2011; Thabane et al., 2010). If a pilot study is going to make statistical estimations for a bigger study, as for a clinical trial for example, then sample size needs to be decided carefully with statistical justification (Sim and Lewis, 2012). This was not the aim for this study so a formal sample size calculation would have been irrelevant. In lieu of a formal calculation, there are a range of suggestions for sample sizes for pilot studies. In an audit of pilot sample size including 50 different studies, the median number of participants was found to be 30 with a range of 8 to 114 (Billingham et al., 2013). This led the authors of the audit to conclude that while sample size should be justified, it need not necessarily require a formal calculation. Leon and colleagues (2011) come to a similar conclusion stating that for a pilot '…it's proposed sample size is based on pragmatics…'.

There was therefore no calculation undertaken to decide the sample size for this pilot study. Julious' rule-of-thumb of 12 participants was used (Julious, 2005); it is based on mean variance, practicality and regulatory standards. This number was also thought practical to achieve with the population; being as the chief aim was to test the methods and spot any process issues, 12 participants was felt to be sufficient to do this.

12 was a minimum number for recruitment, not a limit; should the number of participants returning consent forms have exceeded this, they would all have been permitted to take part in the study.

5.3.3. Study Pathway

One initial and one follow up recruitment email were sent to all staff in both the School of Pharmacy and School of Medicine at Keele University. These emails contained information sheets and a link to the online consent form. If a member of staff decided to participate, they completed the consent form followed by the pre-questionnaire. The link to the VP was included at the end of the pre-questionnaire and also sent via email. The VP was then used by the participants in whatever manner

they chose; it was envisaged they would use it on their own but they could have used it in groups with colleagues. After 24 hours, the post-questionnaire was emailed to the participants; after completing this, their involvement was complete. This process is summarised in Figure 10.

All email communications were sent by administrative staff in the respective schools. Reminder emails (one for each stage of the study) were sent to consented participants in order to try and reduce dropout rates.

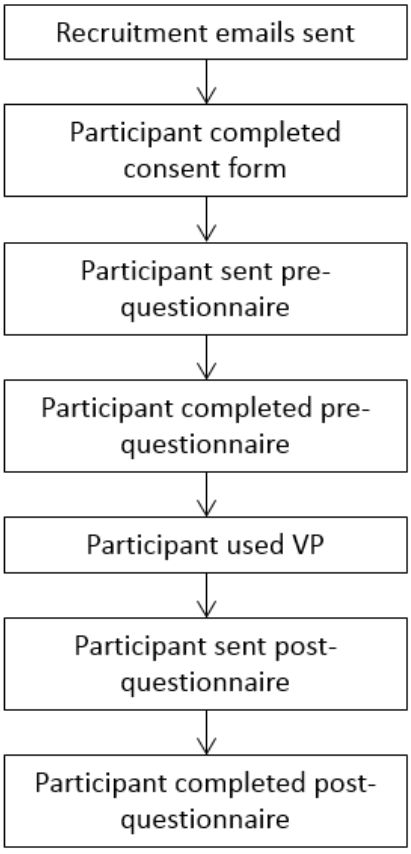

Figure 10 – Pilot study pathway

5.3.4. Data Analysis

The data were predominantly quantitative in nature with Likert and multiple-choice style questions; there were also some free-text fields affording the participants the opportunity to expand upon their answers. Descriptive statistics were used.

The qualitative data from the questionnaires was analysed using content analysis (CA), as detailed in the Methodology chapter. The technique involves coding the data and then grouping those codes into categories. Both supporting quotes and frequencies for the codes were reported. The number of participants whose responses featured each code at least once was reported. Verbatim quotes to illustrate each code were included.

5.3.5. Ethical Issues

The ethical issues and considerations for the pilot study were the same as for the main three strands of data collection. For this reason, that discussion is not reproduced here from the Methodology chapter. There was one ethical issue which was more germane for the pilot than the other sections of this project though. The participants were senior to Simon in his home organisation (Keele University) and consequently they may have felt that they were being judged by someone their junior. No attempt was made to objectively measure the participants practice or knowledge so this fear should have been attenuated. The VP did provide feedback to the participants on their consultation but nobody else could have accessed this, so if a participant received negative feedback, nobody would have known unless the participant themselves chose to disclose.

Ethical approval was sought from the Keele University Ethical Review Panel. There were some minor amendments relating to the storage of the data and specific wording on the documentation. After

this, approval was granted for the study to commence. The study took place from September to October 2017.

5.4. Results

The total number of participants that consented to the pilot study was 21; 18 participants completed the both the pre- and post-questionnaires. The data from the 3 participants who did not complete the study were removed from the results; no reasons were sought or given for drop out.

5.4.1. Pre-Questionnaire

Basic demographic data is included in appendix 6.

Question 1: How would you define a 'digital virtual patient'?

Table 7 - Participant definitions of a VP (pilot)

Computer	n=14	The majority of the participant's suggested that a VP was computer-based
	"A computer program made to respond like a patient" [Participant 5]	
Interactivity	n=10	Interactivity was a feature of some responses
	"An avatar that will interact with you as a patient might" [Participant 3]	
Animation	n=8	These participants thought that animation was a feature of a VP
	"Like 'The Sims' but an animated patient that interacts with a health professional" [Participant 1]	
Patient	n=8	VP's were suggested as being based on real patients
	"A computer programme simulating a real patient which reacts to input from a practitioner via a computer interface." [Participant 9]	

Question 2: Which statement would you say best suits yourself (5 pre-specified options)?

Table 8 - Participant self-assigned adopter class (pilot)

Categories	Self-Assigned Adopter Class	Frequency
I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market	Innovator	3
I enjoy new technology but am rarely the first to invest in a new product	Early Adopter	11
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product	Early Majority	4
I have no desire for new technology, I tend to only adopt it after the majority of other people	Late Majority	0
I dislike change in technology and will only use a product when it has become mainstream	Laggards	0

The self-assigned adopter class was not presented to the participants; they chose which category best fit themselves based solely on the description i.e. the first column.

Question 3: Which of the following methods have you used or experienced in your professional education? Tick all that apply.

Table 9 - Previous education of participants (pilot)

Educational Method	Frequency
Simulated Patients	17
Watching video of someone else's consultations	17
Watching video of your own consultation's	9
Role Plays	18
Digital Virtual Patient	12

Question 4: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following? (1 = not useful at all, 5 = very useful)

Table 10 - Expectation of VP usefulness; subject specific (pilot)

	1	2	3	4	5
Healthcare education	0	0	2	5	11
Clinical decision making	0	0	3	9	6
Consultation skills	1	0	4	5	8
Patient centered care	1	0	4	7	6

Question 5a: Which of the following do you currently use to aid your professional learning or development and how many times per month do you use them?

Table 11 - Current use of educational technology (pilot)

	Apps	Webinars	Social Media	Blogging sites	Online Simulation	MOOCS
Don't use	5	11	11	11	16	14
1-2 or less	8	7	1	6	1	3
3-5	4	0	5	1	0	0
6-8	0	0	1	0	0	0
9+	1	0	0	0	1	1

Question 5b: If you do use any of the above for educational purposes, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Table 12 - Usage of technology; curricula areas (pilot)

Area of Curriculum		Frequency
Basic science		7
Clinical decision making		7
Communication skills		5
Ethical issues		4
Other:	Therapeutics	1
	Law	1

Question 6: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Table 13 - Treatment priorities pre-VP (pilot)

	4th	3rd	2nd	1st
Maximising effectiveness	0	4	4	10
Minimising risks	0	6	8	4
Minimising costs	17	1	0	0
Respecting patient choices	1	7	5	5

5.4.2. Post-Questionnaire

Question 1: How did you find the virtual patient programme to use?

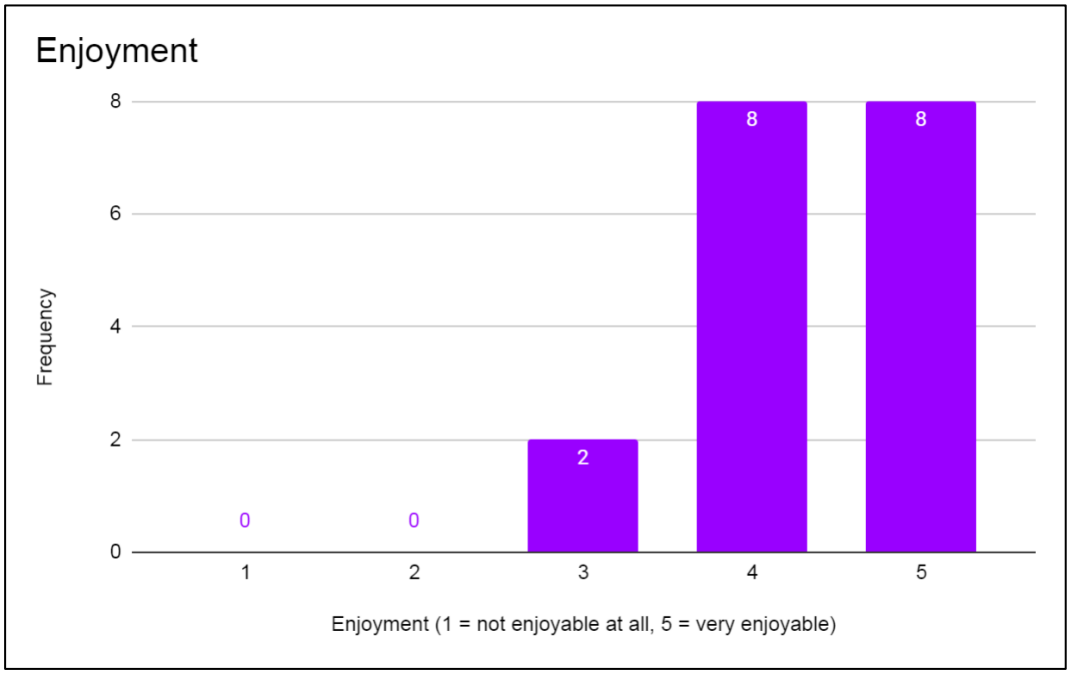

Figure 11 - Enjoyment rating (pilot)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

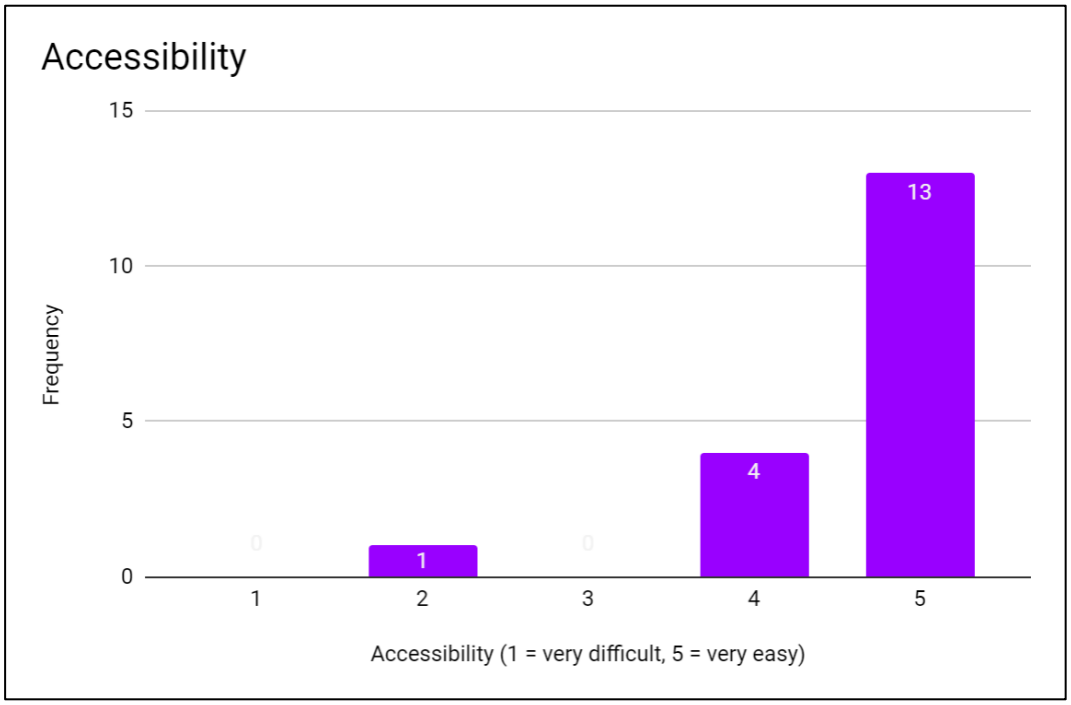

Figure 12 - Accessibility of VP (pilot)

Question 3a: How would you rate the format for giving your reply to the patient?

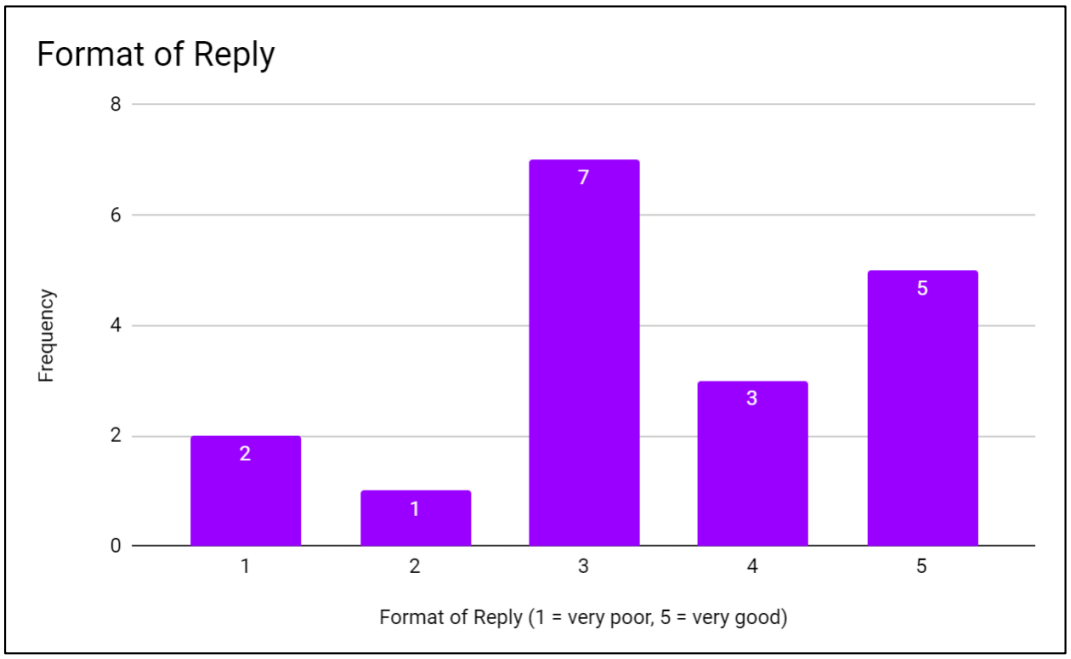

Figure 13 - Format of reply (pilot)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Table 14 – Comments on the format of reply (pilot)

Restriction	n=11	Eleven participants suggested that a negative of the multiple choice system was that it restricted them in their interaction with the VP.
	"MCQs are a rather limited way of communicating with a patient. As such the actual way I would have conducted the consultation may have been somwhat different. The scenario 'led' me to a place which was where the patient wanted to be, but not necessarily giving me the ability to explore all the pertinent issues." [Participant 9]	
Ease	n=1	This participant suggested that the multiple choice system was easy to use.
	"Easy to use on multiple devices e.g. using a mouse or touch input" [Participant 10]	
Obvious	n=1	One participant felt that the multiple choice options were too simple and it was obvious as to which responses were the optimal ones
	"A few options were very clearly divided into a "good" "ok" and "bad" option - for example when the patient first arrives it is very clear, to me, that the best option is to offer him a seat and introduce yourself, and obvious not to head straight into the conversation. However as I have practiced consultation skills extensively I understand that this may not be as obvious for a student currently in undergraduate study." [Participant 5]	
Technical	n=2	Two participants had issues with technical issues when using the VP
	"i did not immediately realise that the arrow at side of comment showed further text so initially chose some comments in error. Perhaps this could be explained before starting the consultation"	

Question 4: How useful was the virtual patient in teaching the following?

Table 15 - Subject specific usefulness of the VP (pilot)

	Frequency (1 = not useful at all, 5 = very useful)				
	1	**2**	**3**	**4**	**5**
Consultation Skills	0	3	3	5	7
Clinical Decision Making	0	3	8	4	3
Patient Centered Care	0	1	3	6	8
Communication Skills	2	4	2	6	4
Managing Medical Complexity	1	5	3	7	2
Managing Polypharmacy	0	7	4	3	4

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

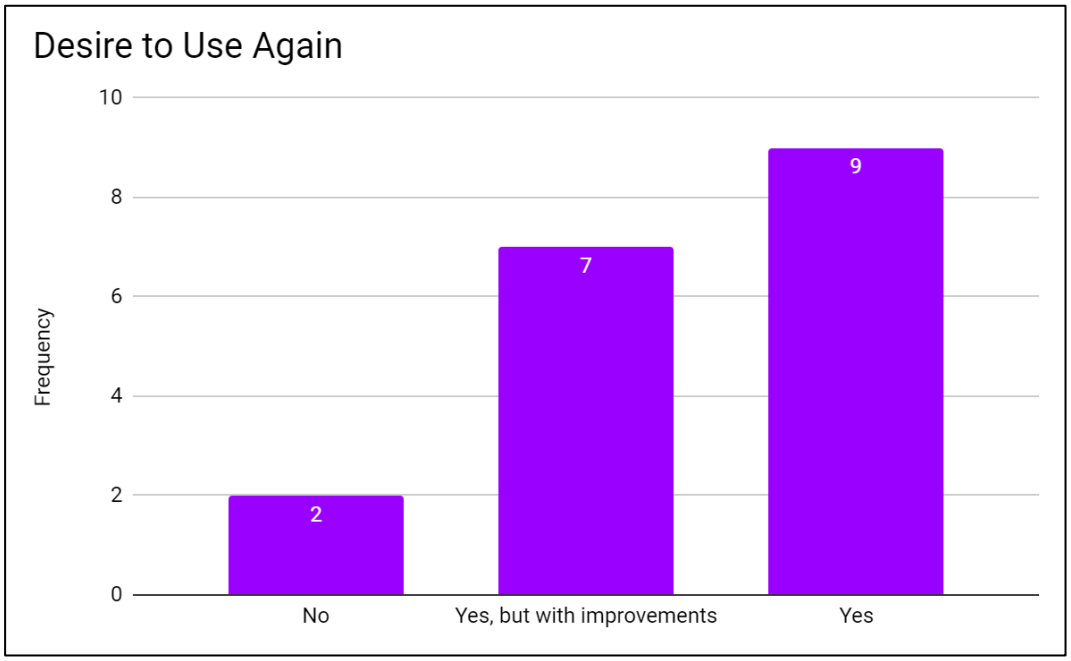

Figure 14 - Desire to use VP again (pilot)

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Table 16 - Suggested improvements to the VP (pilot)

Restriction	n=5	Five participants suggested that they would use the VP again but would like a resolution to the restriction issues. Of these five, one participant suggested a solution to the issue i.e. free-text.
	"I would consider using this in a teaching environment but would prefer ideally to have the use of free text interaction or more response options to better reflect my practice" [Participant 18]	
Another use	n=1	One participant liked the VP software but did not think it useful for the development of consultation skills.
	"Using it in a different manner, consultation skills (eg relevant questioning) are best learned in an experiential setting with real patients." [Participant 9]	
Specific wording	n=1	One participant felt that the choice between specific wording choices ('is there something else' vs 'is there anything else') was too strict; one option closed the consultation down, one opened it up.
	"I tried the virtual patient scenario twice, the first time it was relatively straightforward with seemingly little complexity, the second time I deviated from some of my previous responses which opened up a complexity which was not uncovered previously. So perhaps an improvement might be that the "something" or "anything" question does not "shut down" access to further questions." [Participant 14]	
Ideal route	n=1	One participant wasn't completely clear as to which options were 'best' in the consultation so would have liked to have seen the ideal route through the consultation.

	“it may have been useful to have provided the 'ideal consultation' as based on the feedback I know what I did well and not well but it would be nice to see what the ideal consultation or pathway through the VP was. Each time I tried it, I got different feedback so it would be good to know which kinds of questions are 'best'.” [Participant 15]

Question 6: At which stage(s) in your professional development do you think this type of programme could or could've been useful, or not? Tick all that apply.

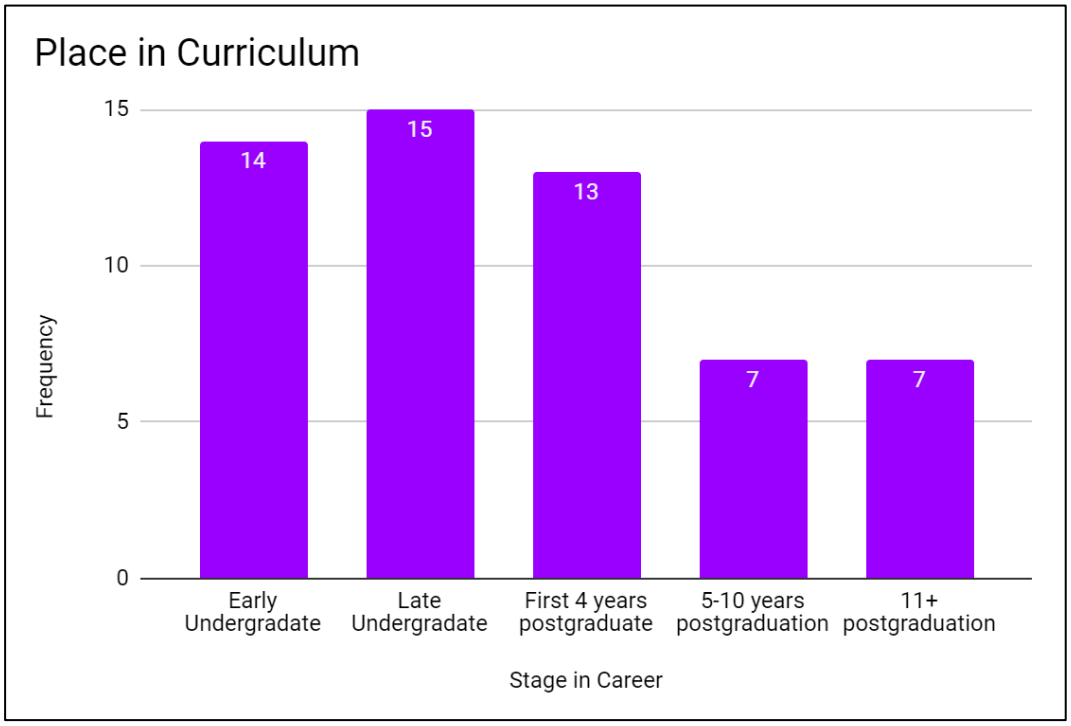

Figure 15 - VPs place in the curriculum (pilot)

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical practice following your use of the virtual patient programme?

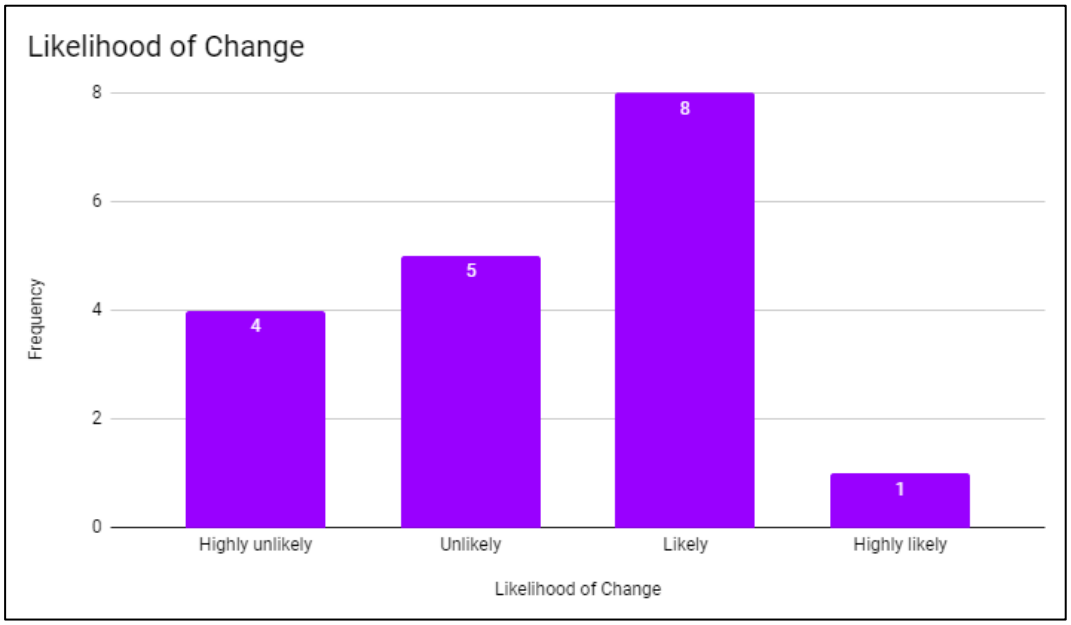

Figure 16 - Likelihood of change in practice (pilot)

Question 7b: If you think there will be any changes, what do you think these will be?

Table 17 - Suggested changes in practice (pilot)

Patient choice	n=3	Three participants suggested that they would be more considerate of their patient's choices when making decisions about their care.
	"More considerate of patient choices about their treatment" [Participant 5]	
Patient centered care	n=3	Perhaps related to the above code of 'patient choice', a different three participants suggested they would try to be more patient centered, but none of them expanded upon this.
	"Primarily to focus on patient-centered care." [Participant 15]	
Wording	n=2	Two participants reported that they would be more conscious of using specific words and phrases.
	"Just considering choice of words to open up avenues for discussion." [Participant	

	12]	
Structure	n=1	One participant suggested they would structure their consultations better.
	"Help plan the process of holding a consultation" [Participant 1]	

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Table 18 - Treatment priorities post-VP (pilot)

	4th	**3rd**	**2nd**	**1st**
Maximising effectiveness	1	6	5	6
Minimising risks	0	7	9	2
Minimising costs	17	0	0	1
Respecting patient choices	0	5	4	9

By comparing the above table with the one from the pre-questionnaire (they were identical questions on both questionnaires) there is a change observed. More participants rated 'Respecting patient choices' as their number one priority, changing from 5 to 9 participants pre- and post-intervention respectively; this change was not evaluated statistically.

General comments

Questions 9, 10 and 11 from the post-questionnaire were analysed together and the resultant codes presented in Table 19.

Table 19 – General comments on the VP (pilot)

Restriction	n=11	As has been raised in responses to previous questions, some participants found the multiple choice system restrictive.
	"I wanted to respond differently to some of the statements available" [Participant 11]	
Realism	n=8	The VP was reportedly realistic and bore a good resemblance to a real scenario.
	"I felt the animation and responses given by the virtual patient were very realistic and mostly followed a natural progression which I would expect to see in real life." [Participant 4]	
Ease	n=7	The VP was suggested to be easy to use.
	"Easy to use" [Participant 16]	
Thought provoking	n=5	Some participants suggested the VP caused them to think, although what they thought about is unclear.
	"A very thought provoking interaction and well developed" [Participant 3]	
Lose sense of time	n=1	Time was felt to be hard to track during the interaction.
	"Difficult to understand just how much time I should have spent with the patient" [Participant 3]	
Bridge	n=1	One participant suggested that the VP would be well placed in undergraduate learning as it could help them bridge to real life practice and prepare them for interactions with real people.
	"I feel that this is a really great teaching tool, particularly for students who may be anxious about practicing their communication skills with simulated patients. I feel that this bridges the gap between undergraduate learning and real life experience very well." [Participant 4]	

Standardised	n=2	Two participants were perhaps thinking as educators as they suggested that a benefit to using the VP with students was that it was standardised.
	"From a teaching and learning perspective, it allows the students the same experience in a safe environment" [Participant 11]	
Lack of non-verbal	n=1	A negative factor to the VP was suggested to be that it did not encompass non-verbal communication.
	"lack of non verbal communication" [Participant 8]	
Safe	n=2	The VP was recognised as a safe environment.
	"A safe clinical environment." [Participant 17]	
Time to think	n=1	As the participants did not have to reply to the VP immediately, they had time to think about which option they wanted to select each time. One participant liked this.
	"I liked the interacting with the virtual patient as it gave you time to think before selecting a response" [Participant 14]	
Feedback (positive)	n=1	The feedback was rated highly by one participant due to the verbal and text feedback given as well as the print out feature.
	"I liked that the VP responded verbally and non-verbally and the same with the feedback. The print out of the feedback is also a good feature - you could keep these and compare after completing a few times to see the good and bad aspects." [Participant 15]	
Engaging	n=1	One participant found the VP engaging.
	"Very engaging way to learn." [Participant 17]	
Apathy	n=1	One participant did not wish to use the VP again.
	"I didn't feel inclined to do the whole thing again." [Participant 20]	

The main reason for conducting the pilot study was to test all of the different procedures for the study, a dress rehearsal before the main study. It concerned the testing of the process, the questionnaires, the virtual patient, the consent form and data collation. During this process, there were four issues which were found during the study.

Prescribing Priorities – this question was on both the pre- and post-questionnaires. The first participant who completed their response was able to rank two of the priorities equally, both 1st; this can be seen by summing the '1st rank' column for the pre-questionnaire as it adds up to 19. This was not what was desired; they had to be strict 1st, 2nd, 3rd or 4th ranks.

Programming issues – one participant highlighted that they received feedback that had nothing to do with the consultation they had just done. Upon investigation, this was found to be an error in the coding of the programme.

Typographical errors – some minor errors concerning grammar on the questionnaires were noted by participants.

Pre-questionnaire failure – one participant found they could not complete the pre-questionnaire. No reason was found for this and no other participants experienced the issue. The participant was sent a paper copy. This participant completed the post-questionnaire online as planned without any issues.

The questionnaires collected and collated the data in a way that was found to be simple, easy and relatively low maintenance. It is difficult to quantify this in a more objective manner but handling the data was not found to be particularly onerous but suitable going forward.

5.5. Discussion

5.5.1. Enjoyment

The results from the pilot study suggested that the majority of the participants found the VP to be enjoyable; as per Figure 11, all of the participants rated the VP at least 3 out of 5 which denotes at least some enjoyment. Enjoyment is well researched in relation to childhood learning but is also seemingly important for adult learning, improving motivation to learn and engagement (Lucardie, 2014). VPs are reported to combine fun with education which is thought to be an important part of enhancing the learning experience and is perhaps part of what motivates students to learn (Kleinert et al., 2016). Enjoyment was perhaps not universal though as one participant commented that they did not feel inclined to use the VP again (see 'Apathy', Table 19).

5.5.2. Interaction with the Patient

While the VP was reportedly enjoyable, there was one negative view expressed by the majority of the participants; the restrictive nature of the multiple-choice system. The VP was designed to permit the user to take circuitous routes through the consultation and still achieve a good outcome. This was to reflect different consultation styles and allow the user some flexibility in how they structured their consultation. Despite this, the majority of the participants still reported feelings of restriction, implying that they could not conduct the consultation in the way that they wanted. Figure 13 shows the spread of responses to the format of reply question with the middle option (effectively ambivalence) being the most common; some participants also selected the most extreme examples, "very poor" and "very good" (n=2 and n=5 respectively). Previous research with multiple choice VPs has reported feelings of restriction so it is perhaps an inherent drawback of a multiple-choice VP (Hurst and Marks-Maran, 2011; Liaw et al., 2000). That said, this point is developed further on.

It would seem that the idea of 'restriction' could refer to at least two different ideas. The first is that the participants could choose the sentiment they wished to express but had to use words or phrases that they would not ordinarily use. A simple example could be that one wishes to welcome the patient with a salutation but cannot say "hi", instead they have to say "hello". Both words achieve the same broad purpose but maybe not in the specific way that one desires. The second aspect to restriction could be that the participants wanted to take the consultation in a completely different direction to the ones the software permitted. Brian, the virtual patient, mentioned his wife had died; a participant might have wanted to explore this further to screen for depression but this was not available as an option. The questionnaire responses suggest that either of these cases could be true.

As the choices made by the participants during their use of the VP were not observed, it is unknown if the VP stopped the participants choosing options that would have been appropriate but were not available. Chapter 1 highlights research showing that SDM is not occurring to the level that it perhaps ought to. There is evidence to suggest that professionals can value SDM but not understand what it entails (Hamann et al., 2012; Karnieli-Miller and Eisikovits, 2009; Stevenson, 2003). The MAGIC programme was set up to help implement SDM in the NHS; one of its findings was that some professionals may think that they are doing SDM when in fact they are not (Joseph-Williams et al., 2017). Maybe this was the case for the participants in this study; unbeknownst to them, the direction they wanted to take the consultation in was not an optimal one, hence why it was not available. Daniel Kahneman's (2003) work illustrates that as people acquire expertise, their behaviour becomes subconscious and automatic; perhaps the participants may have had ingrained patterns of behaviour which did not match the standard required for SDM. There are a huge variety of avenues one could have theoretically explored with the VP; because one of these innumerable options was not available, it does not mean it should have been available. It is unknown whether this was the case or not, but just because what the participants wanted to say wasn't available it does not necessarily mean that their desired choice was an appropriate one. An alternate explanation for the restriction is

that the script was too narrow, not allowing the participants to consult effectively in their own consultation style.

5.5.3. Participants

The pilot participants were academics involved in the education of medical and pharmacy undergraduates. They were also health professionals so consequently had two separate perspectives through which they could view the VP; educator and health professional. Some of the participants were thinking about the VP from the stance of an educator as evidenced by some of the quotes in Table 19; this doesn't mean that they were only thinking about their role as educator though but also as a health professional themselves. They may have viewed the VP as a threat with the potential to reduce their role in education. The questionnaires did not ask about whether each participant was still active in a patient facing role which could have affected their response.

5.5.4. Data Collection

There was very little comment on the feedback provided by the VP. This was perhaps a sign of poorly designed questionnaires as there were no specific questions asking about the feedback on either of them. As a consequence of this, three questions were added as a result of the pilot to the post-questionnaire asking specifically about feedback. Another issue that emerged during the process of the pilot was that the following question did not focus only on VPs; "How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following?" Because "digital virtual patient" is given as an example of a type of new technology, the question does not necessarily exclude other forms of new technology. Therefore a question was added to the pre-questionnaire for the main three strands of data collection asking specifically about the participant's pre-intervention view of VPs, not just new technology.

5.6. Conclusions

This study was a pilot and thus its prime purpose was to trouble-shoot the study process ahead of the three main strands of data collection. The pilot teased out some of the minor issues that needed rectifying prior to the main study. Some adjustments were required to the processes of the main project; grammar issues were corrected, coding was adjusted and the prescribing priorities question was amended. This aided the smooth running of future work.

Some of the participants reported positive views towards the style of interaction but it was not clear why those who liked the multiple-choice reply format did so. It would be premature to draw any conclusions without understanding why some participants liked the multiple choice options.

6. A Service Evaluation of a Virtual Patient Workshop with Pharmacy Undergraduates

6.1. Method

The service evaluation focused on a timetabled, two-hour workshop given to third-year pharmacy undergraduates at Keele University during the first term. The pharmacy undergraduates at Keele receive a two-hour session each year under the umbrella title “Clinical Decision Making” which draws together evidence-based medicine, consultation skills and cognitive psychology. The workshops are designed to build each year in a spiral fashion with the second year workshop building on the first year and so on. The workshop in Year 3 was designed and led by Neal Maskrey and Jonathan Underhill; Jonathan was a Medicines Consultant Clinical Adviser at NICE and had developed expertise in decision-making while working alongside Neal for 20 years at the National Prescribing Centre and subsequently at NICE. The workshop had the following learning outcomes;

- Understand the importance of good communication skills to encourage effective informed shared decision making about medicines
- Learn about the history of how healthcare professionals have been taught consultation skills
- Share examples of consultation approaches to optimise shared decision-making
- See examples of how good (and poor) communication can affect shared decision-making
- Assess your own learning and developments needs in this area
- Practice these skills in a safe environment using virtual patient technology
- Be aware of the need to review and continually improve your communication skills during your pharmacy career

The workshop comprised a short introductory lecture, focusing on some of the theory of consultation skills and was led by Neal Maskrey. Video recordings of simulated consultations were then used to demonstrate both positive and negative features of consultations with this led by Jonathan Underhill, Medicines Consultant Clinical Adviser at NICE. These two stages, the lecture and the video, made up the instruction and demonstration elements of the workshop. The second half of the workshop was based on the VP and incorporated the practice and assessment stages of the workshop; this was led by Simon Jacklin and supported by Neal and Jonathan. The students were given a brief explanation of how to use the technology before using it for around 20 minutes. As there was a voice over for the technology, some students used headphones while others used the speakers of the computer; some students may have elected to use the simulation without sound, reading the subtitles only. Jonathan, Neal and Simon circulated to answer any procedural questions the students had while using the technology. After using the VP a few times, Neal led a brief summary session to feedback on the whole session.

There were two workshops, each identical, with one in the morning and one in the afternoon. The Keele School of Pharmacy split each year group into 50% groups at the outset of their studies, 50%A and 50%B. Two identical sessions were run with the third years; 50%A in the morning and 50%B in the afternoon. The teaching rooms were broadly similar in terms of size, layout and facilities. The students in the morning were asked not to pass on details of the workshop to their colleagues attending the afternoon session.

After the first part of the workshop, the lecture and videos, the students were provided with an information sheet and invited to take part in the evaluation of the VP workshop. The evaluation focused on the second, VP-based half of the workshop which was a new addition for that year. Each of the students had access to a computer (University property, not their own devices) and those who consented to participate in the evaluation were provided with a link to the electronic consent form and pre-questionnaire. The link to the VP was also given to the students so those who did not wish to

participate could still use the VP i.e. using the VP was not predicated on their participation in the evaluation. After using the virtual patient there was an opportunity to complete the post-questionnaire. After completion of the post-questionnaire, the workshop was summarised and concluded. This summary was for the whole workshop, not the VP specifically, and was brief due to time constraints. Both questionnaires are included as appendices.

Two weeks after the workshops the students who had completed both a pre-questionnaire and a post-questionnaire were sent an email inviting them to take part in an interview; a follow up email was sent a week later. The plan was to use a purposive sample, deliberately selecting participants whose questionnaire responses featured divergent views. The aim was for 6-12 interviews to begin with, and then more would be sought if this was deemed insufficient. This was due to the context specific nature of saturation and the judgement required during the process of collecting data (Robinson, 2013). Only a small number (n=8) consented to an interview, therefore a convenience sample was used instead and all those who consented were interviewed. Simon conducted all the interviews; the first interview was conducted via Skype but due to issues with internet connectivity, all subsequent interviews were via the telephone. The participants did not know Simon in a formal capacity prior to this evaluation. Interviews were audio recorded, with participant consent, and transcribed by a transcription service. Transcripts were checked for accuracy and any anomalies corrected. Interview participants were given a £10 Amazon voucher as a small thank you; they were informed in advance they would receive this. The process is summarised in Figure 17.

The interview data was analysed using semantic thematic analysis with NVivo 11; coding was data driven. This technique was chosen as it is not related to any single epistemological school and provides a simple and flexible method to provide an account of the data (Braun and Clarke, 2006). The qualitative data from the questionnaire responses was analysed by content analysis; this is a simpler technique than TA and was more suitable given the superficial nature of the data. All of the responses to each question were coded and then these codes reported with the number of

participants whose response featured each code reported. The frequency of each code was not used to infer validity; if a code were more common than another, it does not mean it is more likely to be true. The quantitative data was analysed using descriptive statistics, with the exception of the treatment priorities question; the latter question was a feature on both questionnaires and analysed using a Wilcoxon rank test using SPSS 24. For full details of the data analysis, please see the Methodology chapter.

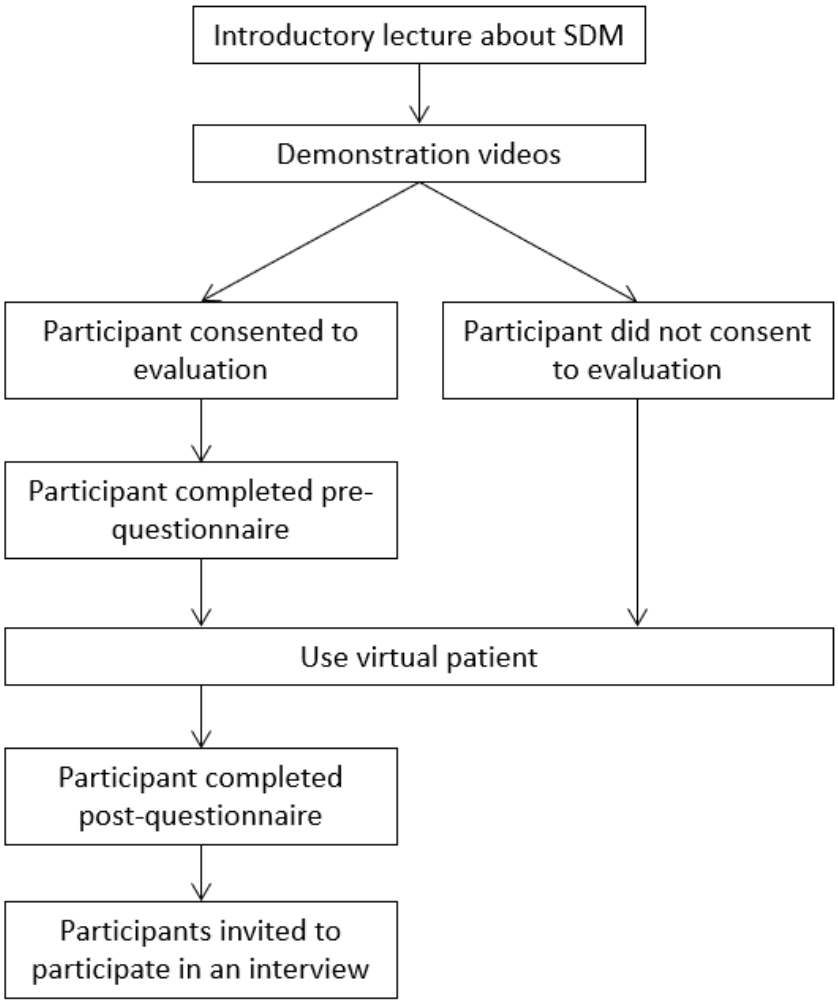

Figure 17 - Service evaluation pathway (pharmacy undergraduates)

6.2. Results

6.2.1. Questionnaire Data

A total of 58 students attended one of the two workshops. There were a total of 54 participants who completed the questionnaire evaluation, both pre- and post-questionnaires; 93% of the total who attended. 2 students elected to complete the pre-questionnaire, but not the post-questionnaire; 2 decided not to participate at all.

6.2.1.1. Pre-Questionnaire

Basic demographic data is included in appendix 13.

Question 1: How would you define a 'digital virtual patient'?

Table 20 - Participant definitions of a VP (pharmacy undergraduates)

Computer	n=24	Nearly half (44%) of the responses suggested that a computer was involved in some way.
	"a computerised patient" [Participant 52]	
Interactive	n=12	These participants suggested that interactivity was a feature.
	"A computer generated interactive program" [Participant 5]	
Animation	n=9	These responses suggested that a digital VP involved an avatar or animation.
	"a human like avatar that you can ask certain questions and get answers" [Participant 11]	
Simulated	n=5	Five participants thought a digital VP was an SP. Whether they thought an

patient		SP was an actor, as the term is used in this thesis, is unknown.
	"A simulated patient" [Participant 24]	
Bridge	n=2	Two participants extended their definitions to the role of the VP; they both suggested that it was a method to prepare or bridge to real patients.
	"a computerised person in a virtual/computerised setting to practise on before talking to real patients." [Participant 2]	

Question 2: How useful do you think virtual patient technology could be in the development of your professional knowledge and skills?

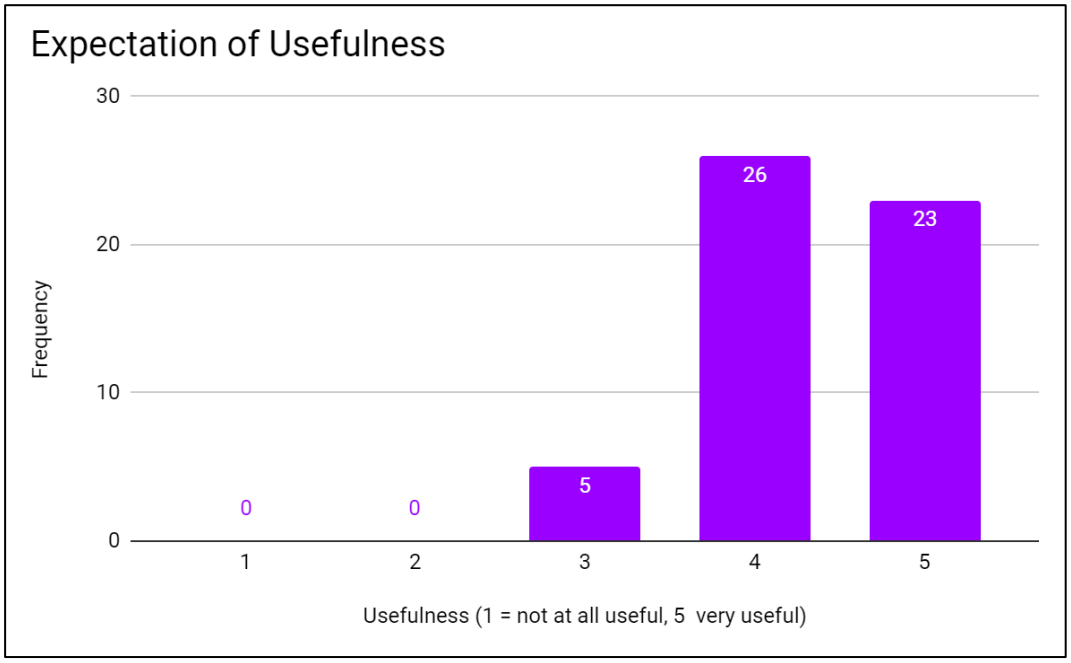

Figure 18 - Expectation of VP usefulness (pharmacy undergraduates)

Question 3: Which statement would you say best suits yourself?

Table 21 - Participant self-assigned adopter class (pharmacy undergraduates)

Statement	Self-assigned adopter class	Frequency
I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market	Innovator	2
I enjoy new technology but am rarely the first to invest in a new product	Early Adopter	35
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product	Early Majority	14
I have no desire for new technology, I tend to only adopt it after the majority of other people	Late Majority	3
I dislike change in technology and will only use a product when it has become mainstream	Laggards	0
		54

Question 4: Which of the following methods have you used or experienced in your education? Tick all that apply

Table 22 - Previous education of participants (pharmacy undergraduates)

Educational Method	Frequency
Simulated Patients	52
Videos of others consultations	53
Video recordings (your own consultations)	22
Role plays	53
Digital virtual patients	35

Question 5: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful)

Table 23 - Expectation of VP usefulness; subject specific (pharmacy undergraduates)

	1	2	3	4	5
Healthcare education	0	1	13	21	19
Clinical decision making	0	0	9	27	18
Consultation skills	0	1	8	20	25
Patient centered care	0	1	11	24	18

Question 6: Which of the following do you currently use to aid your professional learning/development and how many times per month do you use them?

Table 24 - Current use of educational technology (pharmacy undergraduates)

	Webinars	Social Media	Blogging sites	Online Simulation	MOOCS
Don't use	28	28	39	40	40
1-2 or less	8	15	10	8	6
3-5	9	6	5	6	5
6-8	4	1	0	0	1
9+	5	4	0	0	2

Question 7: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Table 25 - Usage of technology; curricula areas (pharmacy undergraduates)

Curricula Area		Frequency
Basic Science		41
Clinical decision making		22
Communication skills		20
Ethical issues		17
Other:	New developments in medicine	1

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

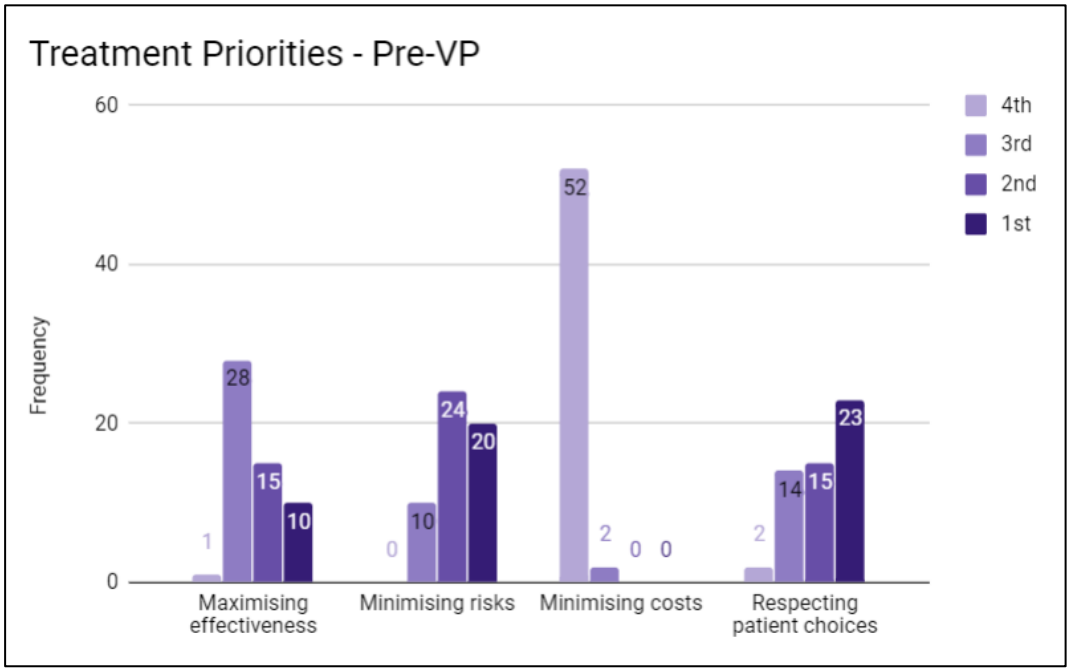

Figure 19 - Treatment priorities pre-VP (pharmacy undergraduates)

6.2.1.2. Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

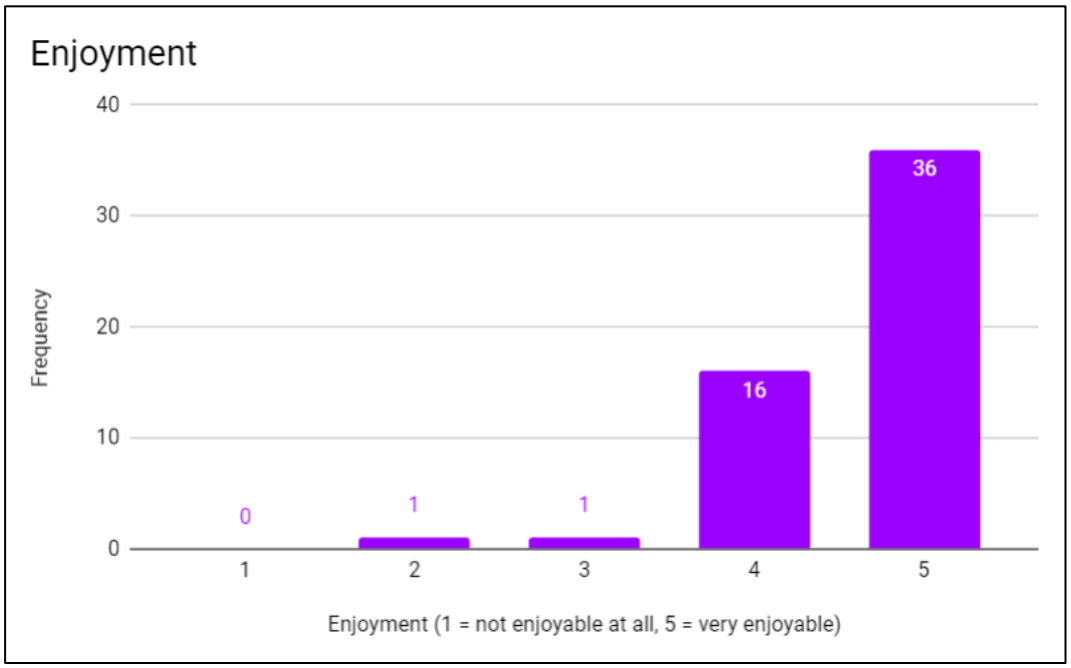

Figure 20 - Enjoyment rating (pharmacy undergraduates)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

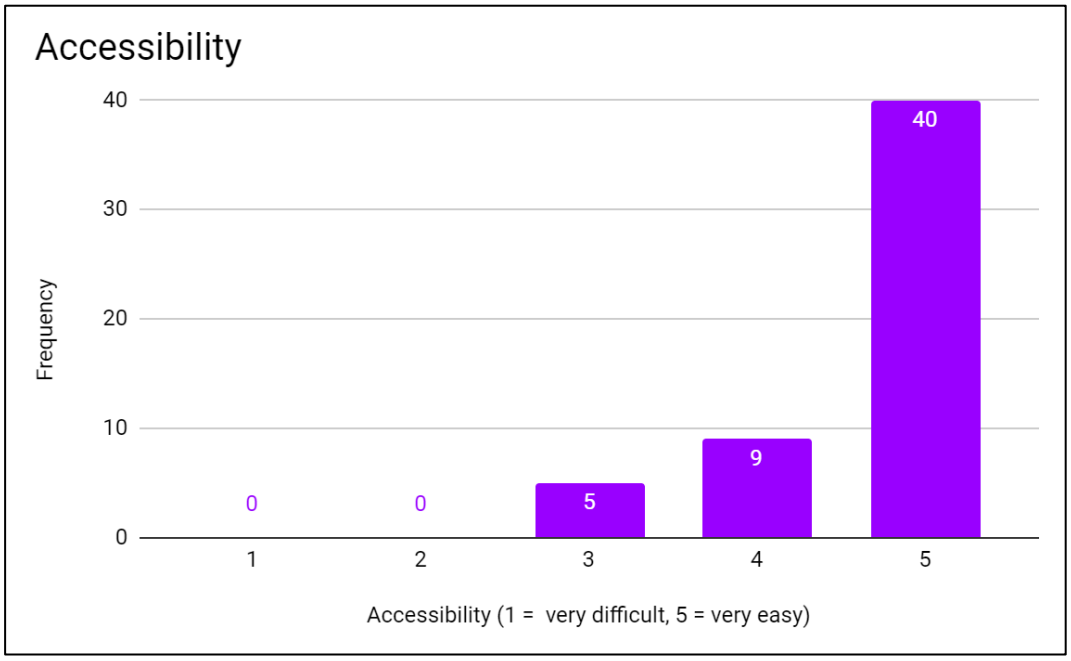

Figure 21 - Accessibility of VP (pharmacy undergraduates)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

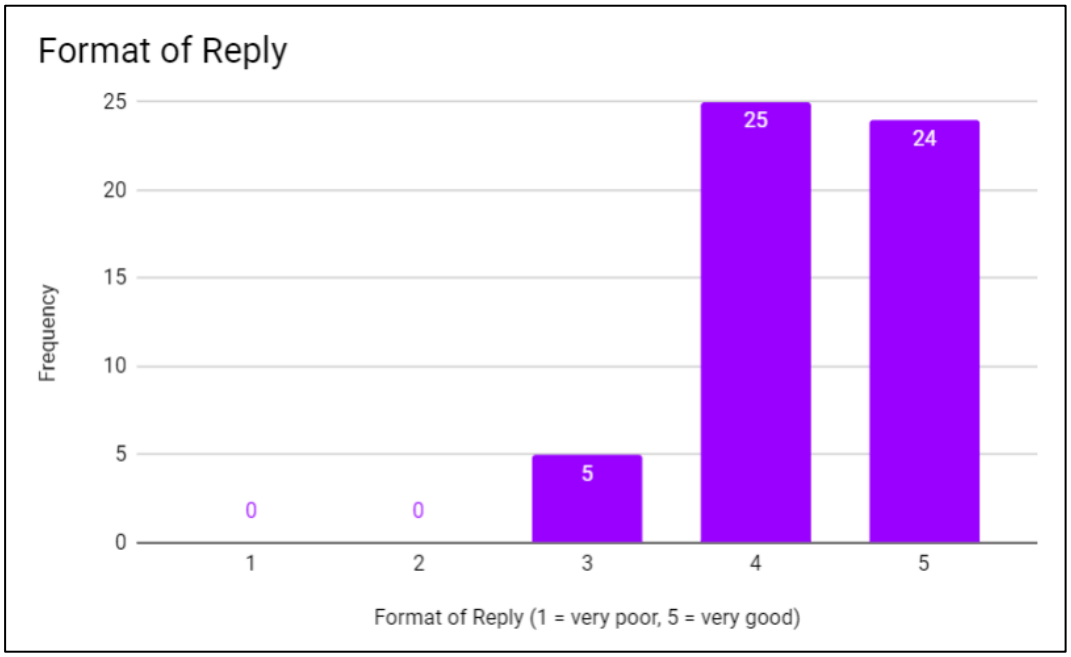

Figure 22 - Format of reply (pharmacy undergraduates)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Table 26 - Comments on the format of reply (pharmacy undergraduates)

Restriction	n=7	Restriction is the label for the responses suggesting that the multiple-choice system limited the participants, making them feel restricted in their interaction
	"Sometimes wanted to ask a question that had been presented before but it wasn't an option to ask later on." [Participant 19]	
Restriction – Free text	n=3	This idea seems to be related to 'restriction'; the participants suggested that a free-text system may have been better.
	"The responses could be typed out by the student?" [Participant 48]	
Easy to use	n=2	The multiple-choice was easy to use.

	"It was presented and staged very well. Having a few choices made it easy to engage with the process and help understand where things either went wrong or right." [Participant 23]	
Technical	n=1	One participant suggested that the options should not be condensed but displayed in full on the screen without having to click on the respective arrow.
	"Shouldn't have to expand longer options, they should be fully visible without clicking on the arrow" [Participant 13]	

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Table 27 - Subject specific usefulness of the VP (pharmacy undergraduates)

	1	**2**	**3**	**4**	**5**
Consultation skills	0	0	2	17	35
Clinical decision making	0	0	7	26	21
Patient centered care	0	2	1	12	39
Communication skills	0	2	2	20	30
Managing medical complexity	1	4	13	18	18
Managing polypharmacy	3	3	16	19	19

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

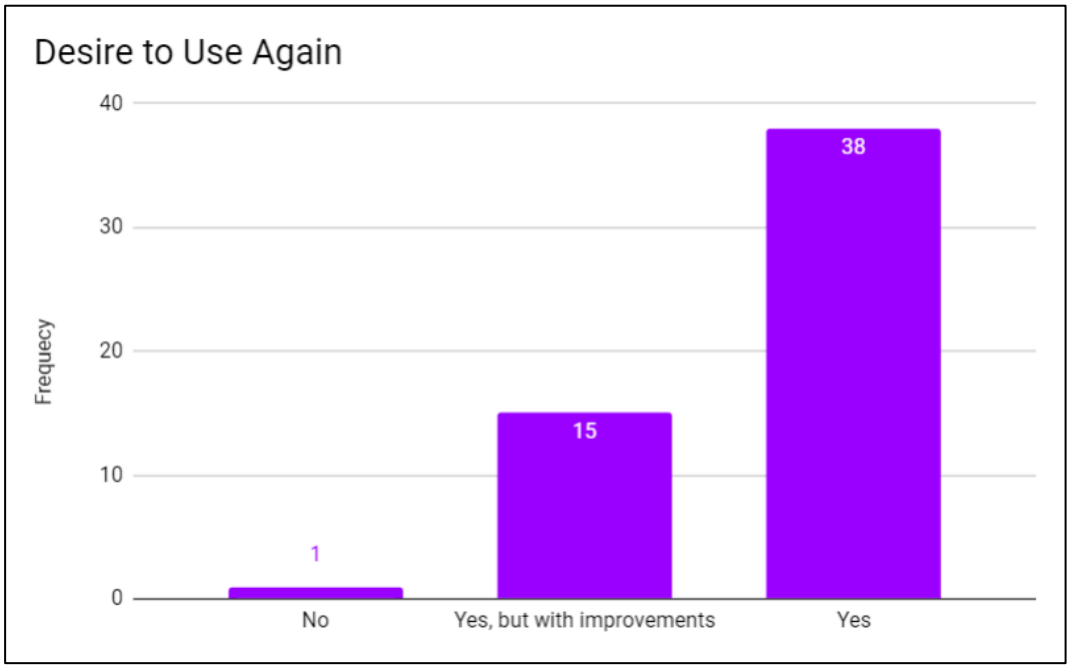

Figure 23 - Desire to use VP again (pharmacy undergraduates)

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Table 28 - Suggested improvements to the VP (pharmacy undergraduates)

Restriction	n=8	Restriction was mentioned in table 7. The same code arose in the responses to this question but there no suggestions of how to improve.
	"Perhaps a less scripted multiple choice pattern. The main issue I had was being able to input my own decision. I felt that if I selected one answer, it shut off so many options that I only found after redoing the simulation." [Participant 25]	
Vague feedback	n=3	Three students suggested that the feedback told them how they had performed but was perhaps not specific enough about what needed to be done to improve.
	"I think after the patient gives feedback, there should be an explanation saying what should've been done, if the wrong thing was said." [Participant 43]	

Question 6: At which stage(s) in your professional development do you think this type of programme could be useful, or not? Tick all that apply.

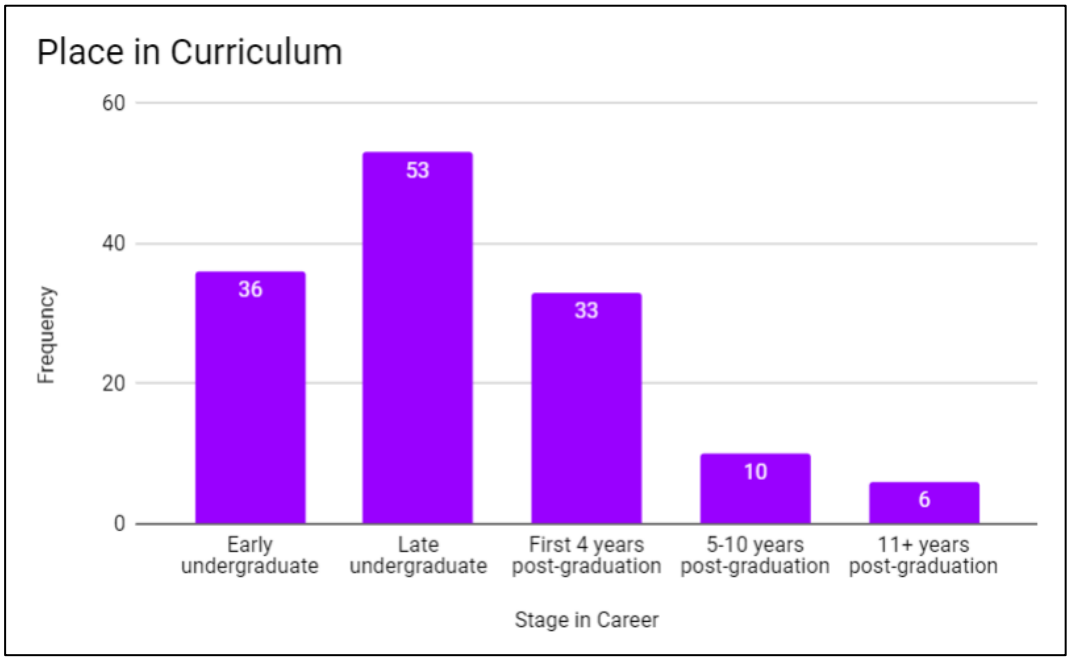

Figure 24 - VPs place in the curriculum (pharmacy undergraduates)

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical scenarios following your use of the virtual patient programme?

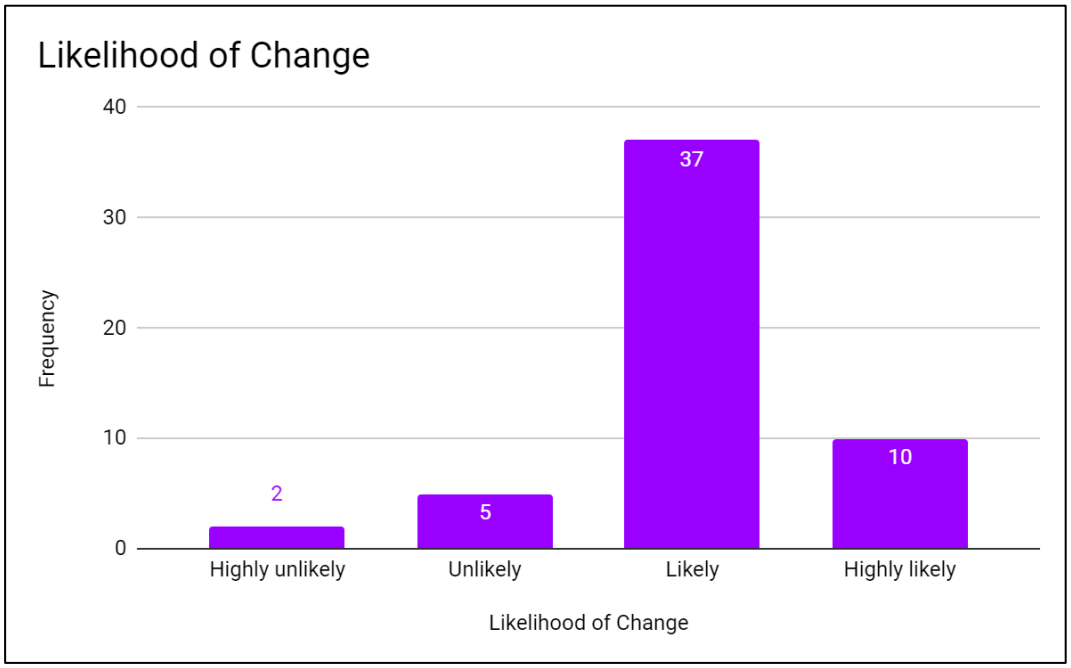

Figure 25 - Likelihood of change in practice (pharmacy undergraduates)

Question 7b: If you think there will be any changes, what do you think these will be?

Table 29 - Suggested changes in practice (pharmacy undergraduates)

Patient centered care	n=12	Twelve participants suggested they would try to be more patient centered in their approach.
	"A change in patient centred care, focusing more on the patient not just the treatment." [Participant 15]	
Better prepared	n=5	Rather than a change in practice per se, some participants said that they would be more prepared for real life interactions.
	"I would be more prepared for real life scenarios" [Participant 21]	
SDM	n=4	While no participants used the phrase 'shared decision-making', four of them made comments suggesting they would change their practice to

		include elements of SDM.
	"put my patient's need first and get them involved in the decision making of their medication." [Participant 8]	
Specific Wording	n=3	Three participants suggested they would be more conscious of the specific words they used. Two of these three gave of an example of using 'something' rather than 'anything'.
	"Being more conscious of choice of words e.g. using anything else rather than something else" [Participant 24]	
Structure	n=3	Three participants suggested their approach to consultations would be more structured.
	"My approach would be more guided/structured" [Participant 22]	

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

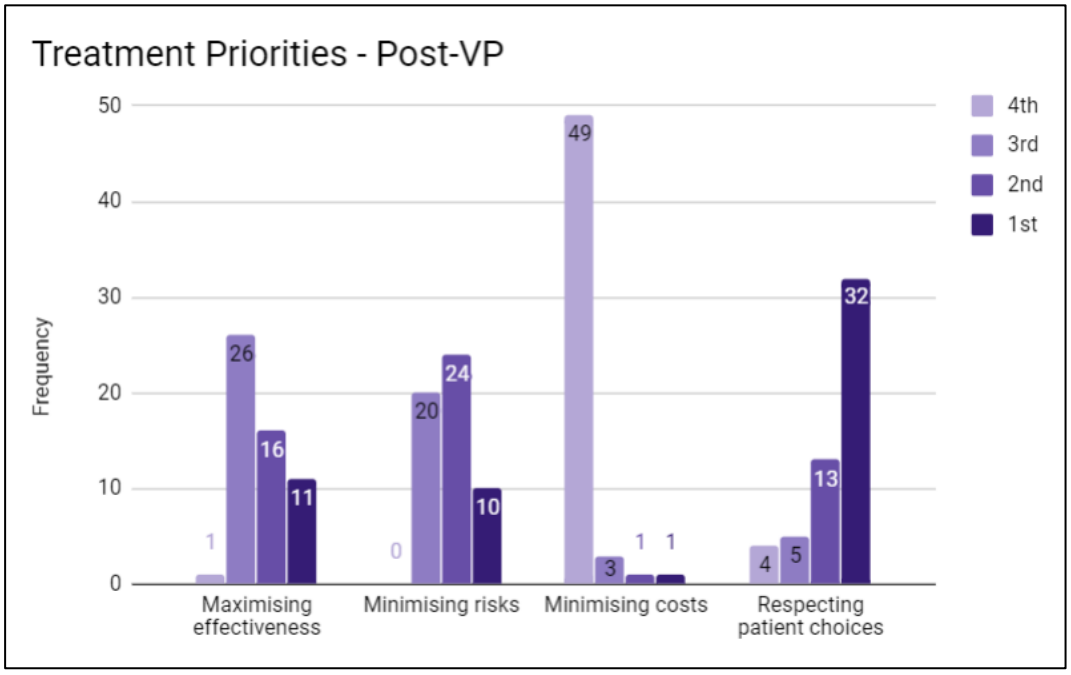

Figure 26 - Treatment priorities post-VP (pharmacy undergraduates)

This question was a repeat from the pre-questionnaire, allowing comparison. A Wilcoxon signed-rank test demonstrated that there was a statistically significant change in the rank position of 'Respecting Patient Choices' (p=0.026); the median changed from 2nd before to 1st after the intervention.

Question 9: How would you rate the format of the feedback given to you at the end of the simulation? (1 = very poor, 5 = very good)

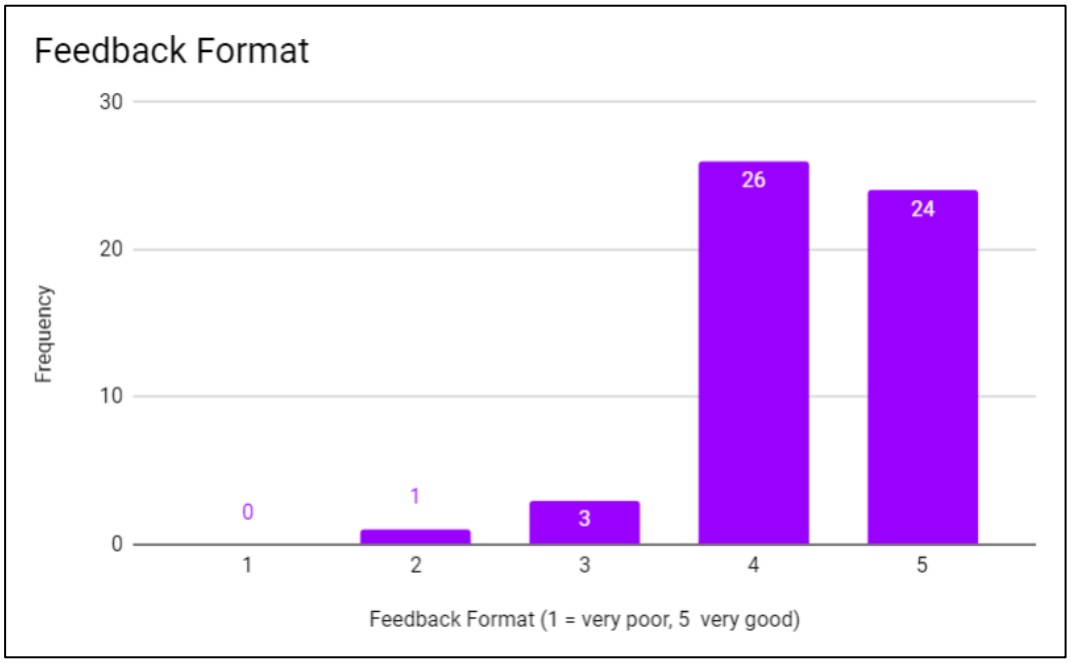

Figure 27 - Format of the VP feedback (pharmacy undergraduates)

Question 10: How much feedback did the virtual patient provide?

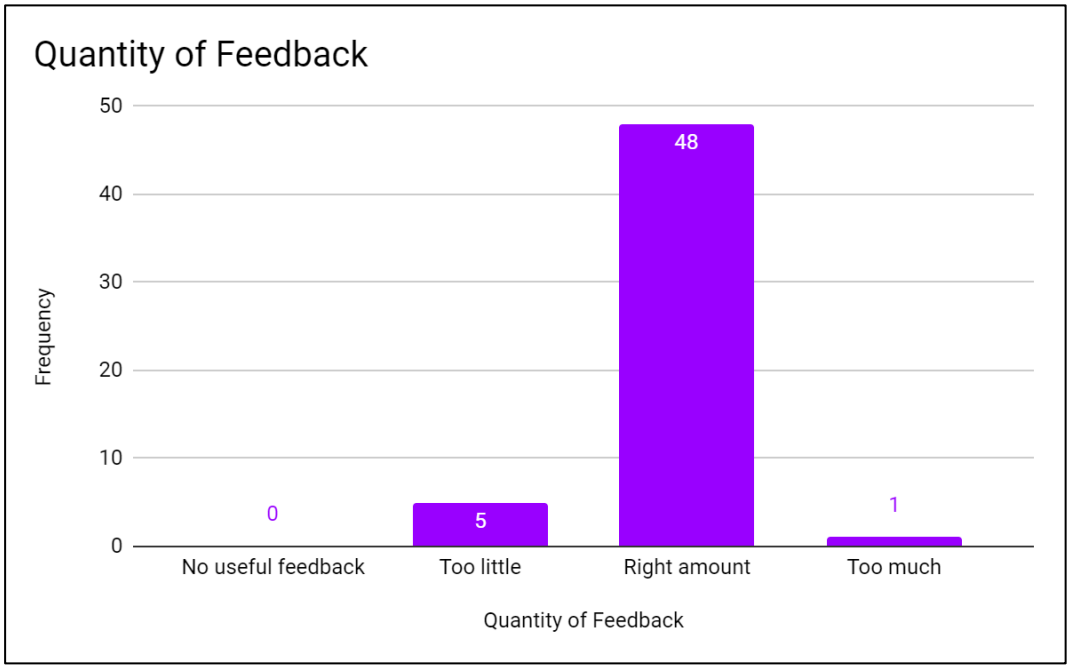

Figure 28 - Quantity of feedback provided by the VP (pharmacy undergraduates)

Question 11: Do you have any comments on the feedback given?

Table 30 - Comments on the feedback from the VP (pharmacy undergraduates)

Vague	n=7	As mentioned in answer to a previous question (see Table 28), the feedback was suggested to be a little vague.
	"Bit vague e.g. "I didn't feel you listened to me" could be expanded upon" [Participant 13]	
Positive	n=5	Some responses were positive but very generic expressions of positive feeling towards to the VP.
	"very good tool" [Participant 1]	
Concise	n=2	Two participants felt the feedback was very concise which was suggested as a positive feature.
	"The feedback was concise and helpful." [Participant 39]	

General comments

Questions 12, 13 and 14 from the post-questionnaire were analysed together and the resultant codes presented in Table 31.

Table 31 – General comments on the VP (pharmacy undergraduates)

Positive	n=16	As for Table 30, some participants expressed generic feelings of positivity towards the VP.
	"I like it" [Participant 1]	
Nothing	n=15	Related to the above code, 'positive', 15 participants suggest they disliked nothing about the VP.
	"nothing" [Participant 34]	
Options	n=11	The multiple-choice system presented three options each time for the

		participant to choose from. 11 participants suggested they liked these options as it provided a range to choose from; these options may have been things the participants hadn't thought of.
	"The different outcomes to the scenario that i may have not thought of." [Participant 44]	
Realistic	n=9	The consultation was suggested to be realistic.
	"It was a good practice as it felt like a real coinsultation" [Participant 3]	
Ease	n=7	The VP was easy to use.
	"Easy to use aspect" [Participant 7]	
Repetition	n=5	Five participants reported that they liked that the VP could be used repeatedly to practice the same consultation.
	"It was very useful to have an environment to go over the same consultation, it allows you to pick up on mistakes and how to continue to improve consultations" [Participant 12]	
Consequences	n=5	Whichever option the participant's chose when interacting with the VP determined the outcome. Visualising the consequences of their actions was suggested to be a useful feature of the VP.
	"That the conversation could make different routes depending on your answers" [Participant 18]	
Engaging	n=5	Five participants suggested that the VP was 'engaging' with one of those suggesting it was more engaging than other, non-specified, methods; see below.
	"It's far more engaging than anything I have used until now." [Participant 25]	
Safe	n=4	Four participants commented on the safety aspect of the VP.
	"Good chance to practise consultations, without the risk of upsetting a real	

	patient." [Participant 28]	
Other use	n=4	Four participants suggested that the VP technology could be used for other areas of the curriculum; all of the topics suggested were technical ones.
	"Perhaps other more holistic methods of diagnosis. Eg. listening to lung function or checking a patients throat. This could help in spotting (and helping students to identify) red flag/symptoms that are characteristic of particular diseases." [Participant 26]	
Specific feedback	n=2	In contradiction to the code 'vague feedback', two participants felt the feedback was quite specific.
	"the feedback told you what you did wrong but also told you how to improve" [Participant 24]	
Pre-tutorial	n=2	Two participants suggested that a pre-tutorial explaining how to use the VP would have been of benefit.
	"A brief tutorial on how to use the virtual patient would be useful." [Participant 5]	
Not realistic	n=1	Participant 46 was one of the participants suggesting that the VP was realistic. They also, paradoxically, suggested that it was not realistic.
	"Answers seem unrealistic & not how a consultation would go with a real person" [Participant 46]	
Quick feedback	n=1	One participant said that the feedback was quick; this was listed as a positive.
	"quick feedback" [Participant 9]	
Not real	n=1	Listed as a negative, one participant said that the VP was not real life experience.
	"It's not a real life experience" [Participant 16]	
Too easy	n=1	One participant said the VP was too easy.

	"It was a bit too easy to choose from the right thing to say to the patient" [Participant 48]

6.2.2. Interview Data

After inviting all of the participants who completed the questionnaires to an interview, 8 pharmacy undergraduates gave consent and all 8 took part in an interview. The thematic analysis of the transcripts resulted in the following themes

- Exploring the consultation
- Bridge
- The balance of options
- What skills is the VP developing?
- The importance of the context of use

The interview participants were all assigned identifiers; 000 referred to their number, unique for each participant. P3 corresponds to their course of study, **p**harmacy and the fact they were **3**rd years. Quotes included are verbatim from the transcript. A full dashed line is used to separate different participant's responses whereas three stops (…) are used to highlight a gap in the transcript of the same participant.

All the themes shall now be explained with the support of quotes and thematic maps. These maps describe how the themes were constructed with use of sub-themes and corresponding quotes to illustrate this.

6.2.2.1. Exploring the Consultation

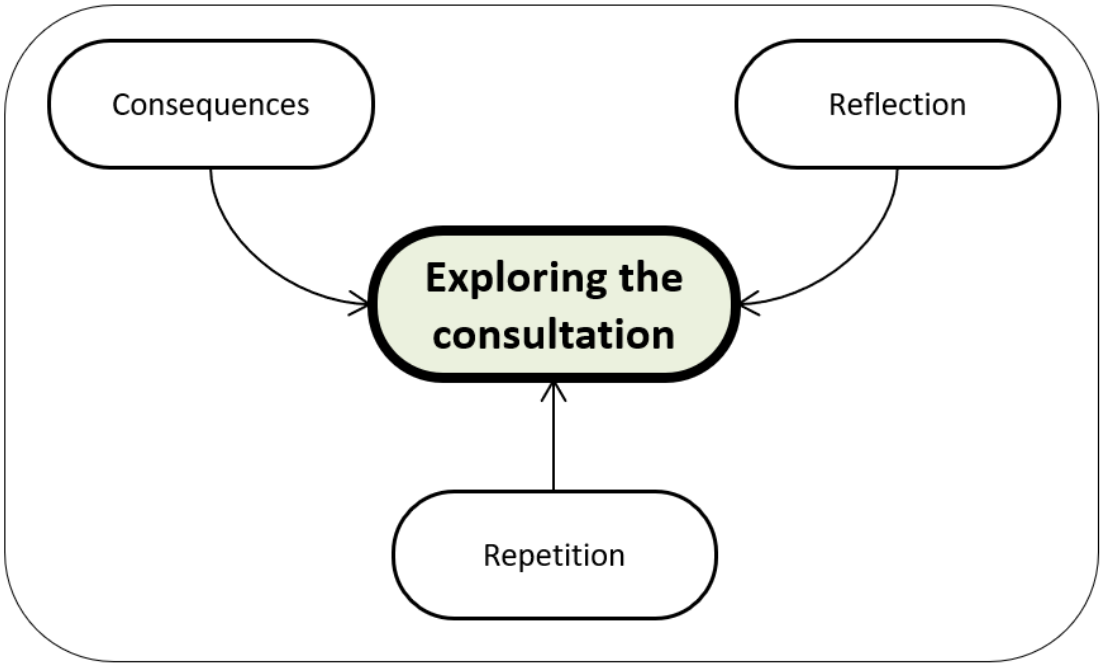

Figure 29 - Thematic map for 'Exploring the consultation' (pharmacy undergraduates)

This theme describes the notion that the VP allowed the participants to explore different ways to conduct consultations, thinking about and trying different approaches.

SJ: How did you find the virtual patient overall?

002P3: It was actually a good experience, it was a different way of doing sort of like advice giving, finding out what a patient is going through and sort of having a guide, not really a guide, exploring the different ways a conversation would go depending on what you say yeah.

008P3: I'd decided to [yeah] explore the different routes and see what happened there.

SJ: How did you find that, just exploring the different routes?

008P3: Yeah it was just quite interesting.

SJ: Yeah, was interesting to see sort of how the patient responded?

008P3: Yeah, yeah to different questions and I think it was if any of them offended him more, stuff like that yeah it was quite interesting.

These two sections of dialogue touch on the point that when exploring the consultation, it was interesting to see how it altered the response the patient gave, which was also expanded on further by participant 002P3 below. The idea here is that seeing the patient's reaction, the consequences of what the participant chose to say/do, was itself a useful device for exploring the effect of different words and phrases; it appears this was a useful way of knowing whether one had done something well or not, a kind of immediate feedback.

002P3: it made me see how my reply or how I talk to the patient determines the information that I get back in that if I ask closed questions or if I quickly dismiss things and don't explore them in depth I won't get as much information as I would possibly um have wanted

…

002P3: what the patient would say back like say I asked them oh what brought you in today or what brought you in today and how are you today [yeah] the type of response which you get is totally different like how are you today the patient might give more information rather than what brought you in today where they might be like oh just my knee, that's it, that's all, we don't get to know if there's anything else going on. So how you phrase you question determines the information that you get back which is important for how you carry on with the intervention.

Seeing the consequences of actions didn't just happen during the conversation but also at the end when the patient fed back their views on the consultation. Participant 006P3 is commenting on how

the (virtual) patient verbalised the feedback given at the end of the simulation; this feedback was from a first-person perspective e.g. “you made me feel comfortable”.

> **006P3**: I think it kind of brings a real-life situation where you are getting like, I know it’s not the patient telling you how they would have reacted, but I think because you have engaged with the process and you are speaking to the patient and having them being the first feedback with them telling you how you’ve done, I think that was really good, yeah.
>
> **SJ**: Did it sort of help you make… did it make you see them as more of a real patient [yeah] or anything like that?
>
> **006P3**: No it did, yeah it made me listen so much more because he was the one telling me, so I was like, oh if I was to feel, the patient felt this way, so I think that was really, really good.
>
> **SJ**: Yeah, do you think it is better than just the feedback being written down sort of thing?
>
> **006P3**: Completely yes, I agree.

Seeing these different narratives unfold is linked to repetition, repeating the simulation allowing one to explore different routes. Exploring the consultation entails taking different pathways through it. This was not necessarily a matter of trying every single route, that would have taken longer than the workshop permitted, but it does mean that one uses the VP multiple times. For this reason, it seems, participants suggested that using the simulation more than once was important.

> **001P3**: definitely use it more than once because you have to explore all like most of the options like so, actually you get a full understanding of what was going on [yes] because like sure I can like give a proper model answer but like if for some bizarre reason someone has chosen to say that, it’s useful to know how you can, for example say somebody says, ‘I chose something wrong’ like I then the patient wouldn’t say a certain thing and it would be useful for me to know what the options are to get him to talk again after I’d chosen the certain option. So, I think using it more than once is quite useful.

This repetition wasn't necessarily about always trying to improve the consultation but experimenting with different techniques to see how it would affect the outcome.

> **005P3**: Erm the first… the first go I did try and get… I treated it more as like, I'm trying to get 100%, all, I'm trying to get all the points, so I'd say I took it quite seriously the first go, [yeah] and then I think on the second go I got all the points, it was, [yeah] and then after that I thought it was… I treated it more like a game, just you know, to see where all the different questions led [yeah what would happen, that sort of thing?] yeah, yeah, that type of thing, yeah.
>
> ---
>
> **SJ**: Yeah, do you think you can learn everything you need to know using it once? Or do you need to use it a couple of times?
>
> **007P3**: Yeah, a couple of times even if you're switching the answers about and not just because you think they're the right thing, just see where it goes in a different way.
>
> **SJ**: Yeah so, sort of does it give you that opportunity to see what happens if you maybe do the, not the wrong thing but the less good thing.
>
> **007P3**: Yeah definitely.

By exploring some of the different options, the VP provoked reflection in the participants; it caused them to think about their practice and what they might do differently.

> **006P3**: after the session that we had, it allowed me to reflect on what order of questions I should ask and how I should introduce myself, if I said this I would have missed asking him about what other drugs he had, so I think it does actually make me reflect and wonder what I would be doing differently in the real world.
>
> ---

> **008P3**: when I first did the thing I didn't really think about the whole, yeah the whole aspect of like how you'd introduce yourself to the patient, how you'd make them feel and how you know, you'd go off on different tangents. I wouldn't have thought about that at first, but now I definitely think that that's really important. It just wasn't something that I was really you know, made aware of. I don't know, I just didn't think about it but until then.

Reflection is grouped under this theme as it seemed that it was the repeated exploration of the consultation, trying different words, phrases, or routes through the simulation that demonstrated the consequences of different actions; this led the participants to reflect on their experience, their exploration of the consultation. This theme could well have been named 'experimenting' rather than 'exploring' but the participants used the word explore, so this was co-opted as the name for the theme.

6.2.2.2. Bridge

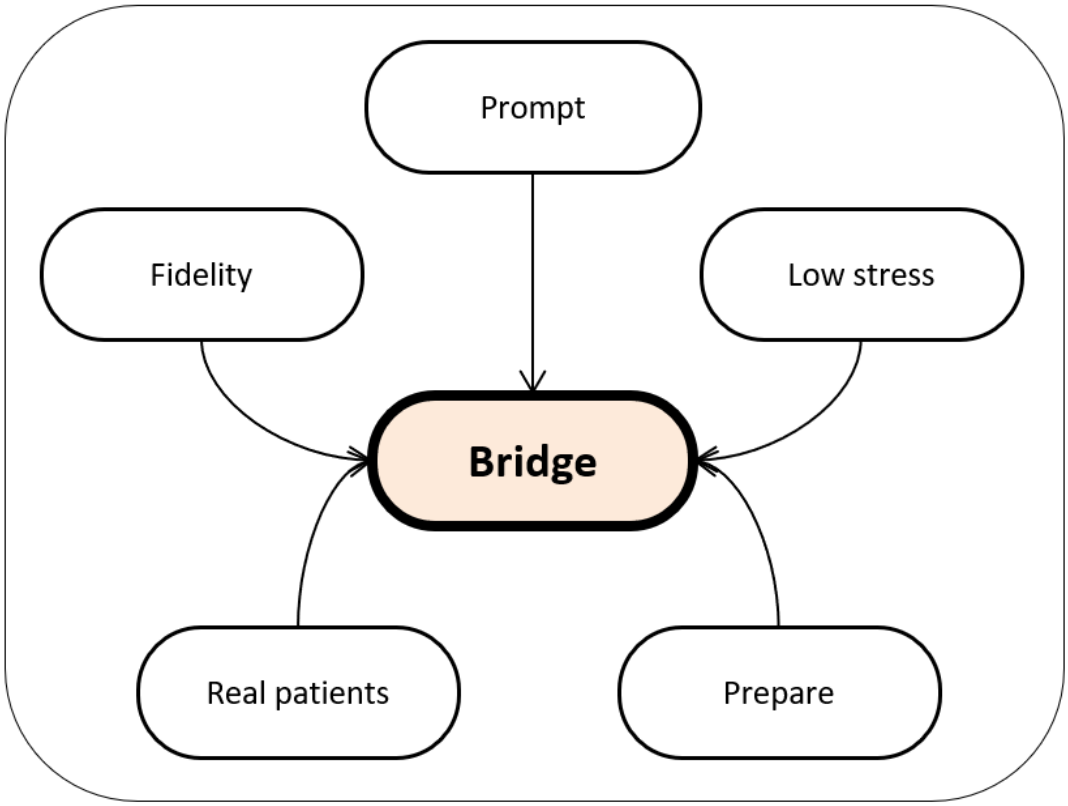

Figure 30- Thematic map for 'Bridge' (pharmacy undergraduates)

Bridge is a theme describing the idea that the VP helped, or could have helped, the participant's transition in their education; specifically, from early, theoretical learning to the more patient-focused, situated learning later on in the undergraduate course. The 'could've' helped is relevant as the participants had all had patient contact already, as well as placement-based learning.

> **006P3**: I think this technology is established at the point after the science bit and before you meet actual patients or even simulated actors, if you introduce this between those two, it kind of prepares us for what we expect or how to gauge a situation, how to possibly change what we would have done without even having practised on it before [yeah] and I think that if you put it there it would be brilliant.

The idea that the VP prepared the participants for their placements and interacting with real patients (or actors) was suggested by multiple participants. This did not make explicit reference to bridging from theory to practice in those words but was more about preparing for interactions with real or simulated patients; bridging from the part of their education which did not focus on real humans (actors or patients) to the part of their education that did.

> **002P3**: when I started my placement um I was quickly told to give a patient advice on their medicines and so on but at the time I did not know how I should carry myself and when I was doing the when I was doing the, what's it called, virtual reality, I was like oh this is actually the things that I should have said in that situation, and applying to it to a past experience so if I was able to have done it before my placement and have an idea of the certain cues that I should pick up
>
> ---
>
> **SJ**: Yeah, with, you sort of mentioned there the sort of simulated patients and the actors, do you think, how do you think these compare? Do these work alongside them or are they a replacement, or, what do you think?
>
> **007P3**: It wouldn't be a replacement because speaking to someone is a bit of a different thing because of all the confidence and everything but it'd help you build up that and make you better when you are in that situation.
>
> **SJ**: Yeah, yeah so, sort of maybe you mentioned it might be useful you know in the early years maybe using these before you get to those encounters, do you think that would be…?
>
> **007P3**: Yeah, yeah that's exactly what I meant.
>
> **SJ**: Yeah, so I think you said yeah, building that confidence to sort of get you ready for those interactions sort of thing.

> **007P3**: Yeah, so you know what you need to do so, when you actually speak to the person the only thing you've got to worry about is the actual interaction and not the content in what you've got to say.

The final remark from participant 007P3 above ("the only thing you've got to worry about is the actual interaction and not the content in what you've got to say") suggests that there are multiple components to consider when speaking to real patients or actors. The VP was suggested to be useful for helping with the content of the words i.e. the specific words that one uses. It was suggested that one component that wasn't incorporated was the body language of the professional, noted as an important element in real communication.

> **006P3**: In terms of non-verbal… because sometimes non-verbal expressions when they see a practitioner or the pharmacist speak to the patient they often influence the way they behave [yeah] so that wasn't incorporated because I do think it's quite difficult to incorporate but that side, that aspect I didn't reflect much on but in terms of communication has answered the questions.

The data shows that one way in which the content of speech was taught/developed was via the multiple-choice system. It was suggested that the multiple-choice system of interaction was inherently valuable as it acted a little like a prompt. At each stage the participant had to choose from three options of what to say or do; not every stage had three options but the vast majority featured three. Sometimes these options would all communicate the same intent (e.g. a greeting) but do so with different wording (e.g. 'hello' or 'hi'). At other points, the options would take the consultation in different directions, such as choosing to explore the patient's views, or not. It seems that the participants liked being prompted, it made them think about alternative options of what to say or do.

> **001P3**: because it's mcq like it gives you an, like it kind of prompts you to think that way as well as in healthcare professional like so, I think it's pretty good.

003P3: I think it's good to like give people options because I think rather than some people in that room who wouldn't really know what to say if you just had to type out your response they wouldn't really know what to say and I think it's having the option there, those answers could have been one that's right and so it does make you think and I think you learn more if there's multiple-choice options rather than if you type the response yourself

…

003P3: I think it makes you think about different options

005P3: the options definitely provided sort of something to say, you know, it made me think about what I wanted to say [yeah] so I don't think I would have thought of all of them, I would have thought of a few of them but I don't think I would have thought of all of them

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007P3: I think when you're in pharmacy, I'm set on what I say, I know so, I'd know what to say in different situations and it gave me an outside the box sort of way to look at things.

SJ: Sort of almost helping you...

007P3: Expand, you know expand my views sort of thing.

008P3: the different amount of options it gave you as well, because it really made you think. Like at first when I first did it, I think I did it wrong. I was like you know, there's no way I'll have to go into that much depth about something else and then but when I went it over again, when you read all the options it really makes much help in a good decision.

SJ: Yeah, you mention there about reading the options, did some of the options presented, were they things you'd not thought of saying before?

008P3: Yeah, I think so. I can't really you a specific example but yeah there was.

Creswell (2014) suggests that during qualitative analysis, or more specifically, the write up, any surprising themes should be highlighted. The sub-theme *prompt* fits this category; the only rationale for choosing a multiple-choice system was ease of use. What the interview transcripts highlighted was that the system was indeed easy to use but also had an inherent value as it suggested new phrases or approaches.

As mentioned, these prompts, which the participants suggested they may not have thought of previously, could be about what sentiment to express or how to express it as the following participant comment seems to suggest.

SJ: Okay so was it more of a way of more of a way of, of phrasing it rather than taking the consultation a different way?

003P3: Um it was a little bit of both I thought [okay] there was um yeah a bit of both.

One surmises from the data that without the VP acting as a bridge, the participant would have to go into their first patient interactions trying to grapple with both the content of speech and body language, as well as other elements. The VP was therefore thought to help smooth the transition to real patients by helping the participants prepare for some of the features of the interaction. Perhaps because of this, the data suggested that the participants thought they would've felt more confident prior to interacting with real people. As third year students, all of the participants had interacted with both actors and real patients already so the following responses were based on them thinking back to a previous time.

005P3: Yeah I think it would be good as well because I think as well it would prepare you for an actor as well because the questions they give you, they give you a set of questions to ask

in the simulation [yeah] so I think it would help, it would give you a bit of a guidance of what you would ask in real life as well so I think that would also be helpful for an actor as well, so I think it would, it would give you a bit of confidence going in if you were going to see just a normal actor or something like that.

Some of the previous quotes, and the next one from 003P3, describe the VP helping with the content of speech and the notion that interactions with real patients are stressful. It seemed that because the VP was not a real human, the participants could focus on the content of the conversation and hone these skills with the VP before moving onto real people; they would then have some of the basic skills, such as the content of speech, so they could focus on the things the VP did not simulate, such as body language and the intimacy of conversation with a real person.

002P3: like the fact that when you are supposed to choose an option it is not timed [yes yeah] so you do have time to process and evaluate oh what should I ask the patient next, what should I do? It made me more aware of that, taking time before you answer is not a problem actually, it's okay because you are able to understand better or get more out of the conversation than before.

SJ: Was it, do you feel it was sort of a less stressful environment than like a placement?

002P3: Yes it was [yeah] well technically if you make a mistake it's still virtual reality

---

003P3: I thought it was quite realistic and is it is um sometimes a lot more stressful if you're with an actual patient [yeah] and you're having to come up with answers and I think sometimes in that situation I just tend, I don't I don't tend to think very, I do think but I tend to like rush what I'm saying and I always think back and think what I'd do differently so in that situation it's not as pressurised

---

005P3: How do I think it compares to a simulated patient?

SJ: Yeah like an actor.

005P3: Like an actor? Oh, erm, I think it compares quite well, I mean, I mean we've had an actor in, I think it was first year [yeah] and I enjoyed that, that was good, but I think an actor it can be a bit nerve-wracking to be honest with you, you know you are going in there and you are sort of like it's one on one [mmm] and you can be nervous and that but I thought with this it was quite calm and I think you could think things through clearly, more clearer [yeah] you know you had time to think about it [yes] and trying to, you know, what you wanted to ask, the questions as well.

As well as the participants suggesting the VP was low-stress, it was also suggested to be a realistic simulation.

SJ: Mmm did it sort of feel like a real scenario to you?

006P3: Yeah it did, honestly like I was surprised because I was thinking it wouldn't be that much to put into it but as I was going deeper and deeper into asking questions I was actually thinking right, I think I should phrase it this way and then realising how the patient saw this so yeah it actually did feel like that, it was a good way to make it happen.

007P3: I liked yeah, I liked the way it was quite realistic and the detail on it was good.

SJ: Yeah, what would you say was realistic about it? Was it the animation or the scenario?

007P3: The animation was very good [yeah] but the scenario was realistic as well, yeah.

SJ: Yeah, did it feel like something that you could encounter in the real-world sort of thing?

007P3: Yeah, yeah 100% [yeah]

SJ: Yeah. Did it sort of feel like a real situation? Or did it feel a bit fake?

008P3: No, I think it felt real. I felt that it brought up other issues as well. Yeah, felt like something that would definitely happen.

SJ: Yeah, so you think his, Brian the virtual patient, do you think his responses were realistic?

008P3: Yeah [yeah], yeah.

SJ: Did you sort of think of him as a real patient kind of thing?

008P3: Yeah definitely.

One participant also contrasted the realism with both academics and other student's role playing as patients. Participant 006P3 said that when academic staff role played as patients, as appose to professional actors, the experience wasn't that realistic, noting a sense of prefabrication. The subsequent remark suggests that the VP was actually more realistic than student or staff role plays, despite the fact that the VP was not a real person.

006P3: So, the lecturers can give always the correct answer while a patient sometimes might not. They might hide symptoms, well or actually because they want to help us they're going to give us some symptoms which we might not even ask for, do you know what I mean?

SJ: Yes.

006P3: Yeah, I feel like it will be more realistic than doing scenarios between us, the pharmacy students [yeah], or between us and the lecturers.

Participants suggested that the VP would've been useful in the early stages of their career. The reason this supports use as a "bridge" is that they seem to be suggesting that when seeing patients, real patients, they would not have need of VP simulations. The idea being that real patients are more useful for honing their skills.

001P3: …I say it'd be more useful in the earlier stages of my career like because, simply because when I'm actually older or getting into the real world of working in there I don't think I would have the need to use simulations because I'm seeing the patients every day.

003P3: I think once you're post graduate and you qualify as a pharmacist you get a lot of that practice in real life anyway so although it could be useful I'm not sure how many um pharmacists would be interested in using technology like this.

Taken together, this seems to imply that there is a spectrum of practice methods, with non-interactive methods, followed by VPs, followed by real patients. In this way, the use of these educational methods is viewed linearly, although not necessarily in this strict order i.e. students start with didactic methods; progress to their lecturers or other students role playing; VP simulations; SPs; real patients. This seemed to be one way the interview participants viewed the role of the VP.

Both themes, *Bridge* and *Exploring the consultation*, are closely linked. The idea of exploring the consultation, investigating different options to see what happened, is perhaps part of the way the VP worked as a *Bridge*. *Exploring the consultation* is perhaps also a theme of its own though, not just concerned with *Bridge* so the two themes are kept separate. One could potentially explore a consultation at any stage of their career, not just to bridge from early theoretical instruction to real patients and scenarios.

6.2.2.3. The balance of options

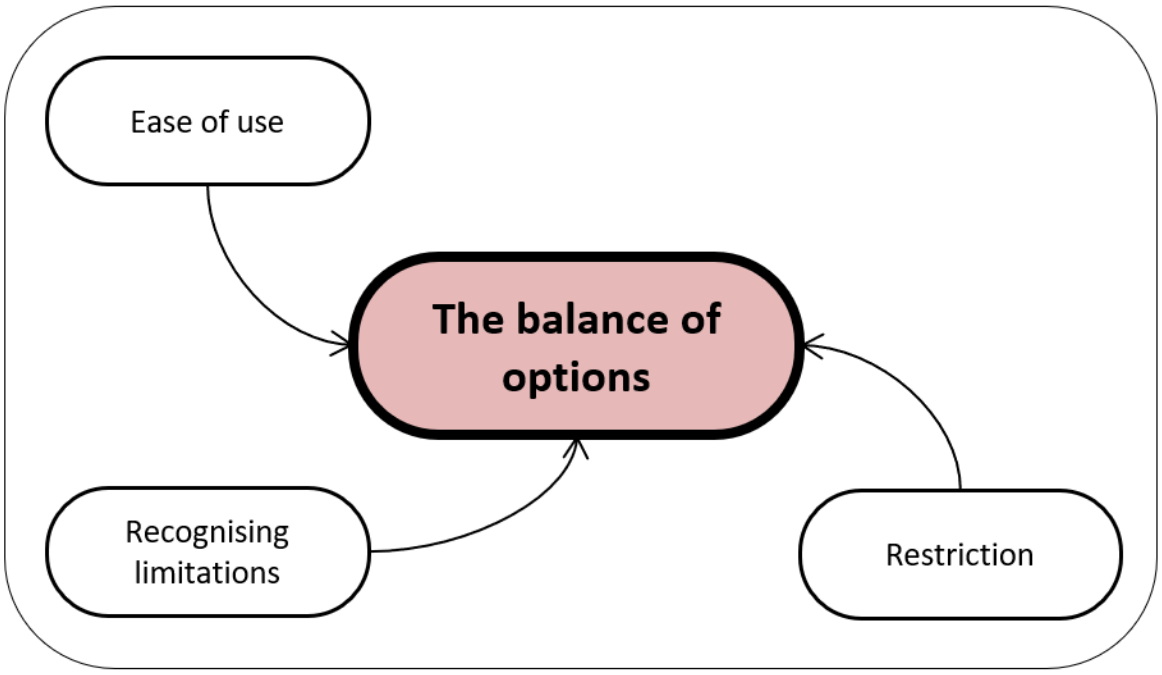

Figure 31 - Thematic map for 'The balance of options' (pharmacy undergraduates)

The balance of options represents the theme that the multiple-choice system had both good and bad features. More than this though, it describes the fact that the multiple-choice system was finely balanced and that to change in one direction or another would disrupt a precious equilibrium.

One side to this equilibrium was restriction; the multiple-choice style of interaction restricted the participant's use of the simulation as they were not free to explore the consultation exactly as they wished. As three options were presented almost every time, the participants had to select from those options and couldn't say whatever they liked in whatever fashion. If one option presented at the start, but was not selected, it was often not possible to return to revisit it; the order of the consultation was also restricted.

> **004P3**: If you want to ask more than one of those questions, there is no way to go back and ask that question as well [okay]. So there were times that I want to ask both of those

questions but because I asked one of the questions then the conversation kept going on that question and I couldn't go back and then it reached to a point that I either had to end the whole conversation or - I couldn't go back, that was what I didn't like [yes]. I would rather more, to have more options on the questions

---

006P3: the only think I would say is erm, there were some bits where I wanted to say something but there were no options available for that [yes]

…

006P3: sometimes I wanted to ask something and there wasn't any choice of asking that was available, I mean a text box could be put at the bottom saying 'others' and you can type your opinions

A potential solution to this restriction, which was raised with all the participants in the interview, was to have more than three options each time. Some participants suggested that while the VP may have benefited from the inclusion of more options (more than three), that would have had to have been weighed against the additional confusion that could've brought.

SJ: Yeah, do you think it would be better to have anymore? Or would you think three was enough?

007P3: More wouldn't hurt, but too many would be a bad thing.

SJ: Yeah, why do you think it would be a bad thing?

007P3: Because then there'd be too many options.

SJ: So, would it be confusing?

007P3: Yeah, it's confusing and you'd start repeating yourself in the different options.

Indeed, participants who suggested that the simulation was restrictive, revised their thoughts later in the interview to suggest that more options could be confusing. As well as being confusing there is also the related issue of the usability of the tool.

001P3: I think the options were pretty good but it maybe it could be like one or two more.

SJ: One or two more?

001P3: Yeah.

SJ: So, sort of four or five options sort of thing?

001P3: Yeah something like that, yeah.

SJ: Yeah, is that just to give you a bit more choice sort of thing?

001P3: Yeah, yeah that's what I felt like, I mean obviously on the same page like on the same, at the same time like I'm not sure if you gave people five options people bother to do it anymore because there's too many options to look at but yeah personally I think if I were to, if I really needed to simulation and I've engaged in it then five options would be absolutely fine for me

…

001P3: like 90% of the time like I wouldn't say anything other than those choices that are there [okay, yeah] so, you know so I think multiple-choice covers like your generic as far as pretty what you respond to the patient in that situation anyway

---

006P3: I think three options are perfect because if you give less then it kind of limits the person as to what they would ask and if you give more I think it would just be more confusing and like you lose track of what you actually want to ask the patient so I think the three questions is enough

It seems that the participants recognised the limitations of the multiple-choice style.

SJ: Yeah what did you think about the sort of, because it was like a multiple-choice system wasn't it [yeah] what do you think about that style of using the virtual patient?

008P3: Yeah that's absolutely fine because realistically you realise you definitely do have choices so it's more like which one you choose so that was fine with me, I didn't mind it.

SJ: Yeah do you think it would be better with more choices or was three enough?

002P3: Um the second question you might need more choices but from what was there it was okay, not the best but it was okay.

008P3: I feel like it's not a major issue if I can't say what I want to say [yeah] it would be nice if it was there but I think with the options that are available eventually they led me to what I wanted to say anyway so it's not that much of a big issue.

Several participants suggested that the style of interaction made the tool easy to use which in turn aided learning.

003P3: Yeah I think, sorry, no I'm thinking people will enjoy the tool a lot more if there is multiple-choice because it will make it a little bit quicker and I think in some fashion people think oh I can't be bothered, don't want to have to type everything [yeah] it helps with learning if they have the multiple-choice there.

SJ: Okay yeah is it sort of more fun to use with the multiple-choice I suppose?

003P3: Sorry?

SJ: Is it sort of a bit more fun with the multiple-choice system?

003P3: Yeah definitely I completely agree and then you can um you don't feel like it's a chore to repeat the exercise because when you didn't get the right answer you have the option to repeat and I think if it was free text a lot of people were saying oh I can't be bothered to do that.

001P3: I found it pretty easy to use like I mean there's only so many options you can press on each question so, like it's not like, it's not like the fact that you have to, when you've got to do the website or anything it was just really simple, well laid out, there was like three different options you can take and each answer leads to something else. So, I thought it was really easy to use.

There seemed to be a tension between having too few options and it becoming restrictive and having too many and becoming confusing and/or less easy to use. This tension between these two linked but directly oppositional features is what led to the creation of *the balance of options*; the idea that there is a balance to be struck between having too few and too many options.

6.2.2.4. <u>What skills is the VP developing?</u>

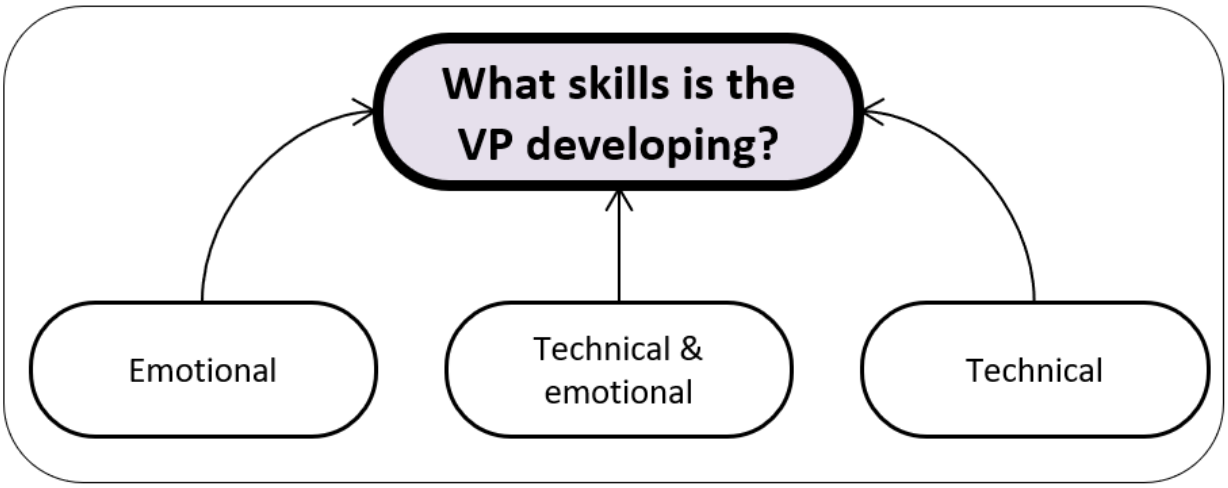

Figure 32 - Thematic map for 'What skills is the VP developing' (pharmacy undergraduates)

This is a theme describing the different views that the participants seemed to take towards the aims of the VP. The talk connected to this theme could be grouped into two categories; firstly, the skills the participants thought this specific VP developed and secondly, the skills they thought the technology could be applied to in future.

The VP's intended aim was to develop emotional skills with only a slight focus on the technical skills; emotional skills include communication, building rapport and encouraging the sharing of information. Technical skills include diagnosis, prescribing and, in the VP's case, differentiating between the signs of a medication side effect and prostate cancer. Despite this intended emotional focus, one participant made comments suggestive of the idea that they wanted to focus on the technical elements.

> **SJ**: Do you think the, the virtual patient, the technology, do you think that would be more useful in a workshop or would you rather have used it on your own at home?
>
> **004P3**: I think using it on the workshop, it was alright, but if it was to be used for myself, I would have used it for sure. Especially like prior to an interview probably that they could ask me like 'if a patient comes in and has da da da da da symptoms, what would you recommend and what is your possible differential diagnosis' or something [yes]. That would be a really good tool to practice on [yeah], or even for the CBAs, because we do have a station this year called Responding to Symptoms.
>
> ….
>
> **004P3**: I would love to have like broader spectrums like for example cardiovascular [mmm] or lung stuff or bowel stuff [yeah]. Like I would like to have like the most common ones, the most common presenting symptoms in a community pharmacy

It appears from this dialogue that the participant is focusing on what could be described as the technical aspects of their education and not the emotional element; they are talking about the VP in

different terms to those it was designed for. To further evidence the idea that this participant's intended aims were not aligned with those of the VP, they go on to comment;

> **004P3**: I don't know how it works, I don't know how you do it, but to give like a keyword for example angina and give you like questions I could ask about angina [okay, yes] or for example cough and ask different questions about coughs and as I said I would like to ask multiple questions like have a choice to ask more than one of the questions [yes] so ask one of the questions, get the answer, ask the second one of the questions, get the answer and then ask the next set of questions, if that makes sense? [yes]

This features speech based on the clinical elements of care but moves on to describing a style of communication which could be described as an interrogation, quite paternalistic; question, answer, question, answer. This is in opposition to the natural flow of conversation that is perhaps more desirable in SDM, respecting both individual's role in the shared partnership. While participant 004P3 voiced these opinions, they also made comments suggestive of the fact that this type of technology could develop emotional skills too.

> **004P3**: I would like to have different kinds of patients. I would like to have a more angry patient, a more shy patient, a more talkative one.

Here they are suggesting they would like more cases in addition to the VP evaluated to practice different emotional skills. Some participants suggested that the VP developed both types of skill, the emotional and the technical. In many ways, this was the aim of the VP as SDM requires both.

> **SJ**: Yeah so do you think it can teach clinical as well as communication or does it do one better than the other?
>
> **006P3**: I think it teaches both equally, but like I said, the non-verbal bit of the communication is not there, I think it's hard to implement anyway but potentially with the verbal bit of the

communication, the way you engage in communication and the clinical bit as well, it's a balance of both [yeah] yeah.

Another participant made a similar comment, albeit in a less concise manner; there is little punctuation in this section deliberately as the participant did not punctuate their speech. What they are describing is the idea that in a consultation, you need both the technical and emotional skills, you can't get by with one and not the other. This participant suggests that there is 'interplay' between the skills, hence why the VP developed both skills.

002P3: Um I think it's an interplay of both really um because if it's a result of communication in terms of communication it's with reference to the type of questions that you ask which will determine the feedback that you get and in terms of clinical knowledge it's more like knowing which specific things to pick up on that the patient has like if it's a certain problem, picking out what the problem is and coming up with a solution for that problem but it does require your clinical knowledge but also your communication in terms of how you get that information out of the patient is also another thing, it's an interplay of both really.

There were suggestions that the VP developed the participant's emotional skills.

006P3: Erm, well it helped in terms of how I should phrase my questions, essentially like what I would say, because obviously there was an example in the session where they were like how would you introduce yourself, like you wouldn't say, hiya, you wouldn't say hi, you would say good morning or you can say hello, like the way you phrase it, it also teaches you to essentially reflect on how you should communicate

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SJ: You said you learnt a lot, what sort of things did you particularly, that you felt you learnt about?

008P3: More about how to open a conversation, so like there was a lot where you'd be asking, you know, if you brought up a different issue and then you would ask about that, you know, ask more information about that rather than just sticking to the problem they came in with originally [yeah]. Yeah it was more about the whole picture rather like, you know like asking him how he is, asking to take a seat, like things like that you know, just rather than just getting straight to it and that being it.

The interview data show that some of the participants viewed the VP as a good tool for developing the more emotionally-centred skills, such as rapport building. Other participants seemed to think that the VP would be better suited to the learning and practice of technical skills; others felt both could be developed at the same time. This theme describes the participant's different views towards the aims of the VP, describing the heterogeneity of opinion.

6.2.2.5. <u>The importance of the context of use</u>

This describes the theme across the interview data that the VP could work in a variety of contexts; context as used here means the stage in education (e.g. first year, second year) as well as the way in which it was actually deployed (e.g. alone or in a workshop). More specifically, when using a VP the context in which it is used needs careful consideration, the structure of the workshop for example, as is the case for this evaluation.

There does not seem to be a clear answer from the data as to what stage in a pharmacy student's studies or post-graduation practice is the VP most suited. Some participants felt this sort of tool should be introduced at the start of the undergraduate course to instil these skills early on.

SJ: Why do you think it might be useful earlier on?

008P3: Because you'd be dealing with patients later on and that's something you should learn from the start [yeah], I think yeah.

SJ: Do you think it'd help prepare you for those, you know, encounters with real patients?

008P3: Yeah definitely, yeah. It just teaches you to have a better conversation with someone and find out more information from them, so yeah I do think, you should learn that from the beginning.

The above dialogue also links to *bridge*. Some participants felt that rather than introducing this tool in the first couple of undergraduate years, prior to patient contact, this tool would be best utilised as this patient contact starts, later in the course and upon graduation.

005P3: ….so for like in the future when we are going to have to have those interactions with the patients, one on one, and in hospitals I think a different type of simulation would be better, like more designed for specific hospitals [yeah] but yeah I could definitely, could definitely see it being useful.

SJ: Mmm. You sort of mentioned there about later on in your career, do you think this would be later, you know, either when you graduate or in your pre-reg?

005P3: I think pre-reg is probably when you will start having to do those type of interactions [mmm] because I think with the placements now a pharmacist is always going to have an eye on you, there's always going to be like, people there to help so you are never going to be, you know, in that situation where you are going to have to advise a patient, you know, one on one, so I think pre-reg is probably when you'd start having to do that type of thing.

This participant does however go on to suggest that this tool could still be used earlier in the course.

SJ: Yeah but do you still think it can have that use in say, first and second year, preparing you for meeting actors and things like that?

005P3: Yeah, yeah I definitely think that would be a good use for it.

This thread of dialogue with participant 005P3 highlights the idea that while this VP could be preferred or most appropriate at certain stages, it is not constrained to a single point in time, a thought echoed by another participant.

> **SJ**: Yeah, you mentioned sort of CPD do you think this sort of tool, this tool could be useful for use further on in your career? You know not just as a student.
>
> **007P3**: Yeah it could be, you know like when you do training modules with companies?
>
> **SJ**: Oh yes, training modules, yeah.
>
> **007P3**: When you work with Boots or what not [yeah] so, yeah you could use it in that sort of application.
>
> **SJ**: Yeah, do you think it might maybe need to be made a bit more difficult for people later in their career?
>
> **007P3**: Yeah, yeah it would have to, yeah apply it to them rather than students [yeah] it's going to be slightly different.
>
> **SJ**: Yeah, do you think it might also be useful earlier in the course as well [yeah] so for first and second year? Do you think that would be…?
>
> **007P3**: Yeah you could use it from day one.

007P3 adds a point about difficulty; the VP would have to be more difficult for it to be used with someone later on in their career, that the technology could work for those more experienced but the exact same simulation would not be useful to both undergraduates and more proficient professionals. How to make it more difficult was not discussed.

Perhaps the VP does not have a singular place in the curriculum but can work at a variety of stages. The reason the theme is named as such is that the participant's responses suggest that wherever the

VP was used, at whichever stage, one would have to be mindful of this i.e. the tool may not be suitable for lifting out of one context and placing in another without adjustment.

The other dimension to context is the setting in which it is used; where and in what situation the VP would work best e.g. a workshop or alone. Little thought had been given to this idea prior to the interviews; where and in what setting the VP was used could affect the experience significantly. The idea arose in the first interview.

> **001P3**: …and I think because if we didn't go for that session we'd still be kind of puzzled but there's something and anything else so…
>
> **SJ**: Okay, yeah.
>
> **001P3**: So, at that you know I think that's something I would want to know like if I was just doing it on my own on the computer and didn't come to the session and I answered something else and he said, 'No' and so, I wouldn't know, understand why that would be it, yeah

The participant is referring to the section in the simulation when there was a choice between using the word 'something' and 'anything' to elicit any hidden agendas from the patient. It seems that they were confused as to why this was an issue and wanted to discuss the feedback they got in greater depth, something they could do as the VP was used in a workshop. If they had used the VP at home, alone, this opportunity for discussion would be lost. If used alone, the suggestion was that an opportunity to ask for further feedback, or to clarify an issue, was missed.

Other participants suggested the workshop was a good setting to use the VP first due to practical issues.

> **SJ**: Yeah do you think it worked, because you sort of mentioned there asking for advice, do you think this sort of tool works better in a workshop like you used it or using it on your own at home?

003P3: I think definitely the first time you use it it would be better in a workshop because if you do have any queries or any problems you'd have someone on hand to help you with it, I think if you did it at home and you had any problems you might be inclined to give up if you type in the wrong answer.

SJ: Yeah do you still think it could be used at home as well or…

003P3: Yeah of course I do think like an introductory session in the workshop first [yeah] although I think people can use it without um it is pretty self-explanatory but I don't know I think it was nice in a workshop setting.

008P3: I think it would be, to do it in a workshop first probably be better, because if I think if I was just given it to do at home, I probably wouldn't do it [yeah]. You know if someone just said, like a teacher just said 'go and do that', if you used it in a workshop first and everyone used it then, then and if you had access to it at home then that would be better [yeah]. But yeah, workshop first definitely.

Some participants commented on the benefits of using the VP in isolation.

003P3: in the workshop although I kept saying you know it would be best to do it in a workshop environment, sometimes it's quite easy to get distracted by your friends and they were like making jokes and you got a little bit distracted from what you were actually doing

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007P3: So, it might even be better on your own because students say wouldn't be using it as a joke with their mates they might be gaining more from it.

SJ: I see sort of yeah, maybe take it a bit more seriously perhaps?

007P3: Yeah.

These last two points highlight that a workshop is not necessarily the only way to use the VP, as some of the earlier comments might suggest. There were different ways of using the VP, it seems, but that each of these approaches would have their specific positives and negatives and, more importantly, however the VP is used, the structure around it is important. The VP was not a sealed educational unit but the time and place of its use affected the learning experience.

6.2.2.6. Data Saturation

All of the main themes were apparent from the sixth interview; the following two interviews tended to cover the same topic areas and points of discussion. It would therefore seem appropriate to suggest that all of the main themes were identified and thus data saturation had been achieved; there is also the issue of any minor themes but these appear to have been present by the sixth or seventh interview too. Data saturation is relevant for the discussion of the results but this was somewhat academic; as no other students came forward as interview participants, there was nobody else to interview if data saturation had not been achieved.

6.3. Discussion

The data from the questionnaires suggested that the VP was enjoyable and accessible (Figure 20 and Figure 21). Much of the research about fun in education has focused on children but it is also relevant for adult learning, motivating class attendance as well as encouraging concentration and aiding the absorption of material (Lucardie, 2014). Perhaps as a consequence of this enjoyment, the majority of the participants said that they would like to use the VP again (Figure 23); 28% (n=15) with improvements and 70% (n=38) as it stood. While it doesn't necessarily mean it was useful for their education or improved their skills, this seems to be a positive indicator for the VP, suggesting it was well accepted by the participants. Some of the participants reported that they would change their practice as a result of the VP. Figure 25 shows the likelihood of change as reported by the

participants themselves; 87% (n=47) stated that it was either “likely” or “highly likely” that there would be a change in their practice. Content Analysis (CA) showed that the suggested changes were concerned with a focus on patient centred care, descriptions alluding to SDM and a greater degree of confidence or structure in consultations. More than simply being fun, the VP resulted in participants suggesting they would change their practice in line with the aims of the intervention. Whether these intentions bore fruit and the participants altered their consultation style to involve patients in decision-making is unknown.

6.3.1. Bridge and Transitions

The results from the evaluation suggest that the VP was a low stress, realistic way of preparing for interactions with real or simulated patients. The participants suggested it was more interactive and realistic than didactic methods, and some even suggested it felt less fabricated than role plays with educators or students. Despite the low stress nature, it was reported that the ability to see the consequences of one’s actions made the simulation feel realistic. While the level of fidelity was suggested to be quite high, as the VP lacked both the stress of a real interaction and the body language of the participant, it was noted that real patients were still required for practice but that VPs could help bridge the gap from didactic methods to these real interactions.

The interview responses suggested that meeting real or simulated patients for the first time is a nervous or tense experience for the participants; anything that can reduce the stress or demand on students is posited to be useful. Others have come to a similar conclusion, also suggesting that VPs can help bridge this ‘fear’ to real patients (Sunnqvist et al., 2016). Prior research shows that VPs offer a low stress environment and when they were placed before interactions with SPs, they may have led to increased confidence in subsequent interactions (Kleinsmith et al., 2015). Deladisma and colleagues (2007) come to a similar conclusion, that VPs are not to replace SPs but can augment the curriculum, offering a safe method to repeatedly practice.

The idea of bridging could be related to the theory-practice gap, defined loosely by Rolfe (1993) as the disparity between what occurs in practice and the theory of what ought to happen. The theory-practice gap is associated with the development of expertise; from a nursing perspective, Scully seems to link it to the Dreyfus model of skill acquisition (Dreyfus and Dreyfus, 1980; Scully, 2011). Nursing students, like pharmacy students and many other professions, start their education by learning theory, understanding basic principles and rules which are applied rigidly (Ericcson, 2015; Scully, 2011). As learners progress they must apply this theory to real clinical practice, bridging the theory-practice gap and decreasing their reliance on the rote application of rules. Simulation is suggested as a useful tool in bridging this gap (Hope et al., 2011; Monaghan, 2015), hence the theme name *bridge*. Research has found that pharmacy students perceived a gap between the learning of theory which was followed, with little or no transition, into practice (Cresswell et al., 2013); the study authors concluded that simulation in undergraduate education could smooth this transition. Evidence from the interviews for this evaluation would seem to suggest that this could be the case for the VP.

A potential reason for the VP acting as bridge to an SP is that it can prompt the user with phrases or words they may wish to use. This was a surprising result as the multiple-choice system was chosen primarily as it was assumed to be easy to use; the interview results show that the system helped the students learning in an additional way. At each juncture there were three options of what to say or do presented and the user had to choose one of them to progress through the consultation. The results show that the participants were often not sure what to say or hadn't thought of any alternatives but having the three options on screen gave them some inspiration; it prompted them to think about new phrases or words to use. This reportedly helped with learning the content of speech (i.e. which words to say); this is a sub-skill that VPs have been reported to be useful in developing (Dickerson et al., 2006; Raij et al., 2007). In accordance with the work of the Deladisma (et al., 2007) and Kleinsmith groups (et al., 2015), the participants suggested they would have been better prepared for interactions with SPs and real patients had they experienced the VP prior to these

interactions. The participants had already started interacting with SPs and real patients so they were reflecting on their recent experiences, those prior to using the VP.

Cain and Piascik (2015) comment that one does not have to advocate a singular place in the curriculum for any educational intervention; an educational tool can work in different places in the curriculum and in different ways. The evidence from the both the questionnaires and the interviews are supportive of the VPs use at different stages in the curriculum and also in both workshops and alone. There is a caveat to this though, that while the VP may be usable at different stages and in different ways, these curricula loci are not interchangeable; as an example, if used alone by students, some participants felt they may miss the context for the VP afforded by the instruction and demonstration stages of the workshop. This point is developed further in 6.3.3, Feedback and Reflection.

6.3.2. System of Interaction and Balance

There are four stages to the acquisition of a new skill; instruction, demonstration, practice and feedback (Ericsson, 2015; Maguire and Pitceathly, 2002). It seems that the VP was used by the students as a kind of guided practice, a hybrid of demonstration and practice. Rather than entering into an encounter with a real person (role play, an actor or a patient), the VP allowed them to practice this type of situation in a safe, low stress way with additional support, like riding a bicycle with stabilisers. When the participants were unsure what to say or had maybe not considered alternatives, they could read the options presented and think about what they wished to do. They still had to make the decision themselves though and make judicious choices; some of the options presented were not optimal but examples of bad practice. This could affect how one would incorporate such a VP into a curriculum or session; is a multiple-choice system useful for more advanced learners? Figure 24 shows much greater support for the VP in the undergraduate years

than postgraduate; to extend the bicycle metaphor, one does not return to using stabilisers after cycling without them.

There are suggestions from the VP literature that multiple-choice may be more suitable for learners early in their development and free-text for those more experienced (Carnell et al., 2015; Huwendiek et al., 2009b). This is because multiple-choice relies on recognising the optimal response whereas free-text involves the recall of previously learnt information (Schittek Janda et al., 2004). After one has completed the instruction and demonstration phases of skill acquisition, they then move on to practicing the skill for the first time; at this point, one's knowledge is somewhat abridged so the support and prompts from the multiple-choice system may be helpful (Maguire and Pitceathly, 2002; Maskrey et al., 2009). As one repeatedly practices the behaviour, it becomes second nature and the learner is unconsciously competent, utilising system 1 thinking where conscious thought is not required to complete a process (Flower, 1999; Kahneman, 2003). After this stage, learners may then move onto a free-text VP, akin to removing the stabilisers from the bicycle. This links to the curricula structure suggested by Rodriguez-Paz and colleagues (2009) where one starts with simple simulations and progresses to more complex ones; this is underlined by Miller's pyramid where one moves to the next simulation after the assessment of competence (1990).

The participants noted that in their future clinical practice their interactions with real patients would serve them more effectively in honing their skills. Whether this is true or not, it is perhaps why they thought the VP would be most useful early in their career (see Figure 24). On the other hand, could the prompts suggest new phrases or words to an experienced professional, helping them break old habits? This is speculative as the participants have not yet graduated so are, in effect, guessing how useful they would find the VP in future. A relevant finding in the literature describes undergraduate medical students finding simulated patients (actors) less useful once they had been exposed to real patients (Bokken et al., 2009); the students did acknowledge though that one cannot 'experiment'

with a real patient, perhaps suggesting a place for SPs and/or VPs. Whether pharmacy students would feel the same is unknown.

The multiple-choice style of interaction, while seeming to prompt students to consider new ideas and being easy to use, also restricted some students. Clearly, any user of the tool is restricted in that they cannot say whatever they wish but only choose from the options presented. The interview data highlighted that some participants acknowledged that, with a multiple-choice system, there is a trade-off between making the VP easy to use with only a few options and it being perhaps a little restrictive, or having lots of options and it being unwieldy. Multiple-choice VPs have previously been found to cause feelings of restriction but also with acknowledgement that there is a balance to be struck with the ease of use that comes with multiple-choice (Bearman, 2003; Dukes et al., 2013); the findings from this evaluation concur. An alternative system is free-text, where the user can type in a response, rather than selecting from pre-defined options (Bracegirdle and Chapman, 2010). While the participants did not use such a VP in this evaluation, some of them suggested it as an option. Free-text comes with its own issues though including phrase recognition (Stevens et al., 2006); a VP system must recognise the individual words that a learner uses as well as the context in which they are said (Maicher et al., 2017). Medical student participants in Stevens study reported that while the phrase recognition issue was frustrating, it was still acceptable as in real clinical practice, questions may have to be rephrased or repeated.

As the evaluation and the literature suggest that VPs can help one prepare for interactions with real people, the VP session could perhaps be moved earlier in the academic year or even to the year before. This would enable it to be placed prior to contact with real patients and thus help prepare the students for those interactions. This evaluation suggests that for the third-year pharmacy students, a multiple-choice system was appropriate, balancing ease of use and restriction as well as utilising the prompting feature. While not perfect, it seems the format of reply was received largely positively (Figure 22) suggesting that an appropriate balance was struck. Free-text systems may be

useful but their place when compared to multiple-choice systems seems unclear; assessment or more advanced learners may benefit from free-text VPs. Different styles of VPs could potentially be built into a spiral curriculum where one can progress from simulation to simulation with the difficulty and fidelity increasing as the learners become more skilled (Kurtz et al., 2005; Rodriguez-Paz et al., 2009). A future research project could aim to directly compare both modalities as the participants only used a multiple-choice VP in this evaluation.

6.3.3. Feedback and Reflection

It is not only instruction, demonstration and practice that are important in the acquisition of skills but also feedback. The VP gave feedback to the learner as a built-in feature; the questionnaire data, particularly Figure 27 and Figure 28, seem to suggest that the feedback was appropriate in terms of the volume and overall impression. Automated feedback from the VP has previously been suggested as important as it is more palatable than feedback from an educator alone (Pantizaras et al., 2014). Did the automated feedback meet the learners feedback needs completely? Perhaps not as some interview participants commented that they had questions to ask the academic staff after using the VP. The automated feedback from the VP could perhaps be improved to include further explanation of the feedback points. When the session is run in future, consideration could also be given to including a more comprehensive debrief session after using the VP. Research with other VPs supports this notion (Close et al., 2015; Edelbring et al., 2012). A debrief session allows the learners to discuss their experience and, connecting to andragogic assumptions of education, link their simulated and real-world experiences (Cook, 2012; Knowles, 1980, pp43-44).

A debrief can aid the learners reflection on their experience too. Reflection was a sub-theme of exploring the consultation and can be related to Kolb's theory of reflective practice, where a concrete experience leads one to reflect and review the experience; the cycle then moves on to abstract conceptualisation, which involves learning from the experience, and then moves on to

action, putting into practice what is learnt (Kolb and Kolb, 2005). The interview data seemed to suggest that elements of this cycle were incorporated into the VP. Participant responses suggested that the VP provided an experience which made them think about how they approached interactions with patients. Whether this thinking was active reflection is unknown; there is an important distinction to be made between active reflection and simply following a process or thinking uncritically (de la Croix and Veen, 2018). Educators using VPs have used the Kolb theory of reflective to inform the design of their interventions (Kleinert et al., 2016; Pantziaras et al., 2015) and it is also a feature of simulation learning more widely (Husebø et al., 2015); the Husebø paper focused on manikins, a different type of simulation from VPs, and is also based on Gibbs reflective cycle (1998) which links the Kolb theory to educational practice (Healey and Jenkins, 2000). Husebø and colleague's position is that incorporating a debrief after the simulation was essential for learning.

Does the aim of the simulation affect the requirement for a debrief? It was not clear from this service evaluation but if one is teaching, for example, technical skills where there is a right and wrong answer, does the learner require a debrief? They may do and that question was not addressed in this evaluation but when simulating consultation skills and SDM, the need for a debrief is perhaps even more pertinent as there are not absolute right and wrongs; defining what is 'good' in a consultation is difficult with no such thing as a perfect consultation (Howie et al., 2004). When designing the VP, it was acknowledged that it could be wrong to enforce a singularly 'correct' script and there were multiple ways to navigate the conversation in what could be described loosely as correct. There is subjectivity at the heart of a patient-centred interaction (Epstein et al., 2005; Mead and Bower, 2000); could this make a debrief particularly useful and why some interview participants desired to use the simulation in a workshop first, not just in isolation? This result from the evaluation has ramifications for future practice recommendations at Keele; if the workshop is to be repeated with the next cohort of third-years, perhaps space should be allowed at the end of the workshop for a comprehensive debrief; the amount of time and the composition of this debrief is not clear from the

results. The Kolb cycle (Kolb and Kolb, 2005) could be used as a theoretical foundation for this (Zigmont et al., 2011); a reflective discussion or piece of writing after the session could be of benefit.

One issue with applying the Kolb theory to this VP workshop is the idea of *prompt*. Zigmont et al. (2011) suggest that with Kolb as a theoretical foundation for simulation, the learning occurs exclusively after the event, during the reflection and debrief; this is perhaps because the simulation Zigmont and colleagues appear to be drawing on is mannikin based, although this isn't clear. It appears that some of the learning with the VP in this evaluation occurred during the experience; both the reading of prompts and visualisation of the consequences were learning events that occurred during the simulation. This has implications for the application of the Kolb theory to this VP workshop as the learning was perhaps not uniformly aligned with traditional experiential learning theory. Another theory of reflection is Schön's (1987); the Schön theory differentiates between reflection "in" action and reflection "on" action. The VP evaluated here would seem to be better suited to the Schön theory as during the simulation, while receiving prompts of what to say and observing the consequences of one's actions, the learners were reflecting in action. Afterwards, the learners could reflect on their action.

6.3.4. Priorities

There is evidence to suggest that medical students' empathy towards patients' decreases as they progress through their degrees (Chen et al., 2012; Haidet et al., 2002; Woloschuk et al., 2004). The literature suggests that this shift occurs around the third year of the undergraduate medical course, the start of the clinical training after two years of foundational training (Griffith and Wilson, 2001; Hojat et al., 2009). There are some who suggest that this decline is real but exaggerated (Colliver et al., 2010) while others suggest that it does not exist at all (Costa et al., 2013). The decline is perhaps not as dramatic as the early research feared but a decline may well be happening and more nuanced measures of medical students empathetic development may be required (Roff, 2015). How well

these studies map to pharmacy students doesn't appear to be known; there is also the issue that undergraduate courses change over time with some now including patient contact very early (Hargie et al., 2010). In tandem with this is the proposition that EBM has been misinterpreted and population-level risk estimates are being applied dogmatically to individuals, nullifying the role of the patient's preferences in the decision-making process (Greenhalgh et al., 2014). It is proposed that decisions are not being individualised but instead guidelines are being used as "tramlines", neglecting the role of the patient's perspective (McCartney et al., 2016).

To explore this area, the participants were asked to rank Barbers four prescribing priorities (1995), both pre- and post-VP. Barber suggested four things a prescriber should aim to do when prescribing and monitoring treatment; maximising effectiveness, minimising risks, minimising costs and respecting patient choices. The priorities were conceived in what could be argued as the white heat of the EBM movement, just before Sackett and colleagues published their seminal editorial (1996). If both undergraduates (medical) and practicing professionals are suggested to be focusing on misinterpreted EBM and not practicing in a patient centred way, it was interesting to find that a short 20-minute exposure to the VP resulted in a statistically significant change in the rank position of "respecting patient choices" ($p=0.026$) comparing pre- and post-VP; the median rank shifted from 2nd to 1st. This is argued as a positive result for the VP, increasing the priority of patient centredness within a consultation for the participants in this study.

The change measured in this evaluation has a number of caveats though. To start with, it is not clear whether any change endures over time. Evidence from the literature would suggest that to sustain any change, the development of skills needs to be longitudinal, not a one-off intervention (Brown, 2012; Laidlaw et al., 2002). Even if the change is sustained over a long period of time, the relevance to clinical practice is unknown i.e. there is no evidence to suggest this shift equates to greater SDM in a consultation. The measure itself is also a potential target of criticism; the participants were asked to rank their priorities within a clinical consultation. The four domains are not necessarily a hierarchy

though but things a prescriber should aim to meet in all prescribing decisions. None the less, it was thought to be interesting to see, when forced, how the participants would rank the four domains and whether this changed after using the VP.

Furthermore, the aim of the VP was to promote SDM, not "respecting patient choices" per se. As commented in the Background chapter, a key feature of SDM is the professional surrendering power and respecting the patient as a partner in the decision-making process (Towle and Godolphin, 1999). Professionals have been reported to theoretically value SDM but not respect the patient's choices in a consultation, something of a contradiction in terms (Hamann et al., 2012; Karnieli-Miller and Eisikovits, 2009). SDM requires a professional to work with the patient, an essential component of this is respecting the patient's choices; if a professional doesn't respect the patient's choices, how can they be said to have mutual respect for one another? It cannot be claimed that those students who ranked "respecting patient choices" more highly post-VP are practicing, understand or value SDM. The only statement that can be made is that there was a statistically significant shift in the rank position of "respecting patient choices" after the third-year pharmacy undergraduate participants used the VP.

6.3.5. What skills is the VP developing?

The aim of the VP was to develop the SDM skills of third year pharmacy students. The focus was not on the technical elements of care but the emotional aspect of having a conversation about potential management options. Table 27 shows that the VP was reported to be useful for the development of communication skills and patient centred care which suggests that the VP met its aims. Many of the interview participants suggested that the VP, and any future VPs, could develop both technical and emotional skills in tandem; one participant in particular commented that you cannot split the two i.e. you need to use both at the same time. Kidd et al. (2005) suggest that while communication skills, the emotional skills, can be developed alone early in undergraduate studies, they need to be

combined with technical skills later on as this is how the skills will need to be used. As an example, when having a consultation about a change in bowel habit, one needs the emotional skills to elicit all the information and to do so in a sensitive way; one also needs to know the red flag symptoms and management options. A 2012 meta-analysis showed that both communication and clinical reasoning skills can be improved by VPs, although the effect was greater for clinical reasoning (Consorti et al.); the analysis only included a very small number of papers though (n=12) and excluded qualitative research.

A minority of the participants' responses, in both the interviews and questionnaires, suggested that they wanted the VP to focus on technical skills, such as spotting red flags and diagnosing minor ailments. Relevant here is the discussion in the 'Priorities' section suggesting medical students become less empathetic as they advance through their studies (Chen et al., 2012; Haidet et al., 2002). There is also the suggestion that healthcare professionals tend to focus on population level risk and technical skills as opposed to emotional skills and individualisation of care. This may be why some participants, albeit a minority, wanted the VP to be developed to focus on technical skills. Did a minority of the participants perceive technical skills as more important than the emotional ones? The literature suggests that pharmacy and medical students have often perceived communication skills as 'soft' skills (Beardsley et al., 2001; Bergh et al., 2004; Rees et al., 2004); in this context, 'soft' is a pejorative term. This could be the case for the minority of participants who wanted the VP to focus on technical skills who may have viewed communication as a soft skill? Research on Nordic pharmacy students found a minority of the participants thought that their communication skills were the result of their personality and thus not amenable to change (Svensberg et al., 2018). With this in mind, it was recommended that when running the VP workshop in future, the evidence demonstrating that communication skills can indeed be developed should be highlighted and explained (Aspergren, 1999; Jin et al., 2017). This may help convince the minority of students that practicing communication skills is an important endeavour, if this were the reasoning behind their preferred technical focus.

6.3.6. Participants Attitude to Technology

Individuals have different attitudes to new technology and consequently adopt it (or don't adopt it) in different ways (Rogers and Shoemaker, 1971). A criticism of this evaluation could be that many of those who responded had favourable opinions towards VPs from the outset; Figure 18 shows that the pre-VP attitude to the usefulness of VPs was high for the cohort. Table 21, based on Rogers work, shows a spread of self-assigned adopter class but with most participants describing themselves as early adopters. If the participants described themselves as being interested in new innovations and also declared that they thought VPs were useful prior to using this VP, this was perhaps part of the reason that the VP was rated so favourably (Figure 20 and Figure 23).

Bennett and colleagues (2008) note the claims that today's entrants to higher education have a desire for technology in their learning which must be sated by universities. Both Bennet, and Jones and Shao (2011) argue that this claim is not quite reflective of the complex situation in higher education. Jones and Shao suggest that today's students don't necessarily have a natural demand for technology but that higher education students desire only moderate use of Information and Communication Technology (ICT) in their education. Margaryan and colleagues (2011) also argue that it is erroneous to suggest that young people adopt radically different learning styles in terms of their technology use; while technological change may be perfectly reasonable, it is not appropriate to base these changes on the premise that learners demand it, they conclude.

6.3.7. Limitations

There are some limitations to this study. Some of these are described at the relevant points in the discussion while the remaining issues are outlined here.

Firstly, no attempt was made to measure any change in practice or outcomes as a result of the VP. The ultimate point of improving undergraduate pharmacy education is to produce graduates who can provide a better standard of care in some way. As this wasn't measured, the ultimate goal of the VP and whether it was achieved remains elusive.

The participants in the first workshop, the morning session, were asked not to communicate with their colleagues in the afternoon workshop about the details of the session. It is unknown whether they kept to this request; it is plausible that the participants in the afternoon received details about the workshop from the colleagues in the previous workshop. This could have affected their view of the session and the VP. In short, the first group could have primed and biased the views of the second group.

An aim of the evaluation was to evaluate the participant's views of the feedback. This aim has probably not been met as the participants didn't have much comment to make on this feature, despite follow up questioning. Perhaps the evaluation design is to blame? A better way to have met this aim was perhaps to conduct a piece of research with multiple, cross-over arms to compare and contrast different types of feedback delivery. The evaluation did touch on issues concerned with feedback though, specifically the suggestion of a post-VP debrief emanating from the interview data. Thus, the evaluation explored some of the issues pertaining to feedback but the participants had little to say about the feedback the VP provided itself.

The findings from this evaluation apply only to this evaluation. It cannot be said whether the same would be found at another School of Pharmacy with different undergraduates or not.

6.4. Conclusions

In conclusion, this service evaluation with pharmacy undergraduates showed that the VP was viewed as accessible and enjoyable to use. The participants liked the VP and suggested it would make them alter their practice; for many of them this was towards a patient centred ideal and practicing SDM. Indeed, when comparing pre- and post-intervention responses, there was a statistically significant change in their priorities within a consultation with "respecting patient choices" more highly ranked ($p=0.026$). Future work could look to establish whether this change endures over time and whether it results in any change in practice, either simulated or 'real'.

It was found that the multiple-choice system of interaction, far from just being easy to use was an inherent part of the simulations utility as it prompted the participants with things to say or do. Due in part to its high degree of realism and safe environment, the VP was postulated to help students transition from the early theoretical years of undergraduate education to the more patient focused ones later in the course. As a result of this, the VP section of the workshop could perhaps be moved forward to the second year of the course, prior to the more patient focused learning and exposure to SPs; if implemented, this would require further evaluation with the potential to move the session back to third year if required.

Another area which was highlighted to require further investigation is the debrief given after using the simulation. It appears from the evaluation that for future year groups receiving this workshop, more time should be built in for this but the exact composition remains elusive. There is also the potential that completing a reflective piece after the simulation may be of use to the students. This too would require evaluation.

7. Evaluation of a Virtual Patient Workshop with Medical Undergraduates

7.1. Method

The setting for the evaluation of the VP with medical students was the annual conference of the Manchester Medical Research Student Society (MMRSSoc). A workshop was delivered at the conference with the following educational aims;

- Provide a basic overview of clinical decision-making and how these decisions are made
- Introduce bounded rationality and its links to evidence based medicine
- Describe how technological innovation has impacted upon clinical decision-making and the ability to gather and process information
- Introduce shared decision-making and outline the rationale for its use and promotion
- Practice shared decision-making within a simulated consultation

The conference was aimed at medical undergraduates of all years from medical schools within the UK. The workshop was 45 minutes in length delivered by Simon Jacklin (SJ) and Prof Stephen Chapman (SC). SC gave a 10-minute introduction to the topic, focusing on the first three aims of the workshop. SJ then spoke for about 5-minutes, focusing on the fourth aim. After this, the delegates were invited to take part in the virtual patient evaluation; the information sheets were distributed at the start of the session. Those wishing to take part completed an electronic consent form and pre-questionnaire prior to using the VP for around 20 minutes, following which they completed a post-questionnaire. The students completed the questionnaires and used the VP on tablets. Half of the students had brought their own tablet devices with them, the other half borrowed one provided by the educational resources. Both SJ and SC were on hand to answer any questions while the students were using the VP. The delegates who did not wish to take part did not complete consent forms or

questionnaires but did use the VP. There was a brief summary at the end of the session and time allotted for questions.

A week after the event, those who had completed both pre- and post-questionnaires were emailed to invite them to a telephone interview. An information sheet was attached to the email and a link to a consent form. To consent to an interview, the participants had to complete the online form. All interviews were conducted by SJ and recorded, following which they were transcribed verbatim by a transcription service. The initial plan had been to sample purposively for the interviews, deliberately selecting participants whose questionnaire responses diverged from the norm, featuring unusual or different views. Convenience sampling was eventually used as only 7 participants consented to an interview. Each participant received a £10 Amazon voucher for taking part in an interview; they were informed that they would receive this prior to their consent. This process is summarised in Figure 33.

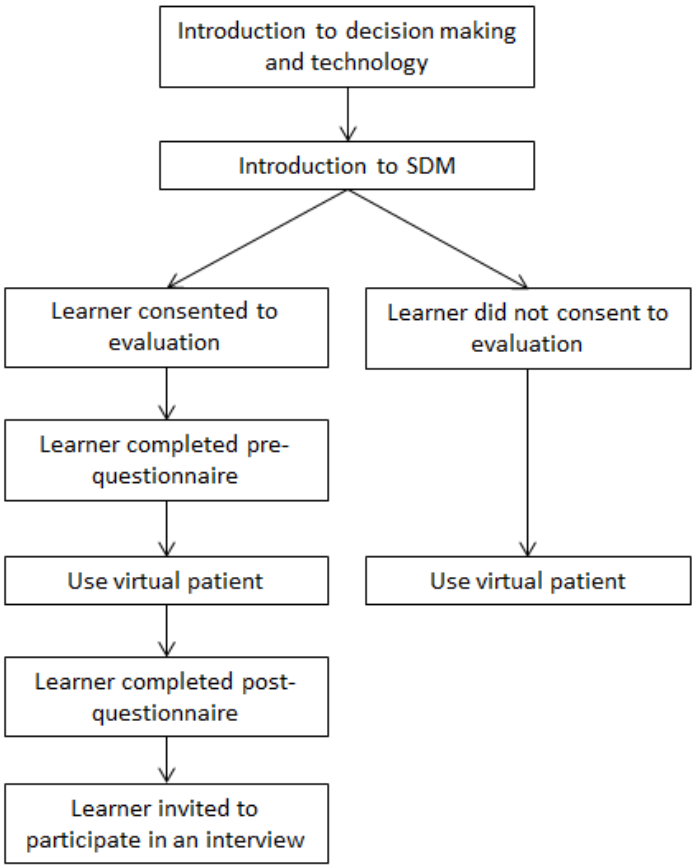

Figure 33 - Evaluation pathway (medical undergraduates)

The transcriptions were checked for both accuracy and data familiarisation. The transcripts were analysed using data-driven thematic analysis (TA) following the process described by Braun and Clarke (2006). SJ completed all coding and theme construction; these codes and themes were discussed within the supervisory team to encourage reflexivity. The quantitative and qualitative data from the questionnaires were analysed using descriptive statistics and thematic analysis respectively; one question (consultation priorities) was analysed using a Wilcoxon rank test to assess whether any change in the participants rankings was statistically significant. As well as being results in themselves, the qualitative data from the questionnaires were used mainly to highlight areas and ideas for future discussion in the interviews.

7.2. Results

There were a total of 24 students in the workshop. Of these, 22 (92%) participated, completing both pre- and post-questionnaires. Basic demographic data is included in appendix 20.

7.2.1. Pre-Questionnaire

Question 1: How would you define a 'digital virtual patient'?

Table 32 - Participant definitions of a VP (medical undergraduates)

Training	n=13	Thirteen participants suggested that a VP was specifically for training purposes.
	"A simulated patient online, that provides a standardised presenting complaint for training purposes for medical students" [Participants 16]	
Real patient	n=12	Over half of the participants defined a VP in relation to a real patient.
	"A patient not physically real but with imaginary symptoms a real patient would have." [Participant 15]	
Simulated patient	n=7	Some participants defined a VP in relation to a simulated patient.
	"A simulated patient that you can interact with online, who is not human." [Participant 19]	

Question 2: How useful do you think virtual patient technology could be in the development of your professional knowledge and skills?

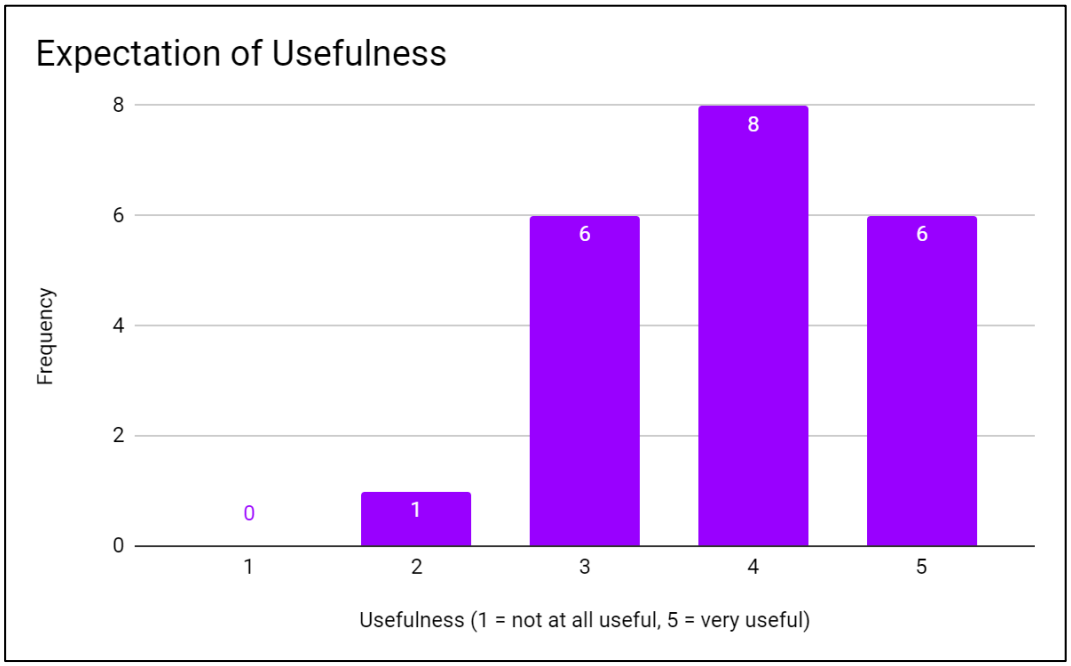

Figure 34 – Expectation of VP usefulness (medical undergraduates)

One student did not complete this question due to an error in the questionnaire.

Question 3: Which statement would you say best suits yourself

Table 33 – Participant self-assigned adopter class (medical undergraduates)

Statement	Self-Assigned Adopter Class	Frequency
I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market	Innovator	1
I enjoy new technology but am rarely the first to invest in a new product	Early Adopter	13
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the	Early Majority	7

product		
I have no desire for new technology, I tend to only adopt it after the majority of other people	Late Majority	1
I dislike change in technology and will only use a product when it has become mainstream	Laggards	0

Question 4: Which of the following methods have you used or experienced in your education? Tick all that apply

Table 34 – Previous education of participants (medical undergraduates)

Method	Frequency
Simulated patients (actors)	22
Watching videoed consultations (not your own)	19
Watching back your own consultations	14
Role playing with other students	22
Digital virtual patient	1

Question 5: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful);

Table 35 – Expectation of VP usefulness; subject specific (medical undergraduates)

	1	2	3	4	5
Healthcare education	0	1	3	10	8
Clinical decision making	0	1	6	8	7
Consultation skills	0	2	5	8	7
Patient centered care	0	3	4	12	3

Question 6a: Which of the following do you currently use to aid your professional learning/development and how many times per month do you use them?

Table 36 – Current use of educational technology (medical undergraduates)

	Apps	Webinars (online seminars)	Social media (e.g. Facebook, Twitter, Instagram)	Blogging sites	Online simulation (e.g. second life)	Massive Open Online Courses (MOOCs)
Don't use	6	6	5	16	18	17
1-2 or less	4	12	6	3	2	3
3-5	7	2	8	2	0	0
6-8	3	2	1	0	2	2
9+	2	0	2	1	0	0

Question 6b: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Table 37 – Usage of technology; curricula areas (medical undergraduates)

Curricula Area	Frequency
Basic science (e.g. physiology, chemistry)	19
Clinical decision making	12
Communication skills	4
Ethical issues	5
Other:	0

Question 7: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

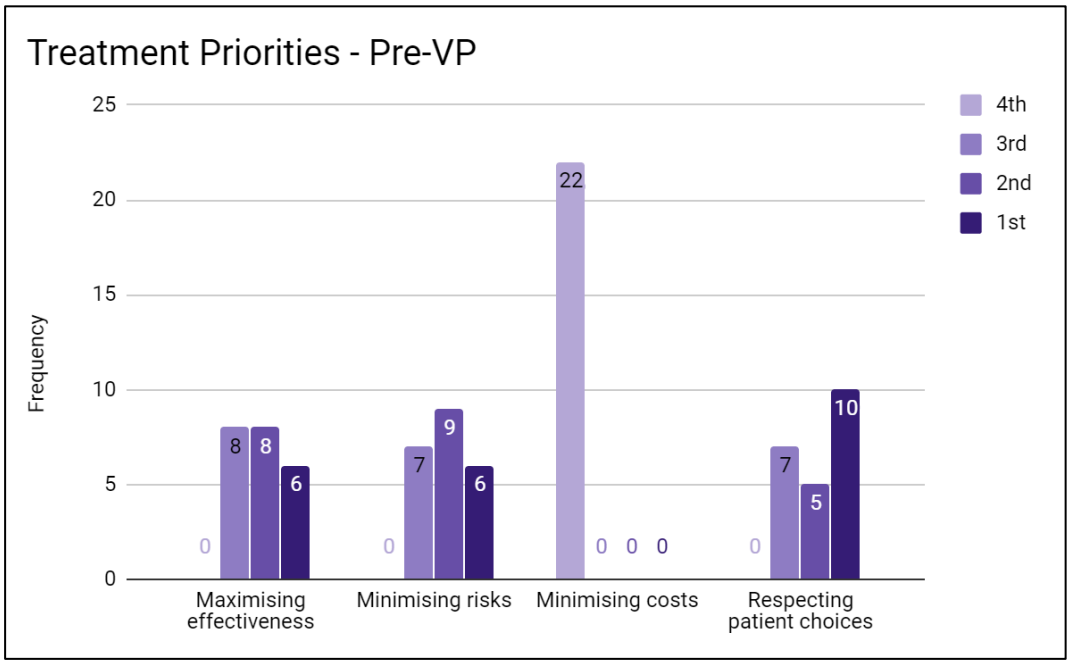

Figure 35 – Treatment priorities pre-VP (medical undergraduates)

7.2.2. Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

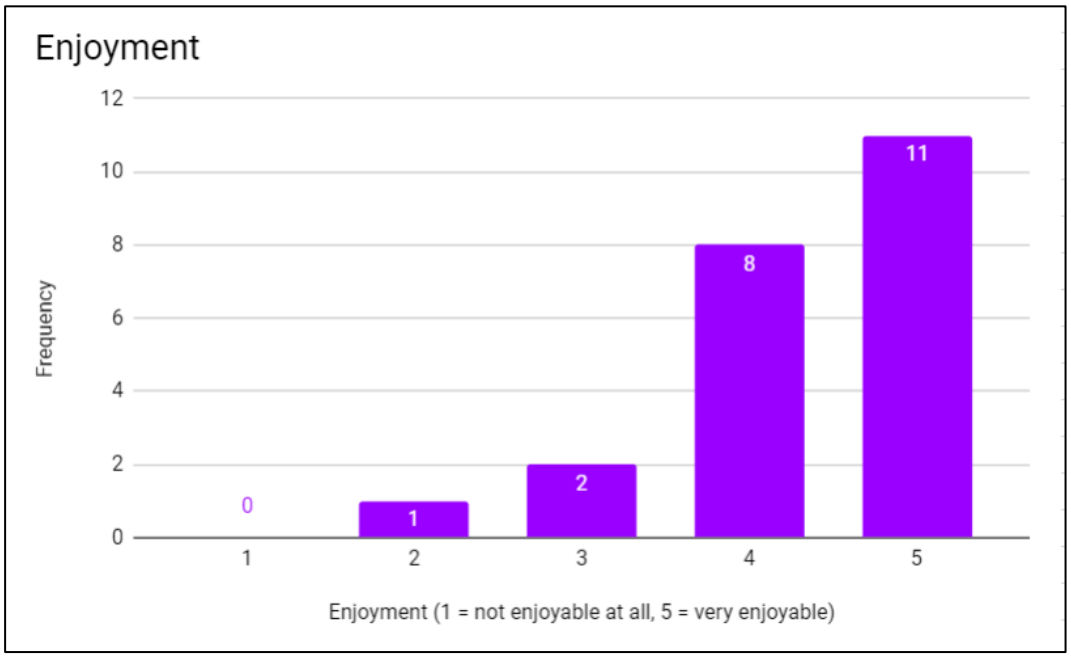

Figure 36 – Enjoyment rating (medical undergraduates)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

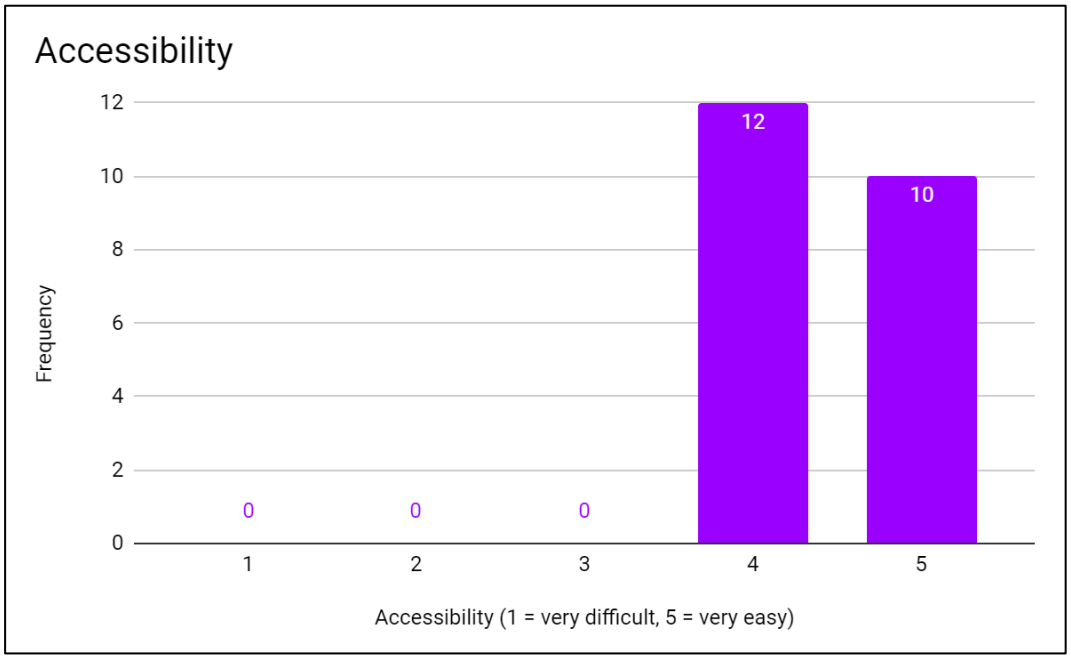

Figure 37 – Accessibility of VP (medical undergraduates)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

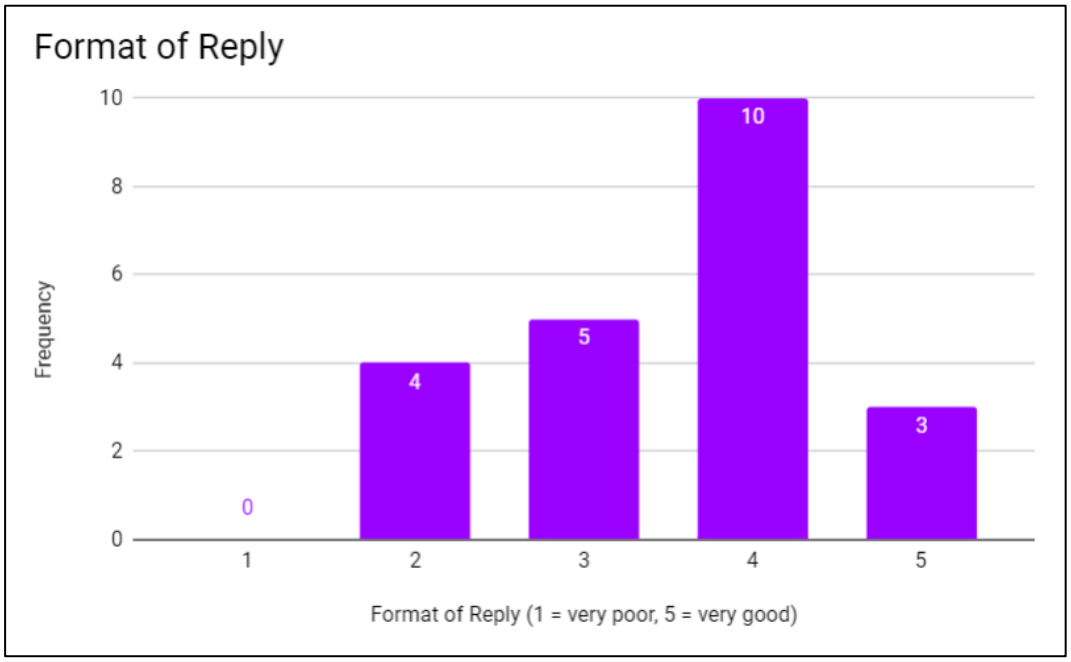

Figure 38 – Format of reply (medical undergraduates)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Table 38 - Comments on the format of reply (medical undergraduates)

Restriction	n=11	The multiple-choice system restricted some of the participants, they could not say whatever they wished.
	"There are many responses you could have so it could be simplifying it a little too much with restricted responses" [Participant 2]	
	n=2	Of the 11 reponses that were coded as restriction, two of the responses reported this idea that the restriction acted like a guide.
	"I wished I could think about what to say myself before I am given the options because the options tell me what I need to choose from." [Participants 12]	

Technical difficulties	n=3	Three participants reported some technical difficulties.
	"It's a bit slow and also sometimes there was only one answer or one that I would not have put" [Participant 20]	
Vocalise	n=1	One participants wanted to speak, rather than type/select a response.
	"Being able to speak myself would be good, but I understand that this would require advanced technology" [Participant 10]	

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Table 39 – Subject specific usefulness of the VP (medical undergraduates)

	1	**2**	**3**	**4**	**5**
Consultation skills	0	3	3	11	5
Clinical decision making	0	5	2	8	7
Patient centered care	0	3	4	9	6
Communication skills	2	2	5	4	9
Managing medical complexity	2	4	5	11	0
Managing polypharmacy	2	4	5	11	0

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

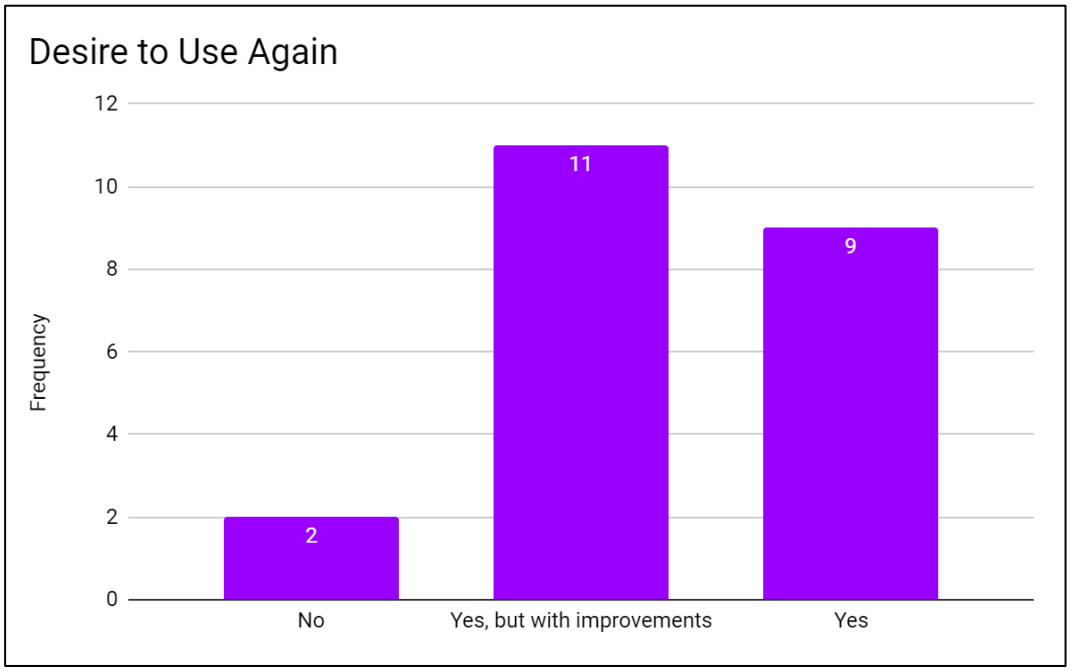

Figure 39 – Desire to use VP again (medical undergraduates)

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Table 40 - Suggested improvements to the VP (medical undergraduates)

Restriction	n=9	Nine participants wanted there to be some sort of resolution to the restriction issue. Two of the nine suggested using a free-text system.
	"More options for answers, with an ability to type your own?" [Participant 5]	
Vocalise	n=2	Two participants wished to vocalise their responses, not just type them.
	"Allow the person using the app to speak, or repeat the word suggestions instead of clicking on choices" [Participant 9]	
Place and purpose	n=1	This participant suggested that the VP may have been more suitable for students earlier in the studies but real people were better later on. They

		seem to suggest that the VP could be applied better to test clinical knowledge; this last point is a little unclear.
	"Maybe in 2nd or 3rd year to make mistakes but I think real people are much better to work with, this is a good way to test clinical knowledge" [Participant 2]	
More constructive feedback	n=1	One participant suggested the feedback was not constructive.
	"It would be helpful to get advice in feedback about how to manage the patient, not just that it went badly" [Participant 3]	

Question 6: At which stage(s) in your professional development do you think this type of programme could be useful, or not? Tick all that apply.

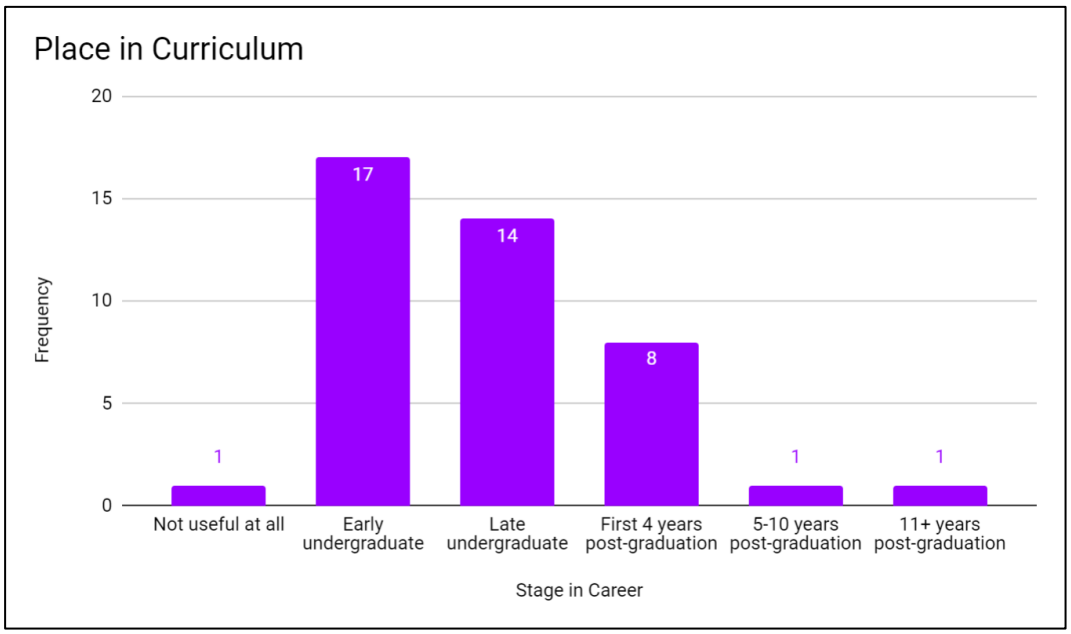

Figure 40 – VPs place in the curriculum (medical undergraduates)

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical scenarios following your use of the virtual patient programme?

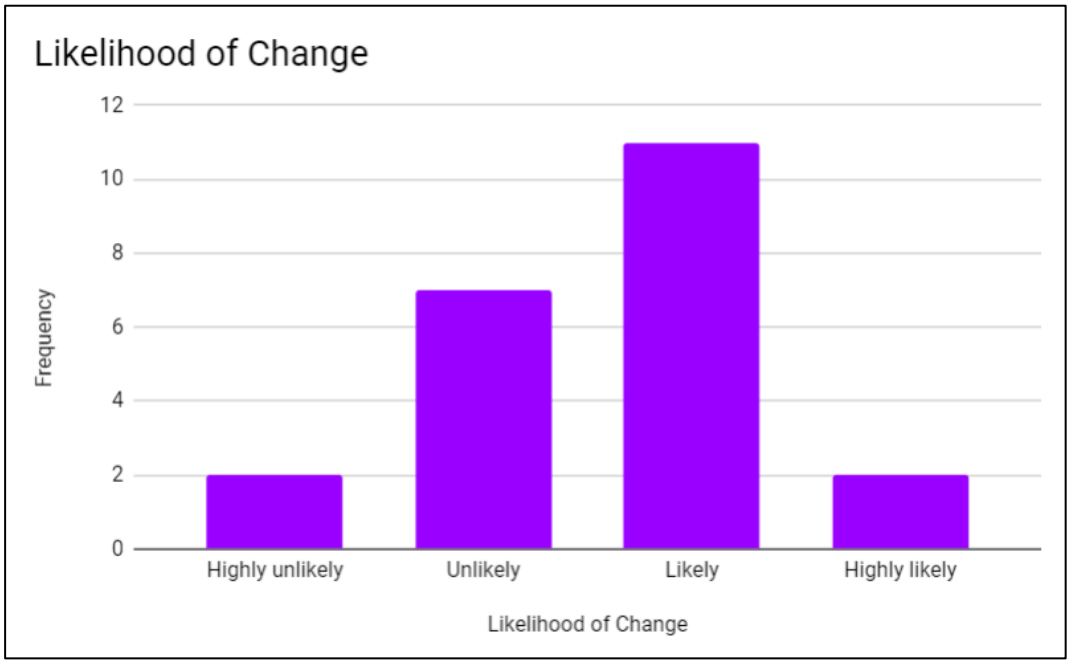

Figure 41 – Likelihood of change in practice (medical undergraduates)

Question 7b: If you think there will be any changes, what do you think these will be?

There were a total of 12 responses to question 7b.

Table 41 - Suggested changes in practice (medical undergraduates)

Patient focus	n=4	Three participants said they focus on the patient and their views more. This particular quote alludes to SDM but the way it ends ("decisions i'm making") seems to not be about SDM.
	"I will hopefully become more receptive patients views and include them in the decisions i'm making." [Participant 5]	
Structure	n=2	The VP was suggested to help structure and organise a consultation.
	"I think it helps organise my consultation" [Participant 3]	
Prompt	n=2	Two participants did not suggest changes to their practice per se but that

		the VP prompted them with options of what they could say at any given point.
	"I would use virtual reality patient scienarios again - it is a great way to see the sort of things we should and shouldn't be saying, with good suggestions to take board" [Participant 10]	
Initiate	n=1	One participant suggested they would focus on how they initiated consultations.
	"Initiating consultations in polite manner (initial greeting, offering seat etc.)." [Participant 13]	
Non-specific	n=5	There were five non-specific suggestions.
	"Makes me think about what I need to ask more" [Participant 12]	

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

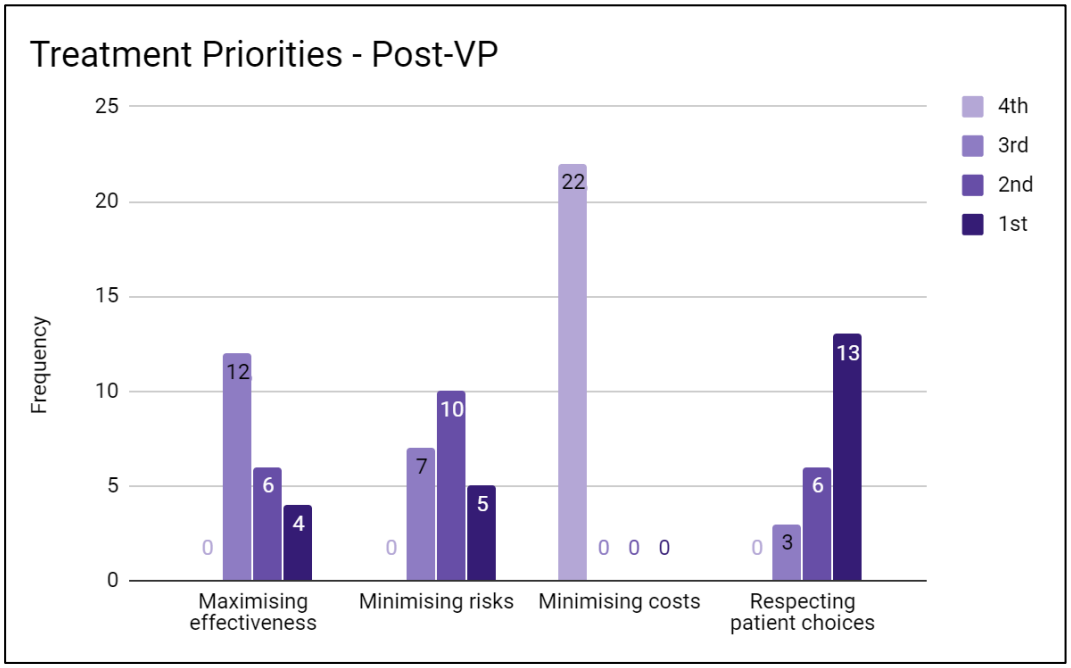

Figure 42 - Treatment priorities post-VP (medical undergraduates)

There was a statistically significant change in the rank position of "Respecting patient choices" when tested with a Wilcoxon rank test (p=0.038). The median rank of 'Respecting patient choices' changed from 2nd to 1st when comparing the pre- and post-questionnaires respectively.

Question 9: How would you rate the format of the feedback given to you at the end of the simulation? (1 = very poor, 5 = very good)

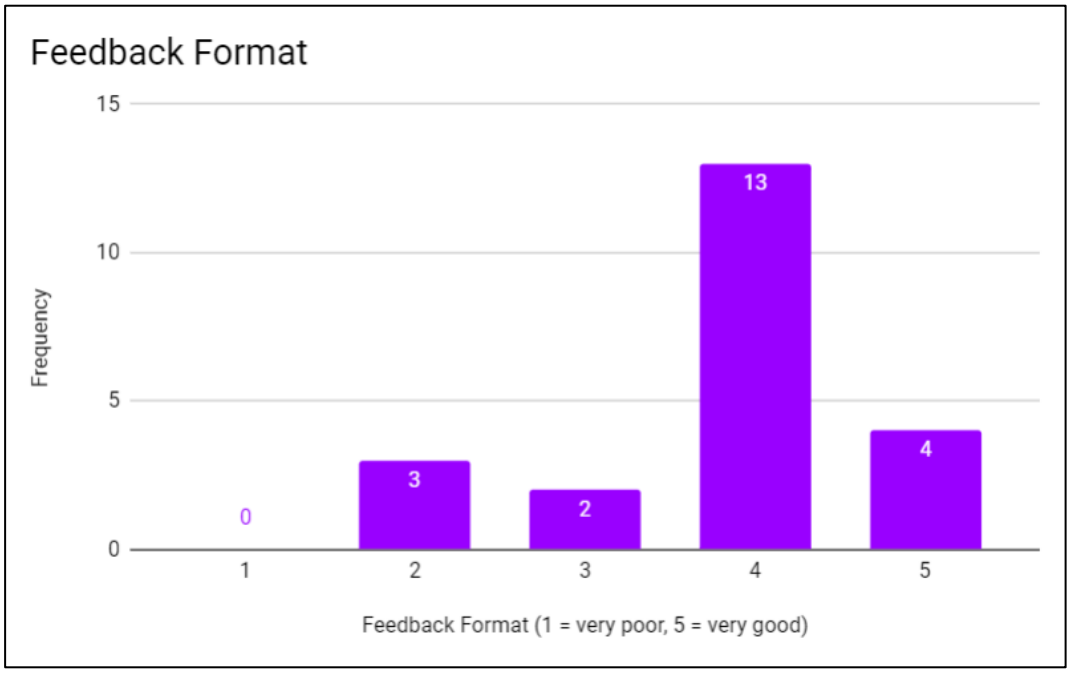

Figure 43 – Format of the VP feedback (medical undergraduates)

Question 10: How much feedback did the virtual patient provide?

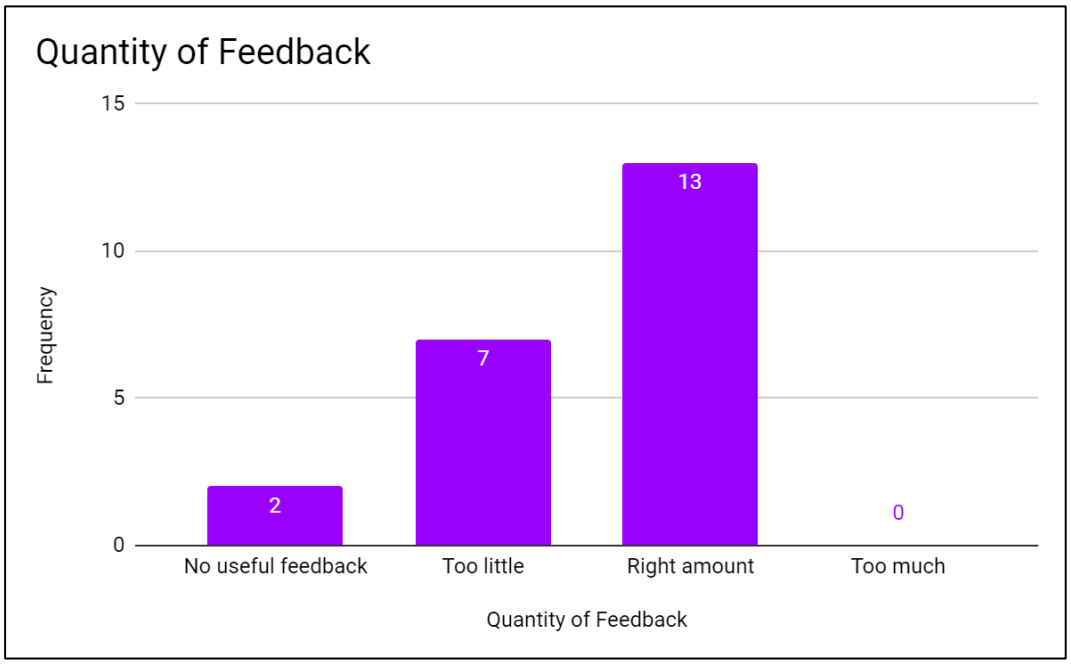

Figure 44 – Quantity of feedback provided by the VP (medical undergraduates)

Question 11: Do you have any comments on the feedback given?

Table 42 - Comments on the feedback from the VP (medical undergraduates)

Positive	n=4	There were general expressions of positivity towards the feedback.
	"Really useful and encouraging" [Participant 10]	
Human element	n=2	Because the feedback could not critique the participants tone or body language, two participants felt that the feedback on their performance was not complete, it missed the human element.
	"Less accurate because what is said is influenced by the persons tone and voice so I think students would benefit much more with direct observation with real patients and supervisors" [Participant 2]	
Contradict	n=2	Two participants felt some of the feedback contradicted itself.
	"Some feedback contradicted itself. Was told I gave the right amount of numbers and too many numbers." [Participant 15]	
Not Constructive	n=1	One participant suggested that while the feedback said what had been done wrong, it did not say how this could be improved.
	"It said what we did wrong but did not provide advice on how it could improve" [Participant 3]	
Immediate	n=1	The feedback from the VP was immediate.
	"Though it was useful to get immediate feedback." [Participant 5]	
Restriction	n=1	One participant felt that they couldn't explore the feedback they got as the multiple-choice system did not allow them to.
	"Expressed feedback that I wasn't able to explore due to limited options" [Participant 16]	
Formulaic	n=1	One participant said that the feedback was formulaic.
	"Feedback was quite formulaic" [Participant 18]	

General comments

Questions 12, 13 and 14 from the post-questionnaire were analysed together and the resultant codes presented in Table 43.

Table 43 - General comments on the VP (medical undergraduates)

Restriction	n=10	As has been noted already, some of the participants felt the VP was quite restrictive.
	"Felt quite artificial. Sometimes the pre-determined answers weren't what I would actually say" [Participant 13]	
Positive	n=7	There were generally positive expressions about the VP.
	"Very enjoyable and look forward to seeing how it develops!" [Participant 5]	
Bridge	n=5	Five participants thought that a VP may be useful early in the curriculcum, perhaps bridging to real patients later on.
	"It would be a shame for this to replace consultation practice with real patients, however this could be good for those who struggle with communication skills in the earlier years of medicine"	
Real Patients	n=4	As was touched on in the quote for "Bridge", some participants felt that real patients were better for practicing communication skills.
	"It feels artificial and doesn't provide the same experience as with a real patient	
Technical issues	n=4	There were some technical issues experienced while using the VP.
	"Slight glitches in my iPad" [Participant 10]	
Reality	n=4	Four participants thought the VP was realistic.
	"Very real situations" [Participant 20]	
Use more	n=3	Three participants wanted to use the VP more.
	"It was really interesting and I hope it will be provided in the future for our	

	learning" [Participant 16]	
Fake	n=2	In contrast to "Reality", some two participants thought the VP was not realisitic.
	"It did not feel so interactive, and I almost felt removed from the situation and it felt more like a game rather than a clinical situation" [Participant 9]	
Safe	n=2	The VP was noted as a way to practice a consultation without harming a real patient.
	"Liked having the opportunity to try a consultation and practice communication skills without risk of things going wrong and actually having an impact on a real patient's life" [Participant 13]	
Options	n=2	The multiple-choice interaction presented the participants with a range of options; two participants suggested this helped them choose what to say.
	"The options show how you can say something in the best way" [Participant 4]	
Interactive	n=2	Neither participant who mentioned interactivity expanded upon this response.
	"Interactive learning"	
Ease & Convenience	n=2 n=1	Two participants suggested that the VP was ease to access and one of those also suggested it was convenient.
	"Easy to access can do it from anywhere easy to organise" [Participant 1]	
	n=1	Convenience was also compared to an SP.
	"Being able to practice in the same way as the simulator patient actor but at my own convenience, free time and anywhere" [Participant 12]	
Positive feedback	n=2	Two participants responded with generally positive feedback. This quote was taken from the 'Like' section.
	"The feedback given from the virtual patient" [Participant 21]	

Negative	n=1	This participants response seems to be one of general negativity.
	"I don't belive the scope is that big for this technology." [Participant 7]	
Vague feedback	n=1	The feedback was suggested to not be specific enough.
	"Need to be able to relate feedback to the points in the consultation. Maybe have selecting the piece of feedback on the summary screen explain why it was good or bad." [Participant 15]	
Animation	n=1	The animations were reported to be of good quality.
	"Good quality animations" [Participant 4]	
Repeatable	n=1	The VP could be used time and time again. One participant related this to an SP (simulated patient).
	"The ability to run through a consultation repeatedly with no SP fatigue" [Participant 15]	
Consequences	n=1	The VP allowed the participant to see how their actions altered the consequences of the situation.
	"The immediacy of how you can see how changing your approach to scenarios would impact upon the scenario" [Participant 18]	
Inclusive	n=1	One participant suggested the VP was both interactive and inclusive but did not expand upon this.
	"Inclusive and interactive" [Participant 10]	

7.2.3. Interview Data

Eight participants consented to an interview. Seven of these completed an interview; one student declined an interview after originally consenting.

The themes constructed from the interview transcript data are as follows;

- Bridge
- Exploring the consultation (explore)
- Personal style and subjectivity (subjectivity)
    - Restriction
    - What type of skills can VPs develop? (skills)
    - The advantage of a workshop
- Familiar feedback

Braun and Clarke (2011) describe themes as being like a patchwork quilt. Themes are separate but can be connected together to tell the story of the data, much like the individual patches of a quilt. Figure 45 shows the map of the themes and how some of them interlink. As the themes interlink and connect, one theme may be raised when discussing another theme. To this end, the terms in brackets after the themes full name are shorthand titles so the full theme name doesn't have to be written each time.

Each theme shall now be explained in turn, what it represents, and the data that contributed to its formation. All supporting quotes are used verbatim. Any clarifications or author additions are included in round brackets. The interview participants were all assigned identifiers; 000 referred to their number, unique for each participant. MU corresponds to their course of study, **m**edicine and the fact they were **u**ndergraduates. A full dashed line is used to separate different participants whereas three stops (…) are used to highlight a gap in the transcript of the same participant.

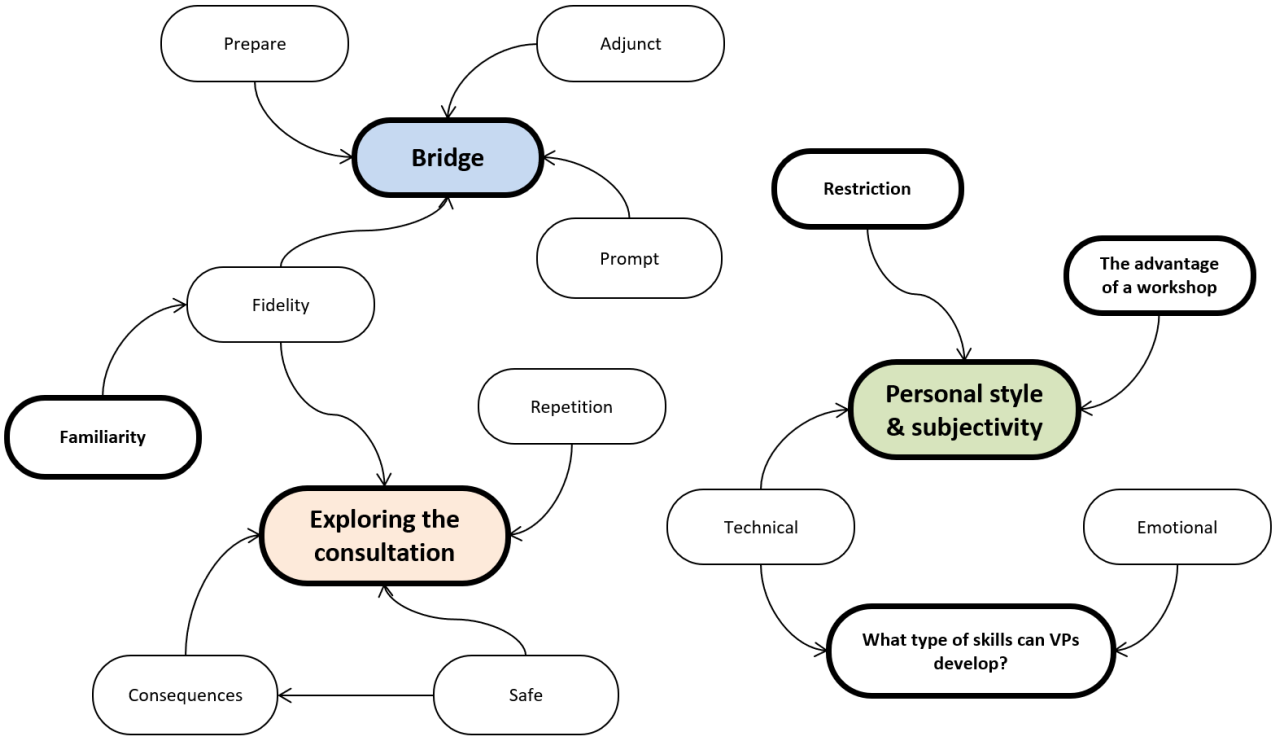

Figure 45 - Thematic map for the interview data (medical undergraduates)

7.2.3.1. Bridge

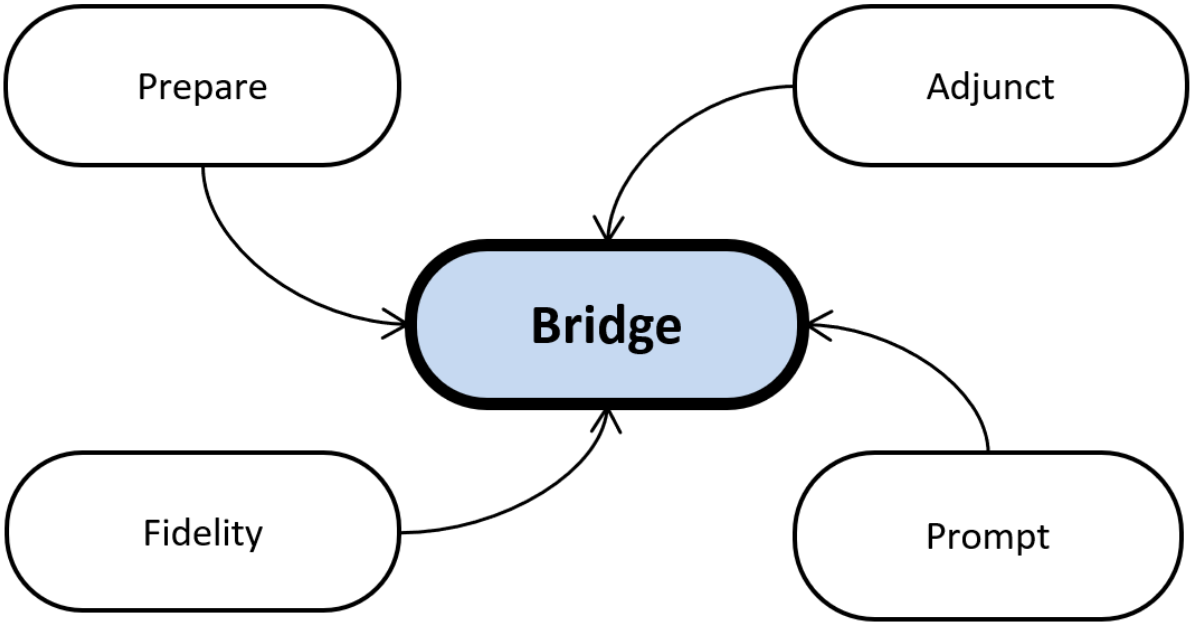

Figure 46 - Thematic map "Bridge" (medical undergraduates)

Bridge describes the VP acting as a bridge between different stages of the curriculum, helping the participants cross from one side to the other (Figure 46). This theme was also constructed from the evaluation with pharmacy students (Chapter 6). The participants described the early years of medical school being theoretical and quite abstract, not rooted in the working practices of a doctor. After this they described the patient-orientated, clinical years and the notion that transitioning between the two was difficult.

> **002MU**: I think for building general communication skills, yes [yeah]. I think it would be more useful, in some ways before you're going into clinical years, but also in that sort of first semester or even first year when you're in it, just sort of build those skills up.
>
> …
>
> **002MU**: I don't think so. I think as it stands at the moment I would definitely say it's more suited to the sort of mid-years of medical school [yeah]. Especially like having spoken to

people about it afterwards, I feel like the people who were in third year were much more like 'yeah, that was really helpful' than people who were in fifth year who said 'oh, I didn't like that it sort of told me what to say'

003MU: I think that's where it has a lot of value because I know that there are quite a lot of people in Medical School who start off Medical School by doing quite scientifical things and then when it gets to their first patient contact, it can be very daunting and it can be quite frightening because you don't really know what to say. People can teach you how to take a history but if you're sat in front of someone and you have to chat to them for bit, then it can feel quite awkward to start off with. I think if you had some kind of virtual introduction to all of this, it can make things a bit easier when you actually get into it.

004MU: I think you'd pick up a natural flow of how these things go, rather than just having to navigate it as it comes at you because you don't really see that much in the first and second year because the focus is obviously more on understanding your basic anatomy and physiology and stuff. It would slightly blur that transition which is probably a good thing, so that it doesn't feel as big when you jump into clinical stuff.

As well as *bridge* relating to the undergraduate curriculum, participants also suggested that the VP could bridge from the undergraduate years as a whole to real practice as a professional. The participant here seems to acknowledge the limitations of the technology ("even if it's simulated") but is perhaps suggesting that shadowing others as a student is a little abstract and is removed from the reality of conducting a consultation themselves.

004MU: As students, you don't really get that opportunity to be involved in the decision making. You might observe it. You might observe a GP doing it or you might observe a

consultant doing it but it's very unlikely that any actual clinician is going to let you be that person that guides the decision making. It's probably only when you get to Registrar level and stuff that you're really taking a hold of that. I think it's good to get people involved in that actively, even if it's simulated rather than sort of passively thinking, 'I'm just going to watch someone else do it'. [yeah] I think that's good because, as I say, it's very easy to talk about in abstract but the 'do' is obviously different. What questions would I ask? How am I actually going to get to someone's beliefs?

The same participant (004MU) also suggested that the multiple-choice system was useful for bridging in the undergraduate curriculum, prior to interaction with real patients. In response to the issue of free-text systems (which the participants did not use) the participant suggests that they may be useful for more experienced learners; the multiple-choice system was thought to be useful for bridging from theory to practice as an undergraduate, while the free-text system was thought to be useful for bridging from supervised practice as an undergraduate to unsupervised practice as a registrar.

SJ: It tries to match what you want to say to a pre-programmed question. Obviously, you didn't experience that but what do you think might be the differences between those two? Do you think one would be better?

004MU: I think if that one (free-text) worked well, it would be good but obviously, it's dependent on how well those autocorrect things can work out what you want. I suppose, thinking a bit more deeply as well, you are kind of changing the dynamics of things between choosing, thinking for yourself what you'd want to say versus which one of these statements do I agree with the most? Which one of these things am I most likely to say next versus you completely doing it off the cuff? I think maybe the pre-selected ones like I did probably suits students earlier in their development where maybe they've not had enough experience of seeing other people do consultations yet to know what they'd say. Maybe if they've got a

choice of three, then that helps steer them through the process; whereas, I'd say, as you move towards the end of Medical School or even postgraduate, you probably should be able to think for yourself by that stage a bit more and so I think that programme (free-text) would probably be more suited to that.

Similar thoughts were echoed by another participant.

SJ: Do you think that free text style would be more useful?

007MU: The ones that you showed me, I think they'd be really appropriate for early on in clinical studies. So, for assessing an early third year, you get used to the idea that there are different ways that you can do a consultation and it can lead to different outcomes. But as you're wading through clinical, I'm in fourth year now, I think maybe having that free text would be quite good.

SJ: Is that because it makes you think for yourself?

007MU: Yes, it just means that you are having to actually think what you've got to say because sometimes that's the hardest bit in a consultation, phrasing things. That's why it's quite nice to practice. But I appreciate that would be a bit more difficult to create.

The rationale for these views seems to be that less experienced learners may need the multiple-choice options while those more experienced may be hindered by them. Perhaps this is because the multiple-choice system was suggested to be useful in prompting the participants. The three choices displayed at each juncture suggested things to the participants.

002MU: I thought it was really good. I thought it would give someone who hasn't had much time in clinical years really useful things to say and ideas of what direction to take the conversation [yeah]. So I really liked it [yeah] and was my initial idea.

…

002MU: I definitely think that would be useful, like getting those prompts of what's good to say [yeah] when you're starting clinical years, I think would be, personally I would've found that really helpful because that's something that takes a while to pick up and you sort of learn, I think you learn more from seeing other people do it and hearing other people do it. So if virtual patient can be those prompts for you and you can learn from that, then I think that would be really helpful.

005MU: I think I thought some of the stuff was a good prompt as to like, you know, I should be saying this or I should have spoken about this.

SJ: Did the multiple choices, did they at any point suggest something, in a good way, that you'd not thought of before?

007MU: I think all of them were things that I'd thought about. There was one specifically…it was the one, erm, one where it was asking if there was anything else.

SJ: Anything else versus something else?

007MU: Yes. That is something I'd never consider as a difference. That when I was made to think about it, I did think that actually that could create a different response in a patient it's what I actually, what I quite liked about the thing itself was that it made you think exactly what you were saying and how that changed in a consultation, so that was good.

The section of dialogue from participant 007MU relates to the section in the simulation where two options are very similar, the only difference being a single word; either 'anything' or 'something'. It seems that having both of those options presented prompted the participant to think about the difference between the two. This seems to describe a degree of active engagement with the VP, actively thinking about the selection of options.

Supporting the idea of *bridge* is *prepare*; the VP was reported to be useful in preparing the participants for the next stage in their education or career. Both *bridge* and *prepare* are very closely linked and describe similar events, hence why *prepare* and *bridge* are not each individual themes but *prepare* makes up part of *bridge*. Participant 001MU touched on the idea of *adjunct*, that the VP would not be the only method of preparing students but is one of many available.

> **001MU**: At least it gives me like an idea of what a real-life situation would be like.
>
> **SJ**: Yes do you think it then helps you prepare for those real life situations?
>
> **001MU**: I think so like part of my curriculum on top of like interacting with patients I think it will help in communication skills.
>
> ---
>
> **003MU**: I thought it was quite a good adjunct to the tools that we use in Medical School, generally speaking.
>
> …
>
> **003MU**: Even if you start the virtual programme adjacent to having patient contact in the same time, it can just make the whole experience a bit easier probably, I think.
>
> ---
>
> **007MU**: You do practice in terms of surgery on different things and they practice in different ways, so it could just be another way you practice your skills.

The final idea supporting *bridge* is *fidelity*; the notion that the VP felt like very realistic. The VP seemed to be a hybrid, not the real scenario (i.e. a consultation) but also not abstract theory, somewhere between the two. This notion of being between two things, abstract, theoretical learning and real world practice is the essence of *bridge*.

003MU: There are a lot of kind of similar things, like GMC in Action and things like that when they have a simulated patient. It's quite similar but I would say it's, erm, it's a bit simpler than the one that you guys did but I think it would be very interesting to use that kind of software, in terms of dealing with ethical situations. It's a bit like the GMC in Action but basically, pushed further a little bit with GP consultation; the patient comes in and is actually there, moving and talking rather than, because It's very fixed for the GMC in Action. They don't really move. That would be interesting.

(GMC in action is a semi-interactive, online learning tool but with no patient animation or video)

005MU: I think one of the reasons was I think the animations were, I think, well done for the scenarios that we had. So, I think it really just helps sort of make it more realistic because you can sort of see the patient responding a bit. I mean, it didn't really show that many expressions but it's just like how when you spoke the lips sort of uttered the words you were saying and it just made it a bit more realistic, I thought that was good.

…

SJ: Yeah. You mentioned the animation; do you think the quality of the animation made the tool more useful for your education?

005MU: Yeah, I think emotion is what we, is the variable and if the animation quality is good then you can really imagine yourself being in the consultation.

SJ: Yeah, it sort of makes it more immersive?

005MU: Yeah.

One participant used the analogy of a television program, something which is not real, but after a while one can be 'sucked into it' and it becomes very immersive and tangible.

> **SJ**: Did it sort of feel like a real scenario? Or did it feel quite fabricated?
>
> **002MU**: At first I was quite like not sure what to think of it because I didn't really know how it was going to play out; I didn't know how it was going to work. But, after like a few questions were answered I just like sort of straight away got used to it. And you sort of, it's like when you're watching a TV series at first you don't feel like you're involved in it, but then you kind of just get sucked into it and you feel like you're in it [yeah]. I kind of compare it to that, like after a couple of minutes you really just felt like you were involved in it [yeah], which I really liked.

The realism seemed to exceed the expectations of the interview participants.

> **SJ**: Did it feel fabricated or fake?
>
> **004MU**: No, I don't think it did actually which I'm almost a little bit surprised at [laughter].

Participant 007MU also found the VP surprisingly realistic. They also go on to say that the VP was a slightly more basic version of an SP interaction. Their statement after the pause though acknowledges that SPs themselves are scripted.

> **007MU**: It felt more real than I thought it was going to. I definitely found it easy to engage with the scenario, possibly because we've had to do simulated patients before. It felt like that but just a slightly more basic version compared to doing it with a simulated actor. [pause] But because they have scripts it is very simulated.

7.2.3.2. Explore

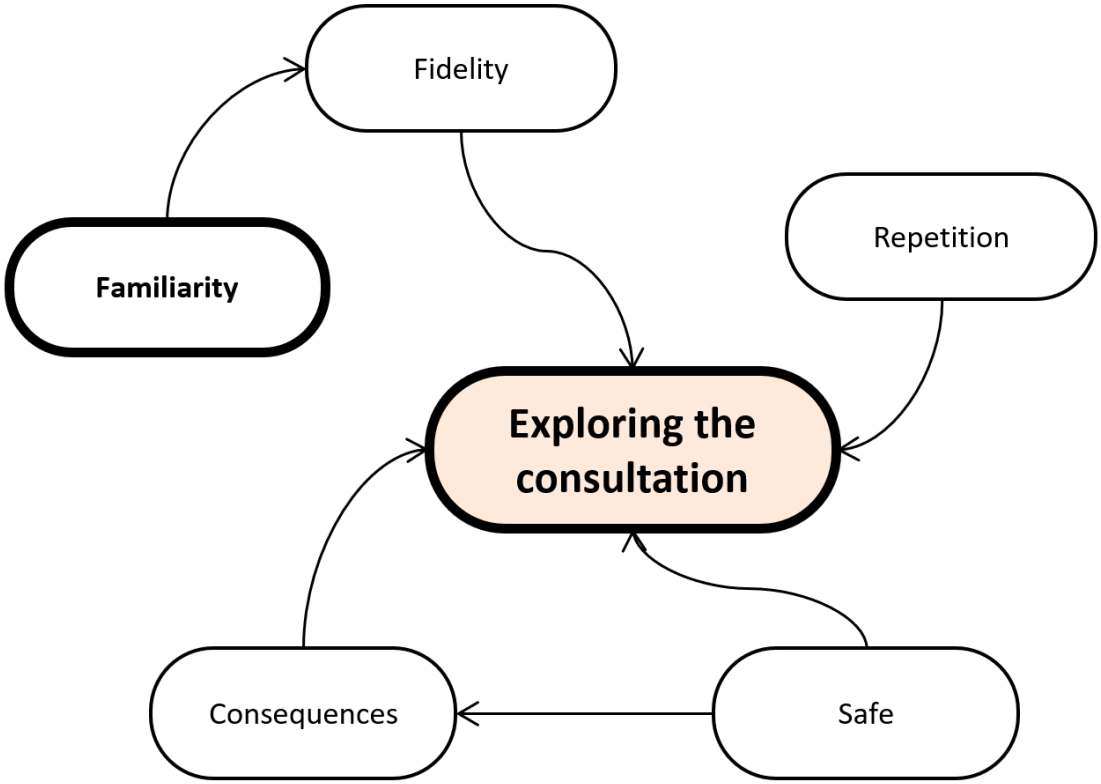

Figure 47 - Thematic map "Exploring the consultation" (medical undergraduates)

Explore is the theme from the data suggesting the VP allowed the participants to explore the consultation, taking different routes through it (Figure 47). These routes were not necessarily to improve each time but to try things out; the theme could have been named 'experimenting'. It was acknowledged that one cannot perhaps do this with other methods of practice, such as simulated patients.

> **001MU**: I did it because I was interested to know what the other outcomes were and how the doctor would like get to the other outcome like what kind of answer would bring me to arrive other outcome.
>
> **SJ**: Yeah so you could explore [yeah] different ways of doing it I suppose?

001MU: Yeah.

007MU: I think what I quite like about the virtual one is that you can take it in different directions and almost test it out. Sometimes it's harder to do that with a simulated patient just because you don't get the opportunity to do it again. Often, when you do a simulated session is you have a go.

SJ: Is it exploring different routes through kind of thing?

007MU: Yes. And I think that can be applied then, into your communication skills.

003MU: It's probably good in terms of it makes you more likely to explore different ways of managing a situation. Some might be wrong; some might be right but even if you take the wrong route, nothing serious is going to happen at the end of the day. It's not like you've committed an offence or anything like that. I think it's quite good in terms of that.

007MU: Yes. That is something I'd never consider as a difference. That when I was made to think about it, I did think that actually that could create a different response in a patient it's what I actually, what I quite liked about the thing itself was that it made you think exactly what you were saying and how that changed in a consultation, so that was good.

The afore mentioned fidelity, an important part of the theme *bridge*, was also relevant to seeing the consequences of the participants actions. Due to the high level of realism, the patient's reaction to what the participant said were communicated.

SJ: Was the, seeing the patient's response to what you said, was that quite helpful?

004MU: Yeah, it was the more delicate, non-verbal things, I suppose, that probably helped as well, like a little pause here or there or a bit of hesitation actually. I think, quite often, conveyed a lot more of what the simulated patient was thinking, rather than just what they were saying. I remember a few times that the patient hesitated and you think, 'Maybe they're not quite sure about something'. I think that was quite important and that was quite well done, actually, as well. I suppose it's even just picking up on those things is quite important to recognise. [yeah] That can tell you so much. It might not tell you what someone's unsure about but it will tell you that they are unsure, maybe.

A key factor for the VP is that the consequences of "errors" did not have real world ramifications; it is possible to give inappropriate responses to the VP and nobody is harmed. This point is touched on by 003MU above and developed further here.

003MU: I think what was good was the fact that because it's virtual, you're not scared to say something because you know that at the end of the day, even if they do react badly, it's just virtual.

SJ: How useful did you think it was for teaching you about patient interactions?

004MU: Pretty useful I think because it gives you a little bit of leeway to maybe make mistakes; whereas, you can't do that in real practice. You can't ask an actual real patient, 'Can I just go back to this bit earlier on please? Just forget what I said'. That was pretty interesting. I guess it's good for that.

…

004MU: … I think it acts as a safety net and you think, 'Oh okay, actually, this is a Virtual Patient. You can practise it a bit more'…

While participants suggested it was useful to see the consequences of the actions, they also suggested that repetition was important to exploring the consultation. Trying out different routes requires one to use the simulation a few times to sample alternate pathways. It was suggested that this is not really feasible with simulated patients (actors), but the VP allowed the participants to start over and trying again.

> **003MU**: I think if you learn from your mistakes and do it again and that's what it's good for as well because with a simulated patient, you can stop and start. When we have the Simulated Patient Workshops, if you're stuck or if you don't know where to go next, you can always stop and it's quite a safe space but you can never really just take the whole thing and start all over again because there's a schedule that you have to go with. You only have a certain amount of time. You can only do one scenario because there are loads of people that need to go through. At least with something like that, it kind of releases the tension because you can just do it over and over again. You don't have that extra time management problem.

Explore could well be part of *bridge*; the way the VP can perhaps act as a *bridge* is that it allows the learner to explore the consultation. *Explore* is still designated as a separate theme. This is because that while this evidence is not apparent from this research, exploring the consultation could be useful at multiple stages of one's education and development whereas *bridge* is confined to a particular place(s).

7.2.3.3. Personal Style and Subjectivity

This theme draws on a central concept expressed in different ways across the interview data (Figure 48). The crux of the theme is the suggestion that a consultation is conducted according to one's personal style. This does not mean that one style is better than another but that the quality of a consultation is subjective with a variety of different ways to achieve a good outcome. This is

represented in the data by three sub-themes; *restriction*, *workshop* and *skills*. Each of these shall now be described.

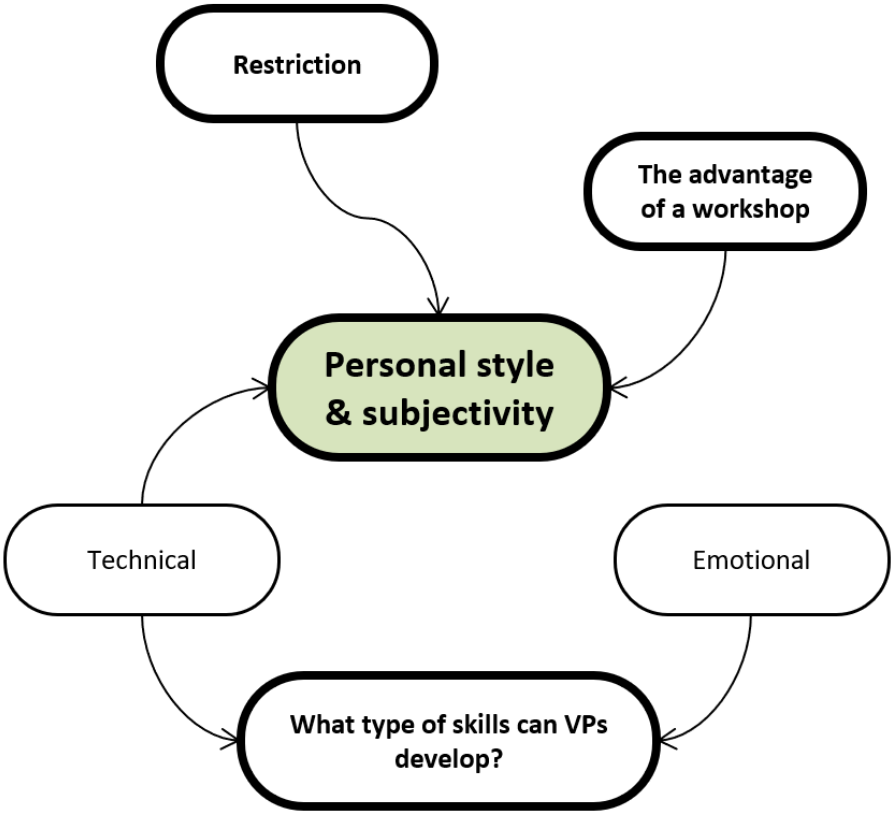

Figure 48 - Thematic map for "Personal style and subjectivity" (medical undergraduates)

1. Restriction

A multiple-choice VP only allows the user to select from pre-defined responses. *Restriction* describes the feeling from the participants that this system of interaction restricted them. This restriction could relate to the options presented each time being too similar or not what the participant wanted to say but also being presented in an order that was different to the participant's preference.

> **003MU**: It's just I felt like the options weren't always appropriate. It's not that they weren't appropriate; I just thought that they were a bit too similar to each other. I think if the options were quite different, then I think it's fine to do it that way.

004MU: I guess the obvious thing was that you are limited by what you can say. You have to choose the answers which the computer gives.

005MU: I think I didn't find them restrictive in the sense that I would chose something else apart from the three options, it's just that the order of, you know, the consultation, like the order in which the consultation was done, there was no flexibility to it [OK yeah]. So, you'd go from a certain topic first and then you had to move onto another topic and then you'd get the final topic. But their own style might be different, they might have the consultation in a different order [yeah, yes] than you could.

Related to this is the viewpoint that all of the participants had different consultation styles. Theses styles were perhaps not wrong but subjective and not reflected in the design of the VP.

006MU: Erm, obviously everyone has their own flow and way of doing consultations [mmm] erm and the algorithm just gave three options, it was really difficult to choose basically, it could be more flexible.

SJ: It could be more natural sort of thing?

006MU: Yeah.

007MU: I think it was the phrasing. I don't think I ever disagreed. Obviously, there were some where I was thinking, 'Well I would never say that?' Because I knew that it wasn't what I wanted because I wouldn't get the right response from the patient. But I think it was just the phrasing for me. Even like the first one, about how you would open consultation, I would definitely open it differently [yes]. But it's all down to personal preference and it varies depending on who I'm speaking to.

One participant suggested that restriction, while perhaps not ideal, was not so inflexible as to render the VP unusable. One had to get used to using somebody else's language and focus on the message being conveyed as appose to the exact words used.

> **004MU**: Everyone has got their own way of phrasing things or the way that they like to do certain things in a consultation, so I suppose but, just by definition, you have to choose what's been selected for you which might not be exactly what you'd do but you can only choose your best match. Maybe with some phrasings, I thought, 'I don't know if I'd quite say it like that' but that's not to necessarily say that I'm right and it's wrong or the other way round [yeah]. I think you just get used to your own vocabulary really which is a bit weird to use someone else's maybe but that is just how it is….
>
> **SJ**: That's quite interesting. You were saying that, it may be that the option you selected was the thing you wanted to do but maybe phrased in a slightly different way?
>
> **004MU**: Yeah, I think so. In fact, when we prepare for exams, you see other people rehearsing and everyone has got their own way of saying things. You're always conveying the same information but you just get used to your own way of saying things and then, when you're trying to visualise yourself in that clinical scenario of the Virtual Patient, that's why it sort of feels a little bit disconnected to then use someone else's. As I say, you're still trying to think, 'What would I want to convey, even if it's not how I'd convey it?'

This participant (004MU) also seemed to suggest that a personal style comes about after a few years of studying or experience.

> **004MU**: I mean I'm in my fourth year of Medicine now and you kind of realise that everyone has their own ways of doing things and that's not necessarily to say that anything is right or wrong.

002MU, a final year student, seemed to echo this sentiment, that earlier year students may not have these established styles and thus would not find the VP restrictive.

> **SJ**: Yeah, did you, because obviously you've got quite a lot of these skills perhaps with communication and consultation skills, did you find it restrictive at all with the multiple choice system?
>
> **002MU**: In a way, yes. But I think that's because I'm like going into my final year. For a third year I don't think I would've found it restrictive, I think I would've found it useful [yes]. To get the prompts.

These statements, about the restriction perhaps being less of an issue earlier in one's education, link to *bridge*.

2. <u>The advantage of a workshop</u>

The VP can be used by a learner in isolation or as part of an educational session, such as a workshop; for this study, the VP was used as part of a workshop. It seemed that the participants felt the VP could be used in isolation, for independent study, but that using it as part of a workshop provided additional benefits. The workshop setting seemed to have been advantageous in the first instance as the initial lecture set the scene for the VP.

> **003MU**: Yeah, that's what we were discussed at the end. Obviously, it was very interesting that you guys were there during the animation at the beginning and being able to explain to us how to use it, why it's important and give us some facts and background. All of that was very important but I feel like purely in terms of answering the questionnaires before, after and during the actual scenario, I think it would have been possible to do it at home, although we wouldn't have had all the background which was important. It's not ideal but it is something that I think is doable.

It wasn't just the instruction element prior to using the VP that the participants found useful but also the time afterwards. The time afterwards was useful for feedback and discussing the simulation.

> **004MU**: I'm not sure how much I would use it completely on my own. [yeah] I think to really reinforce the learning from it, I think it is good in a workshop, particularly in a Communication Skills workshop which we used to have, again, a lot in first and second year. Everyone could have ten minutes to do it and then you could actually have a real conversation with your peers and with the staff and say, 'What do we think about that? How did that go for you?' Use the feedback from the programme but also discuss it amongst each other about why you did it the way you did or why something was good or bad. I think that would cement the experience and what you take away from it, rather than just having it as a play-around at home and thinking, 'I did a bit better that time. Great. I'm going to turn it off now'. People might but I just can't really imagine myself doing it as much at home.

Participant 004MU goes on to discuss how the feedback for the VP was quite subjective. Their response seems to suggest that there were a lot of unanswered questions after receiving their feedback; while the feedback may have been a good way to start the feedback process, alone it may have been insufficient, leaving the participant with questions to which they wanted answers, or at least a discussion.

> **004MU**: I was trying to think how to improve it. That's another authenticity thing because those feedbacks are quite largely subjective, in terms of what each individual person thinks is good and bad because a different thing that a patient would have preferred other things. Again, that is obviously one of the limitations in that you can't account for all those tiny, niche, different opinions of different people. Again, that's one of the trade-offs you make. It was quite good and I tried to improve it for the next time and thought, 'At what point in the consultation did I steer it away from that and made that mistake?' The really interesting one was about the slight rewording of the question; 'Is there anything else?' or 'Is there

something else?' That seemed to throw quite a few people who thought, 'Why does that make any difference?' [laughter].

…

004MU: You could explain, 'This isn't just my opinion about what is better. This is actually backed up by this'. People might pay a bit more attention. I was just confused the first time. I thought, 'Why did that matter?' [laughter] but then when you explained it, I thought, 'Okay, fair enough. Actually, that is interesting'.

Participant 004MU suggested that this requirement for a debrief would depend on the type of skills any VP was trying to develop.

004MU: Yeah, I think you could find that people do this at home and then have all these questions stirring in their head. They won't be able to do anything about it, if they're just sat on your own. With the more concrete stuff, you were saying about the resus algorithm, I think that's fine to do on your own because you know this is the right answer and this is the wrong answer because this is how you manage a resus situation. I don't think many people could debate that. Stuff like shared decision making, where it is more of the art of medicine, I think it's better for people to then be able to discuss with their peers.

These comments can lead to the idea that while using the VP either alone or in a workshop are possibilities, a formal session has some particular advantages over using the VP alone. It seemed that this was, at least in part, because consultations are subjective and devoid of clear right and wrong 'answers'. This was why the workshop setting was important; firstly, to set the context of the learning but more importantly to provide a forum for discussion afterwards; this discussion focused on why the difference options available, which may have seemed subjective, were important.

3. What type of skills can VPs develop?

There are different types of skills taught to medical students; one distinction is technical and emotional; examples of the former include diagnosis and suturing while emotional skills include communication. *Skills* is a theme that described the participants discussing the skills the VP developed and what type of skills the technology could have been applied to. Some participants suggested that the VP made them think or reflect on emotional skills.

> **002MU**: It definitely emphasised the fact that I should let the patient lead the consultation and let the patient take it in the direction that they need [yes, yeah]. I thought that was the overriding think that I learnt from doing it.

As well as more generic patient-centeredness, a participant made comments suggestive of the idea that they had reflected on SDM. It's perhaps fair to comment that the interviewer language here is slightly directive though. Despite this, the participant still gave what appears to be a considered response, not just affirmation.

> **SJ**: Did it make you think about how you might make decisions with patients? How you might involve patients in that at all.
>
> **007MU**: Yes, it definitely did because the situation we were given was the one with the quite elderly gentleman who actually, erm, didn't want to be put on medication. Yes, it did make me think actually that sometimes you don't have to prescribe them medication, it should be down to the patient. You have to obviously weigh-up the advantages and disadvantages, but really the patient is the person that should be choosing, with you.
>
> **SJ**: It's interesting that you say there 'with you' and almost making a partnership with the patient.
>
> **007MU**: Yes. They do try and teach you that in medical school, but it was nice to have it in an exercise because you can easily forget it. We are taught all this information and you just

want to impart it on the patient. 'Oh, this is, oh I know, so therefore we should do x, y and z.' Whereas it should be, 'This is what I know and so what do you think? Where should we go from here?

These participants suggested the VP was useful for the development of their emotional skills and made them think about SDM. Other participants suggested that this technology was perhaps more suitable for purely technical skills.

005MU: Well I think it's a useful tool just to sort of practice consultation skills. Sorry, not consultation skills but sort of like a revision tool [revision tool, yeah?] for the stuff that you … sorry?

SJ: Yeah, like a revision tool, did you say?

005MU: Yeah, a revision tool, yeah [yeah], just for conditions that you may not come across that often.

…

005MU: I was thinking this is more useful in just trying to learn the clinical content of the consultation [yeah], so the stuff that you have to memorise like what medicines should you prescribe or what dosages and stuff like that. So, it's more useful for that rather than trying to make you a better communicator, I think.

…

005MU: just for learning the actual clinical information that you need to know rather than a communication developing tool. [Yes, yeah]. That's where I think there's more use for that. That's my personal view.

> **006MU**: It depends what you are using it as a tool for I think [ok] I think if it's for improving communication skills I think they are such a personal, difficult thing to teach anyway [mmm] and you need a huge amount of empathy and human instinct [yeah] I don't think technology currently can do that [yeah] but it might be quite useful to erm I don't know how much you know kind of about medical education erm but often when revising for exams and things there's specific histories that come up, you'll have like a shortness of breath history, [yes, yes] tiredness history etc [yeah] so it may be quite useful for creating a pattern of them and all the tick box questions that you get asked on the website that you have to go through.

Participant 006MU's remarks describe communication but from the specific perspective of history taking which they describe in a technical fashion; memorising complex lists with which to interrogate patients. A further comment from participant 005MU suggested that they were perhaps not thinking in terms of SDM. This comment in particular seemed to suggest paternalistic decision making with maybe some tokenistic patient involvement; "…I've decided…".

> **005MU**: You just try to get their own opinion on what the treatment plan I've decided for them is

Skills is based on two ideas; what skills the VP did develop and what skills this type of technology could be better placed to hone. It seems from the interview responses that the participants were split with contrasting views given; some felt that their emotional skills, particularly involving the patient in the consultation, were indeed developed. Others felt that this technology would currently be better suited to technical skill development, such as clinical knowledge. One reason for this appears to be a link to the theme *restriction* as 006MU suggests that communication skills are very 'personal'; their comments in the section 'Restriction' seem to suggest that a personal style and restriction are linked to their thoughts that that VP technology is not well suited to emotional skills. This seems to be because they feel that communication is a personal issue with different styles

possible with none right or wrong; the multiple-choice VP seemed to fail to incorporate this for some, but not all, of the participants.

7.2.3.4. Familiarity

Familiarity was a minor theme from the data related to *fidelity*. Some participants felt that, due to their previous experiences, the feedback the VP gave them felt very familiar.

> **SJ**: With the feedback, Brian the virtual patient addressed you first and then there was the text feedback, what did you think about that way of doing things?
>
> **007MU**: Yes, that was good. It was almost like having a simulated patient, in that they often give feedback at the end of a session. Yes, I think that was a good way to give feedback.

It was suggested by another participant that had a student not experienced SPs before and been accustomed to a patient coming out of character to give feedback, the VP could have felt quite unnatural.

> **SJ**: What did you think about having Brian, himself, give you feedback?
>
> **004MU**: Yes, it was quite nice. When we have simulated case patients in our Communication Skills session, who are actors, basically, they do a similar thing. They stay in their character and they will talk to you and say, 'This is what I felt as the character when you said this. I liked you did that' or 'I felt a bit uncomfortable when you did that'. I'm kind of used to that, I suppose. It might be a bit weird for someone who's not had simulated patients before because it's a bit strange for someone to actually say what they think about you [laughter] in that way. Yeah, that felt quite natural for me, I suppose, because I'm kind of used to it.
>
> **SJ**: Yeah, it sort of fitted in with what you'd experienced previously.

004MU: Yeah, I kind of expected it almost and I think it's good. I think it's more organic and natural to come across that way.

This minor theme was linked to *fidelity* as it seemed the feedback was a close approximation of what the participants had experienced previously with SPs. This familiarity seemed to be a positive thing; in the same way that the simulation felt like a real consultation, the feedback resembled previous experiences with SPs which was also viewed positively.

7.2.3.5. Data Saturation

There were seven participants interviewed. There were no more participants available to be interviewed. It was felt that data saturation was perhaps not reached as in the seventh and final interview there were still new ideas and new codes being generated. Unfortunately, no other participants consented to an interview so there was little to be done other than to accept that these findings were perhaps not complete i.e. data saturation was not reached.

7.3. Discussion

The questionnaire data (Figure 37) showed that the participants found the VP accessible with all of them rating it as either "accessible" or "highly accessible". Accessibility is an important factor for educational technology in a wider sense (Volery and Lord, 2000) so this result is a positive one for the VP. Rather than focusing on accessibility specifically, the free-text responses also suggested the VP was easy to use in general. The VP was also rated as enjoyable to use by the majority (n=19) of the participants with a median rating of 4.5, between "enjoyable" and "very enjoyable". Enjoyment is posited to be an important feature in adult learning as it can improve engagement and motivation to learn (Lucardie, 2014). Two participants rated the VP 3 out of 5 for enjoyment while one rated it at a 2. The number "1" on the scale was 'not enjoyable at all' so it could be surmised that all participants

derived at least some enjoyment from the VP. 20 of the 22 participants said they wished to use the VP again. This would also seem to suggest a positive view towards the VP from the participants in the study. If one wishes to repeat something, it could be presumed that this was because they had got something from the experience. The reason for desiring future use is not clear; did the participants find it fun, useful, or something else? With 11 participants registering a desire to use the VP again, but provided changes were made, it is also suggested that the VP requires refinement. Many of these suggested changes were related to the restrictive nature of the VP, which will be discussed later.

The VP was reported as accessible, easy to use, enjoyable and 91% of them desired to use it again. This all seems positive but was there any change in the participants' knowledge, skills or practice?

7.3.1. Change

Just over half of the participants (59%, n=13) suggested that they thought it was either "likely" or "highly likely" that there would be changes in their approach to clinical scenarios as a result of using the VP (Figure 41). Some of the changes suggested were quite vague and did not relate to a specific modification. Of those that were more specific, the suggestions included more structured consultations and, with relevance to the VPs aims, focusing more on the patient; focusing more on the patient is itself a slightly vague term. Focusing more on the patient, including involvement in decisions (Table 41), would seem to be a positive finding although only a small number of participants reported this. Of course, just because some participants suggested it was likely there would be changes in their practice it doesn't necessarily mean that there were any changes as this was not measured; it was unknown whether any of the participants did or did not change their practice as a result of using the VP.

The participants ranked their priorities within a consultation both before and after using the VP. The priorities were those suggested by Barber (1995); maximising effectiveness, minimising risks, minimising costs and respecting patient choices. There was a statistically significant change in the

rank position of “respecting patient choices” (p=0.038); the median shifted from 2nd to 1st when comparing pre- and post-VP responses respectively.

There are a number of caveats to this finding. Firstly, while it is statistically significant, it cannot be claimed to be clinically significant; it is unknown what effect, if any, this change in priorities had on the participants’ subsequent practice and for how long such an effect may have persisted. The introduction to this thesis highlighted the notion that SDM can be valued by professionals but not necessarily implemented (Karnieli-Miller and Eisikovits, 2009). Secondly, the aim of the VP was to enable its user to practice and thus improve their SDM skills; “respecting patient choices” is not directly equivalent to SDM. It is an important part though as if a decision-making process is to be shared, it is essential to respect the patient’s choices. Research finds that paternalism can still occur in consultations (Garrard et al., 2015) and not respecting patients’ choices seems to be a barrier to SDM (Hamann et al., 2012); in Hamann et al’s study, medical professionals suggested that they valued SDM but, in contradiction, also suggested they would dislike it if a patient were to insist on their own choice. A move towards respecting patients’ choices would arguably be a positive one for SDM. Thirdly, there is also the complication that the participants could have been simply ranking priorities in a way they thought would be palatable to the researchers; the participants may not know what “respecting patient choices” entails. In summation, it cannot be asserted that the participants understood, valued or intended to implement SDM in their future consultations, only that, at the cohort level, there was a statistically significant change in the rank position of “respecting patient choices”.

The discussion in chapter 6 (pharmacy undergraduate evaluation) highlighted research suggesting that medical students become less empathetic across their undergraduate studies (Chen et al., 2012; Haidet et al., 2002; Hojat et al., 2009). Proponents of this change report that it might be due to idealistic entrants to medical school but also unintended effects of the curriculum. The change is postulated to be undesirable as it is suggested that negative attitudes can lead to negative

behaviours and vice versa (Levinson and Roter, 1995; Novack et al., 1999; Rogers and Coutts, 2000). There are also concerns that the wider healthcare system is failing to individualise guidelines and consequently, care is becoming a technical rather than patient centred enterprise, neglecting the role of shared decision-making and each patient's preferences (Greenhalgh et al., 2014).

A single, short session with the VP induced a change in priorities towards respecting patient's choices. The limitations of this have been discussed but could the VP offer a way to alter the change in attitude found in undergraduate medical education? This evaluation took a simplistic approach to measuring specific priorities. This was not the same as measuring an 'attitude', a far more complex construct which is often measured using multi-item questionnaires (Eagly and Chaiken, 1993; Haidet et al., 2002). Research focusing purely on how attitudes are, or are not, affected by exposure to the VP could be an interesting avenue to explore in future; the strength and longevity of any change could also be measured.

7.3.2. Bridge and Undergraduate Curricula

Bridge was a theme from the interview data suggesting the VP would have helped the participants cross from the theoretically focused, early years of the medical degree to the clinically focused, practice-based education in the second half the course. This is perhaps reflected in Figure 40 with the early and late undergraduate periods of education being the most supported as a place for the VP; there was no middle category available. The gap between theory and real clinical practice is well documented in nursing education in particular and dubbed the theory-practice gap (Rolfe, 1993). Quotes from the interview transcripts suggest that while some of the participants felt they understood the concepts they were being taught in their early education, they did not really know how to put them in to practice. There were also suggestions that when they crossed into real world clinical settings, there was quite a big jump.

Simulated encounters with actors (SPs) have been found to be stressful for medical students (Hulsman et al., 2010); some of the interview participants alluded to this too. It has been proposed that prior use of VPs could help reduce the fear experienced in SP situations and there is data to support this (Deladisma et al., 2007; Kleinsmith et al., 2015; Sunnqvist et al., 2016). The VP with its "surprising" realism provided a scenario similar to a real one while not carrying the same consequences as reality; numerous participants commented on how life-like and real the scenario felt, while still acknowledging ways in which it was different from a real situation. It could be viewed as a half-way house, more interactive and real than textbooks but not the same as a real person and thus helping to smooth the transition to SPs. Stevens et al. (2006) found that their free-text VP for communication skills was thought of as useful for this purpose, preparing medical students for SPs. A relevant demographic feature was the participants year of study; the majority of the participants had already experienced SPs and real patients so had already made these transitions. They were thinking back to their prior experience to suggest the VP as a useful aid for bridging the gap.

It seems that VPs must be combined with other learning methods, not used in isolation, something that *adjunct* highlights. At the outset of this project it was not envisaged that VPs should replace other methods but complement them instead; the results seem to support this. There were issues raised in the interviews about SPs and the idea that they, much like VPs, are scripted; in other research, medical students have noted the falseness of SPs and suggested they are quite different from real interactions (Yardley et al., 2013). This feeling of falseness has been reiterated from a sociological point of view; due to the different power relations in SP and real patient interactions, SPs perhaps give students a false impression of realism (Hanna and Fins, 2006). It seems from both the literature and this project that both VPs and SPs can help bridge to real scenarios but both have their strengths and weaknesses, some shared, some unique (Lane and Rollnick, 2007; Lin et al., 2011). Using different methods in combination could help students transition from theory-focused learning to real patients; VPs are perhaps not the only method to *bridge*. Each method (role play, SP, VP) acts

like an individual cable on a suspension bridge; together they all support the transition medical students undergo from text-book based learning to real patients.

This links to the educational theory work discussed in the Background chapter, specifically about the structure of the undergraduate medical curriculum (Rodriguez-paz et al., 2009). Learners start with the acquisition of theory, the basic building blocks of knowledge; this tends to occur in lectures and with textbooks and can be loosely described as the instruction stage (Maguire and Pitceathly, 2002). After this, there may be some demonstration or role modelling (Berkhof et al., 2011; Kurtz et al., 2005). Next, there is a phase of repeated practice using different simulations, with increasing realism and complexity (Alessi, 1988). The learners progress to 'practicing' on real patients but under supervision before finally interacting with patients independently; this is based on Miller's pyramid where competency is assessed before progression to the next stage (Miller, 1990). In relation to this model, the results suggested that the VP was perhaps ideally suited to the early stages of practice; the multiple-choice system meant the VP was akin to guided-practice, a hybrid of demonstration and practice. The theme *prompt* is the reason for this.

Prompt is concerned with the multiple-choice system of interaction and the way it offered suggestions to the participants. At each point in the consultation, the participants had to select their desired action from three predefined options. Both the interview and questionnaire data suggested that the multiple-choice options allowed the participants to think about alternatives to what they would usually say; by reading the options they were prompted to think about new phrases or directions to take in a consultation. Thus, the multiple-choice system, which was chosen at the design stage primarily for ease, seems to be an important element in the way the VP functioned. This effects the way one views the suggestions made by the participants on the questionnaire to adjust the multiple-choice format (Table 38 and Table 40). The format of reply was, it seems, an intrinsic feature of why the VP was useful so resolving the issues of restriction may be a difficult task. Switching to a free-text VP may eliminate the restriction issues but then the prompt function is lost;

as the software must recognise the phrase typed by a learner, a free-text VP can also be restrictive (Johnsen et al., 2005).

The prompts from the multiple-choice system were suggested as a useful feature to help bridge from theory to interactions with real people. If, like many of the participants, a learner has crossed the 'bridge' and already begun interacting with SPs and patients, are the prompts useful? They may not be as some interview participants suggested that later on in their learning they would like to use a free-text VP as the benefit afforded by the prompts was reduced; the participants did not use one of these but the concept was explained to them. Multiple-choice VPs require the recognition of the correct phrase while a free-text VP entails the recall of previously learnt information and phrases; the former is suggested to be somewhat easier than the latter (Schittek Janda et al., 2004). Therefore it could be possible for learners to start with a multiple-choice VP and progress onto a free-text one when their skills have improved (Rodriguez-paz et al., 2009). This suggestion is very tentative and warrants future investigation as free text VPs have been found to have problems of their own, particularly with word or phrase recognition (Stevens et al., 2006).

The prompt feature of the VP has implications for the theoretical underpinnings of VP education. Kolb's theory of reflective practice (Kolb and Kolb, 2005) is proposed as a suitable theory on which to design simulation-based learning (Zigmont et al., 2011); the cited paper doesn't define the type of simulation used but appears to be manikinn based. Evidence from this study would suggest that this may not be the full picture. Working with the Kolb theory, Zigmont and colleagues state that all of the learning occurs after the experience; the experience in this case is the virtual consultation. With this VP, the multiple-choice options provided prompts so at least some learning occurred during the simulation, not solely afterwards. This doesn't mean that the Kolb theory doesn't apply to simulated learning but that simulation is a big umbrella term for different technologies which support learning in different ways. To say that the Kolb theory of reflective practice informs all simulation education on its own is perhaps erroneous. The Schön theory (1987) of reflection may be more suitable to

apply to this VP; Schön differentiated between reflection “in” action and reflection “on” action. Reflection in action occurs when one reflects on their actions during the event; this seemed to happen during this study. Reflection on action is what one does after the event. Both of these types of reflection could in principle be accommodated by a single VP.

7.3.3. Individual Style and Subjectivity

The feeling of restriction caused by the VP has already been touched on. As the participants had to select from three options each time (with only a few exceptions) they were constrained as they could not say whatever they wished. This resulted in the negative feeling of restriction which was suggested to be due to the predetermined style of the VP not being sensitive enough to encompass the participant’s own consultation style. Doctors have their own consultation style which doesn’t tend to be altered to any great degree from patient to patient (Byrne and Long, 1976; Sluijs et al., 1984); this idea was expressed by the participant themselves. While some suggest that VPs should try to encompass different consultation styles (Parsons et al., 2008), restriction has been noted in the literature with other multiple-choice VPs (Bearman, 2003; Liaw et al., 2000; Pantziaras et al., 2014); it is perhaps an inherent feature of a multiple-choice system, not an issue with this specific VP.

The discussion of personal style and restriction suggests that the VP did not allow the participants to say whatever they wish. The participants desired choices were not recorded so it is unknown whether the unavailable options would have been appropriate. There is evidence to suggest that doctors theoretically value SDM, but do not understand what is required (Hamann et al., 2012). The MAGIC programme found that doctors may think that they routinely engage in SDM when in reality they do not (Joseph-Williams et al., 2017). There is also extensive literature on clinicians’ and students overconfidence, particularly with reference to diagnostic accuracy (Baumann et al., 1991; Berner and Graber, 2008; Dyche and Epstein, 2011). Could the participants who said they could not consult in their preffered style actually be overconfident and not realise that their ‘preffered style’ is

actually not an appropriate one for the consultation simulated? Within the context of personal consultation styles, participant 004MU said “that’s not necessarily to say that anything is right or wrong”; there are many things that are ‘wrong’ though, so by justifying something as ones personal style does necessarily make it correct. For example, signposting during a consultation is supported by evidence from the literature so to not do so is ‘wrong’ (Floyd et al., 1997; Levinson et al., 1999). Therefore, if the participants felt that the options they would like to have chosen were not available, it does not necessarily mean that they should have been. As the participants desired options were not recorded, this is currently unknown but could be explored in future work.

It was not just restriction that was related to the idea of subjectivity and personal style but also the feedback. The automated feedback from the VP was reported as useful and felt familiar but the subjectivity of a consultation wasn’t incorporated it seemed; the loosely checklist nature of the feedback didn’t allow flexibility and discussion. CA of the questionnaire responses resulted in the code ‘vague feedback’; the feedback did not explain why certain options were more optimal than others. Due to the subjectivity of a consultation, the participants suggested that it was not always clear why certain choices were more optimal than others. Simulation learning is posited to be contextual and experiential which makes debriefing to encourage reflection highly relevant as there are not always clear right and wrong answers (Dreifuerst, 2009; Husebø et al., 2015). This links to andragogy and adult learning theory where a learner’s previous experiences are an important feature which can be drawn on (Knowles et al., 2015). The patient avatar and written feedback reportedly gave the participants an idea of how they had performed but it seems a further debrief could be beneficial. Kidd et al. (2012) reported that nursing students found a debrief an important part of their simulation learning as it allowed them to discuss their feedback. A feedback discussion or debrief after a VP can be achieved by different means including discussion with peers or a seminar from an educator (Edelbring et al., 2012). A debrief could allow the discussion of the automated feedback and the participant’s experience to reflect on why certain options may have been better choices than others, thus exploring and clarifying subjectivity. Miller et al. (2008) propose a four step

process to structure simulation learning; briefing, simulation, debriefing, and follow-up. This is based on manikin simulation but, in conjunction with the evidence from this research, could be a viable way to structure learning with the SDM VP.

The aim of the VP was to allow the user to practice conducting a consultation involving SDM. Table 39 shows that the VP was proposed as useful for both consultation and communication skills. For most of the domains there was a degree of variation and for communication skills in particular, some participants (n=9) rated the VP as “very useful” while others (n=2) rated it as “no use at all”. There is clearly some disagreement about how well the VP developed different skills; this variation was also present in the interview data too. Some participants suggested they would make changes to their practice which included focusing on and involving the patient more. Other participants said that the VP was not useful for communication or patient interaction skills but would perhaps be useful for technical skills, such as diagnosis and clinical knowledge etc. The interviews suggested that the VPs failure to account for different consultation styles in a sufficiently nuanced way was why the VP was restrictive and thus why it was better suited to technical skills.

It is noted that medical students, like other learners, have preferences for the way in which they learn (Karb et al., 2013; Lujan and DiCarlo, 2006). These preferences have been grouped in to two categories; learning styles (e.g. VARK; visual, auditory, read/write, kinaesthetic) and learning methods (e.g. lecture, workshop, demonstration). It appears the participants in this study had preferences for methods of learning with some speaking very highly of the VP for communication skills, others much less so. Some participants suggested that communication skills for SDM were not developed by the VP and preferred real people; others felt VPs were a useful addition. Whether this should guide education is not clear. It seems that VARK learning styles, which weren’t measured in this research, should not be used to design learning activities or curriculums as the evidence suggests that they do not influence performance (Howard-Jones, 2014; Pashler et al., 2008; Wilkinson et al., 2014); indeed, some argue that such constructs are no more than ‘myths’ (Kirschner, 2017). Despite

this it seems that learning styles are still used (Devine, 2018) even when the lack of an evidence base is highlighted to educators (Newton and Miah, 2017). Whether students taught according to their preferred method perform better is not known but, bearing in mind the research on learning styles, it is perhaps prudent to be sceptical; this could warrant future research.

7.3.4. Explore

The theme *Explore* describes the VP enabling the participants to try things out within the virtual consultation. Two key elements to this exploring were the safe environment and repetition. The participants suggested they could repeatedly attempt the consultation and observe the effect this had on the patient, how they reacted and seemed to feel; unlike reality, this did not impact on a real patient and did not cause harm. This also has potential links to the afore mentioned Schön theory of reflection (1987); after seeing the consequences of each decision, one can reflect and adjust their next action accordingly. The fact that VPs provide an environment in which a real person is not harmed is one of the advantages of simulation learning (McGaghie, et al., 2010). Nursing students using a VP for communication skills reported that the simulation allowed them to repeatedly practice their skills but crucially, this practice did not impact on another human being (Kidd et al., 2012).

As well as not causing harm to a real person, it was also suggested that one cannot really repeat interactions with SPs. A second attempt would be different due to a lack of standardisation but with the VP, it was possible to truly reset the consultation and start again. The idea that one cannot freely explore a consultation with real patients is documented in the literature (Bokken et al., 2009). Medical students in that particular study said that although it felt strange to interact with an SP after having started interacting with real patients, one cannot experiment with a real patient. There may be a role here for VPs with more experienced students or professionals, not in 'bridging' but in allowing them space to explore consultations. This could be particularly pertinent given that there is

evidence to suggest that communication skills can be un-learnt (Craig, 1992; Engler et al., 1981) so experienced professionals may need to revisit this area to refine their skills.

Perhaps the prompts from the multiple-choice system will take on a new role in breaking the established patterns of experienced professionals? The literature in the Background section makes the case that SDM does not appear to be occurring in practice to the extent that it ought (CQC, 2018); it seems a reasonable assumption that the participants in these studies may benefit from practice conducting a consultation involving SDM. The interview participants, even those towards the end of their undergraduate studies, suggested that the prompts proposed phrases or wording that they had not previously thought of; could this work in a similar fashion for established professionals? Could the prompts suggest new ways of thinking or break the established patterns of experienced doctors? This requires further inquiry.

7.3.5. Participant Demographics

The participants were at different stages of their undergraduate careers (appendix 20). On advice from the MMRSSoc committee it was anticipated that the majority of the workshop attendees would be third-year students; for reasons unknown the only year group not represented was the third-year. With the theme bridge, some third year participants would have been a potentially interesting group to explore the VP with. The gender representation was skewed towards female participants which is the same in the wider UK medical student population (GMC, 2016), although the differential was greater in this study.

From Figure 34 and Table 35, it seems that the participants were expecting the VP to be useful prior to using it and also self-assigned themselves as broadly accepting of new technology. As the workshop was run as part of a conference, the participants didn't have to attend. This could be an obvious criticism of the research; the participants were self-selecting and already favoured technology. This is particularly germane given that it is unclear whether all of the medical student

delegates to the conference attended the workshop; they could have further self-selected as those who perhaps would not enjoy virtual reality decided to leave the event early. That said both Figure 34 and Table 35 show there was some spread in their characteristics.

7.4. Conclusions

The VP was enjoyable to use and easy to access. It resulted in just over half of the participants suggesting they would be likely to change their practice. There was also a statistically significant change in the cohort's consultation priorities; the participants ranked "respecting patient choices" more highly after using the VP than before ($p=0.038$). Respecting a patient's choices is an important facet of SDM so this is posited as a positive outcome for the VP. A more complex measurement of attitude and whether the VP affects this, alongside a longitudinal measure, could investigate this more completely. It is also important to see whether the VP led to any change in practice to establish its ultimate utility.

It seems that the VP is well suited to help medical students transition from the early years of the undergraduate course to the later ones; bridging from theory-based to practice-based education. There were also suggestions that it could be useful later on in one's career, to permit exploration of a consultation. The next chapter of this thesis looks at the VP with practicing professionals.

The learning experience of the VP was perhaps not purely experiential; it seems that, with the multiple-choice system, some of the learning occurred during the simulation, not solely afterwards. This could have implications for the ways in which educators design and implement VPs.

The feedback provided by the simulation itself was useful but perhaps insufficient in isolation; a debrief is likely to be important for learning. The composition and structure of this debrief is not clear though so could form a topic for future inquiry.

All of these conclusions need to be viewed tentatively due to saturation not being reached in the interviews. This means that this research may not present the full picture; if more participants had been interviewed there may have been more relevant data unearthed. These findings are applicable to the workshop cohort but can't said to be true outside of this group.

8. Evaluation of a Virtual Patient Workshop with General Practice Registrars

Amongst the requirements to obtain a Certificate of Completed Training and practice as a general practitioner, GP Specialist Trainees (GPRs) must complete and pass the MRCGP examination. This examination has multiple components including consultations with simulated patients, the Consultation Skills Assessment (CSA). As assessment of consultation skills is not so explicitly assessed in many other postgraduate medical training curricula for other specialties, GPRs were the most logical group with whom to evaluate the VP.

8.1. Method

GPRs on the Leeds Vocational Training Scheme (VTS) attend two-hour educational sessions each week. The VP was incorporated into an afternoon session on consultation skills at the St James's University Hospital and evaluated with the attending GPRs. The afternoon was structured as shown in Figure 49. The aims of the session were as follows:

- Outline the benefits of good communication skills
- Explain how communication skills can be developed
- Explain the history of how healthcare professionals have been taught consultation skills
- Introduce shared decision-making and outline the rationale for its use and promotion
- Practice shared decision-making within a simulated consultation

The method was similar to the previous two strands of data collection with undergraduates. The same pre- and post-questionnaires were completed by the participants immediately prior and immediately after using the VP respectively. The session was split in two parts which were equal in length; a lecture followed by a session using the VP. The introductory lecture started by exploring what high quality health care looks like in general terms; this included comparing the different aims

and views that patients and doctors might have. The session moved on to highlight why a GPR should learn communication skills including a discussion of the evidence about the outcomes of good communication. Next, the lecture touched how skills can be developed and how this process can occur for communication skills. After this, the session focused on an overview of the different consultation models with a focus on the Calgary-Cambridge (Kurtz et al., 2005).

The rest of the session focused on the VP and took an hour in total. The GPRs were informed about the study both at the start of the lecture and at the beginning of the VP session. All of the GPRs were provided with an information sheet each prior to using the VP. Each GPR could then decide whether to take part in the study or not. If they decided to take part, they completed the online consent form and pre-questionnaire before using the VP; if they did not consent, they used the VP without completing a consent form or pre-questionnaire. Simon Jacklin (SJ) and NM were on hand while the GPRs were using the VP to answer any questions they had and help with technical issues. After using the VP, the group who had consented to be part of the study completed online post-questionnaires. Finally, there was a whole group debrief session after the participants had completed the post-questionnaire, which took around 20 minutes.

A few days after the VTS afternoon, emails were sent to all those who had completed both pre- and post-questionnaires to invite them to participate in an interview. Attached to the email were both an information sheet and a link to an online consent form. To consent to an interview, the participant had to complete the consent form. After completing the consent form, each GPR was to be contacted individually to book an interview slot. All interviews were to be conducted over the phone and recorded with the participants consent. The interviews were to be transcribed verbatim by a transcription service. None of the participants received any remuneration or gifts for participating in any part of the study. No financial offer was made to the GPRs for participation.

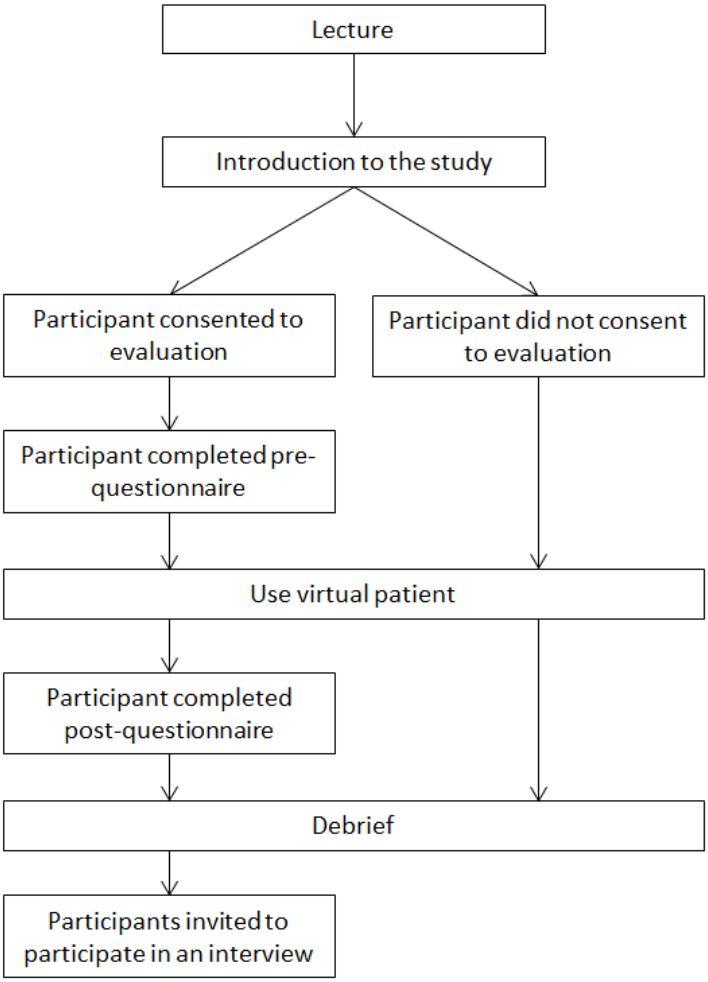

Figure 49 - Evaluation pathway (GPRs)

The quantitative data from the questionnaires was analysed descriptively apart from one question (treatment priorities) which was analysed with a Wilcoxon rank test to assess whether any change was statistically significant; the rank position of "respecting patient choices" was compared both pre- and post-VP. The qualitative questionnaire data was analysed using content analysis. Each response was coded and each code reported with the associated frequency of occurrence for each question; verbatim quotes were used to illustrate each code. The interview transcripts were to be analysed using data-driven thematic analysis. All analysis was performed by SJ.

8.2. Results

A total of 43 GPRs attended the workshop; 3 left early, prior to the VP session. 26 GPRs completed both a pre- and post-questionnaire.

8.2.1. Issues on the day

The VP was accessed via a webpage which requires internet access. The internet connection at the location for the workshop was slow at times and some of the GPRs had to wait after selecting their desired option to see the patient's response; there is usually about a 1-2 second delay while the patient's responses loads but this time window was greater at times during the workshop. This didn't seem to affect all of the participants as some used the technology with ease while others had a few connection issues; nobody was stopped from using the VP but for some the experience did not flow quite as well as for others.

8.2.2. Pre-Questionnaire

Basic demographic data is included in appendix 25.

Question 1: How would you define a 'digital virtual patient'?

Table 44 - Participant definitions of a VP (GPRs)

Computerised	n=18	A VP was thought to be computerised in some way
	"A computerised simulation" [Participant 4]	
Interactive	n=6	Interactivity was a feature of a VP
	"an animation which responds differently to choices in consultations" [Participant 22]	
Animation or actor?	n=2	Some responses (as for the quote from participant 22 in section "Interactive") suggested that the VP was thought to be an animation.
	n=2	Other responses reported that a VP could be either an animation or a recording of a patient.
	"An animation/video of a patient" [Participant 27]	
Unsure	n=2	The participant was unsure or did know how to define a VP
	"no idea" [Participant 6]	

Question 2: How useful do you think virtual patient technology could be in the development of your professional knowledge and skills?

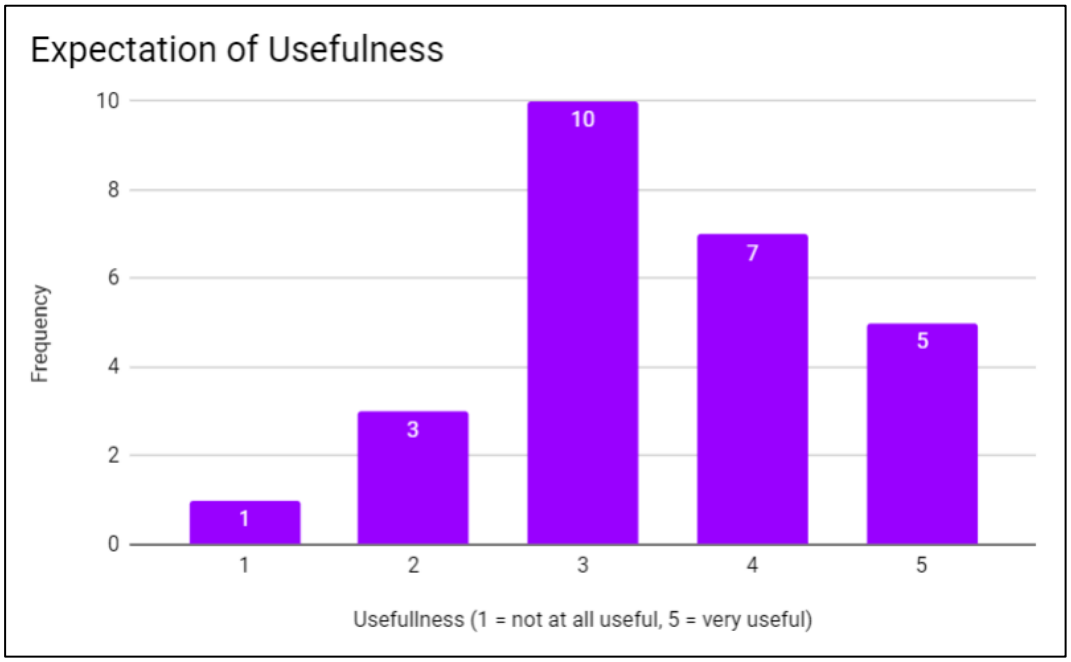

Figure 50 - Expectation of VP usefulness (GPRs)

Question 3: Which statement would you say best suits yourself?

Table 45 - Participant self-assigned adopter class (GPRs)

Statement	Self-Assigned Adopter Class	Frequency
I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market	Innovator	3
I enjoy new technology but am rarely the first to invest in a new product	Early Adopter	13
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product	Early Majority	7

I have no desire for new technology, I tend to only adopt it after the majority of other people	Late Majority	1
I dislike change in technology and will only use a product when it has become mainstream	Laggards	2

Question 4: Which of the following methods have you used or experienced in your education? Tick all that apply

Table 46 - Previous education of participants (GPRs)

Method	Frequency
Simulated patients (actors)	26
Watching videoed consultations (not your own)	25
Watching back your own consultations	25
Role playing with other students	24
Digital virtual patient	0

Question 5: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful);

Table 47 - Expectation of VP usefulness; subject specific (GPRs)

	1	2	3	4	5
Healthcare education	1	2	6	13	4
Clinical decision making	0	4	7	11	4
Consultation skills	2	3	5	11	5
Patient centered care	1	5	4	13	3

Question 6a: Which of the following do you currently use to aid your professional learning/development and how many times per month do you use them?

Table 48 - Current use of educational technology (GPRs)

	Apps	Webinars (online seminars)	Social media (e.g. Facebook, Twitter, Instagram)	Blogging sites	Online simulation (e.g. second life)	Massive Open Online Courses (MOOCs)
Don't use	5	15	15	22	21	19
1-2 or less	8	10	5	4	3	5
3-5	5	2	6	1	2	2
6-8	6	0	1	0	1	1
9+	2	0	0	0	0	0

Question 6b: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Table 49 - Usage of technology; curricula areas (GPRs)

Curricula Area		Frequency
Basic science (e.g. physiology, chemistry)		16
Clinical decision making		19
Communication skills		7
Ethical issues		6
Other:	Guidelines	1

Question 7: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

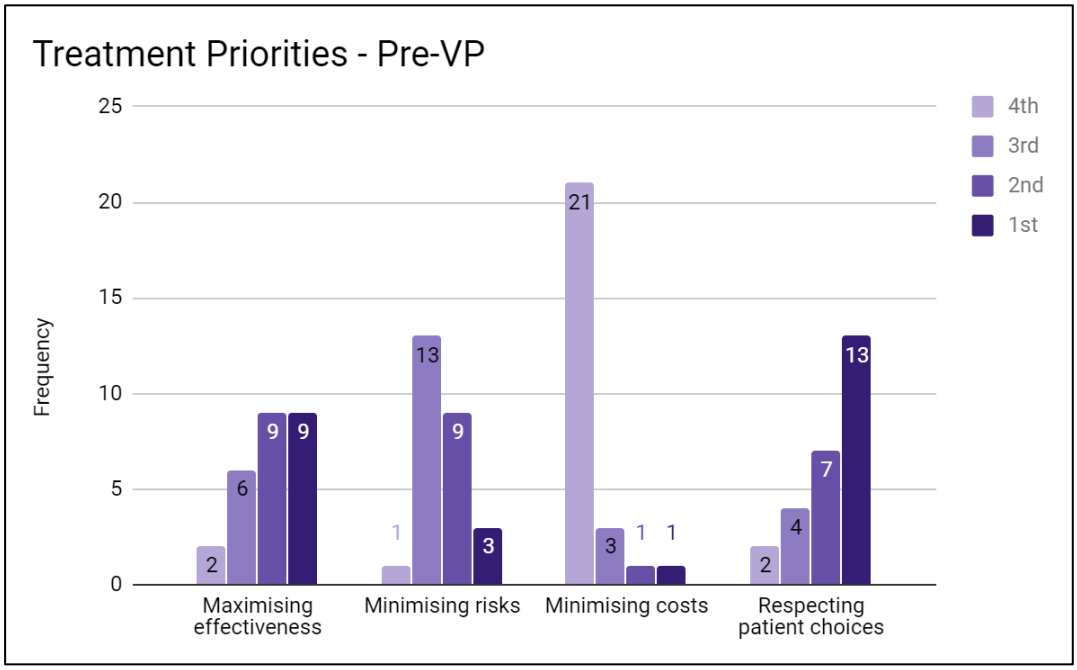

Figure 51 - Treatment priorities pre-VP (GPRs)

8.2.3. Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

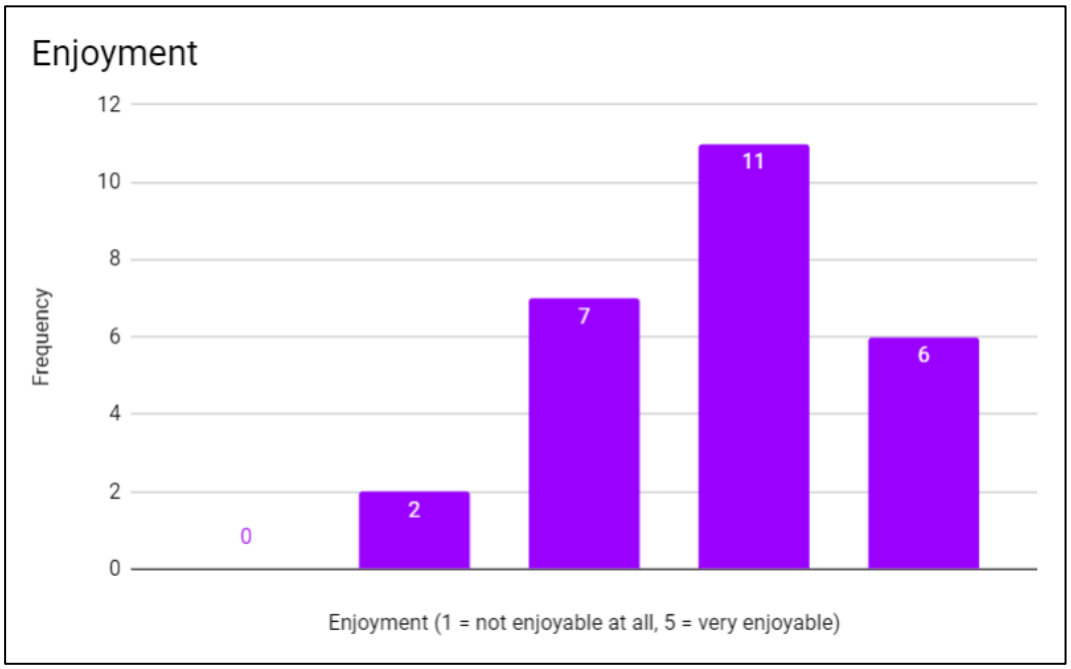

Figure 52 - Enjoyment rating (GPRs)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

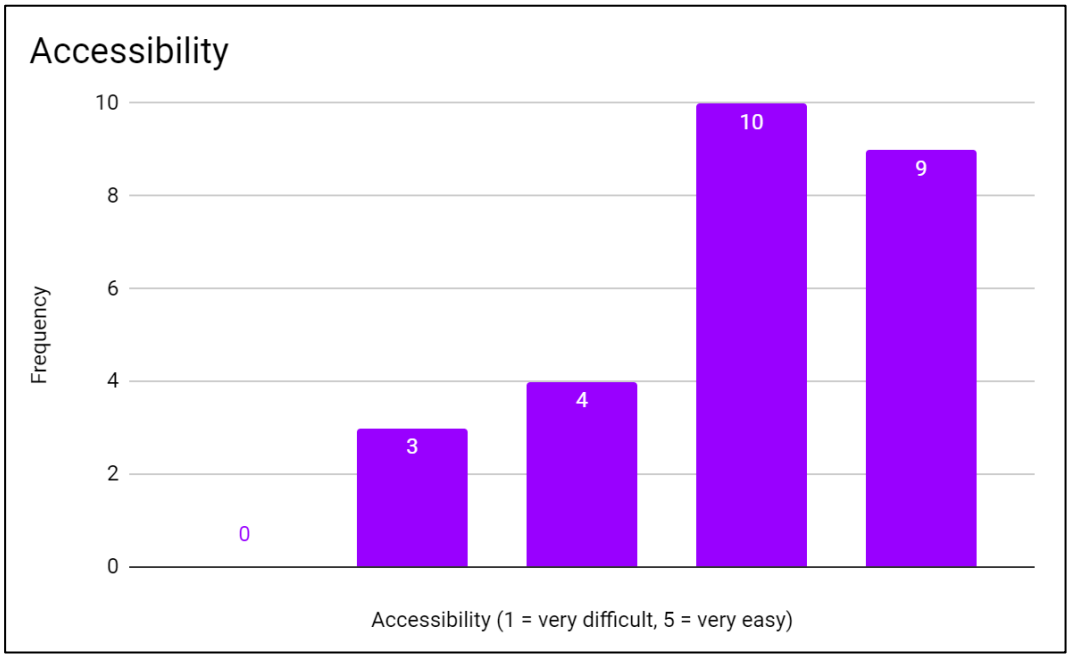

Figure 53 - Accessibility of VP (GPRs)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

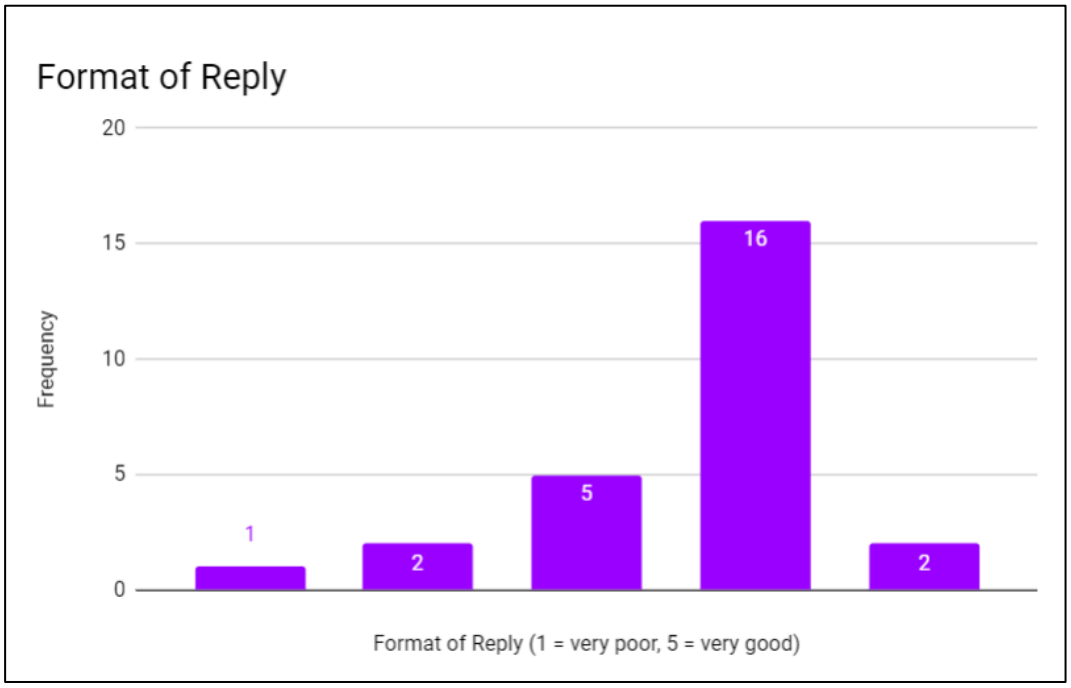

Figure 54 - Format of reply (GPRs)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Table 50 - Comments on the format of reply (GPRs)

Restriction	n=10	The multiple-choice was reported to be quite restrictive by some participants; this was because they could not say whatever they liked in whatever order
	"Largely there were good options. Sometimes a response I felt flowed naturally from the conversation wasn't available." [Participant 11]	
Restriction - Wording	n=1	One additional response about restriction was more specific; it suggested that while the VP was restrictive, it was because the wording was different from that normally used by the participant
	"perhaps not the exact wording that I might use" [Participant 18]	

Voice	n=2	Two participants wanted to use their own voice to interact with the VP
	"If there were a way to speak into the phone like in real life would be better. just free speach." [Participant 14]	

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Table 51 - Subject specific usefulness of the VP (GPRs)

	1	**2**	**3**	**4**	**5**
Consultation skills	2	1	5	17	1
Clinical decision making	2	4	6	11	3
Patient centered care	1	3	6	14	2
Communication skills	2	3	10	10	1
Managing medical complexity	5	6	7	8	0
Managing polypharmacy	6	4	8	7	1

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

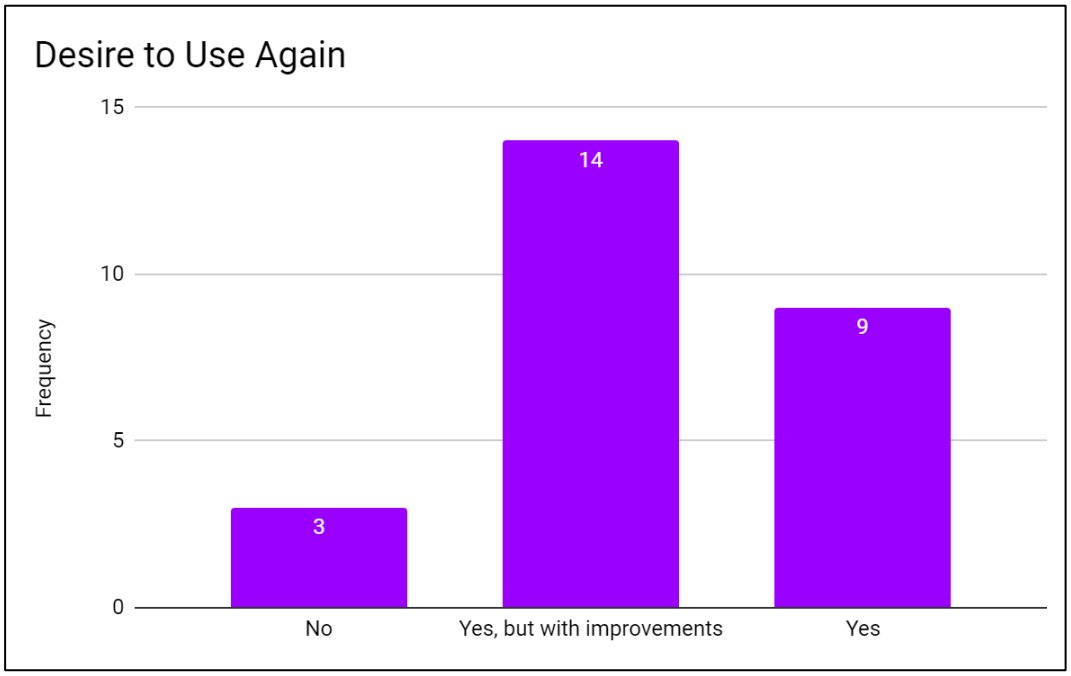

Figure 55 - Desire to use VP again (GPRs)

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Table 52 - Suggested improvements to the VP (GPRs)

Restriction – range of options	n=6	Restriction was reported in answer to this question. Numerous replies relating to this suggested that there needed to be a greater range of options
	"More options and directions in the consultation" [Participant 16]	
Voice	n=3	While using the VP, the users selected their response by clicking on their desired option; some suggested that they would like to speak rather than select from options.
	"speak into the phone" [Participant 14]	
Multiple	n=3	The participants only interacted with a single patient in a single encounter;

patients		that encounter could be repeated but it was the same scenario afresh. Three participants said that they would like to experience multiple different patients to learn from each one
	"I think to get benefit for repeated use they're would need to be different patient scenarios etc." [Participant 24]	
Technical	n=4	There were some technical difficulties associated with the internet connection at the venue, particularly at the start of the session. This was suggested as requiring improvement
	"All in a room trying to load, slow, long buffering time" [Participant 9]	
Different use	n=1	One participant reported that the technology may be useful but for a different application; technical skill development rather than communication
	"I would use it more for clinical decision making, for example in a simulated cardiac arrest, which I think would work very well." [Participant 1]	
Earlier use	n=1	One participant suggested that the VP may have been more useful for those earlier in their career such as medical students.
	"More useful for those with less experience with consultation skills, eg medical students o those in other specialties" [Participant 10]	

Question 6: At which stage(s) in your professional development do you think this type of programme could be useful, or not? Tick all that apply.

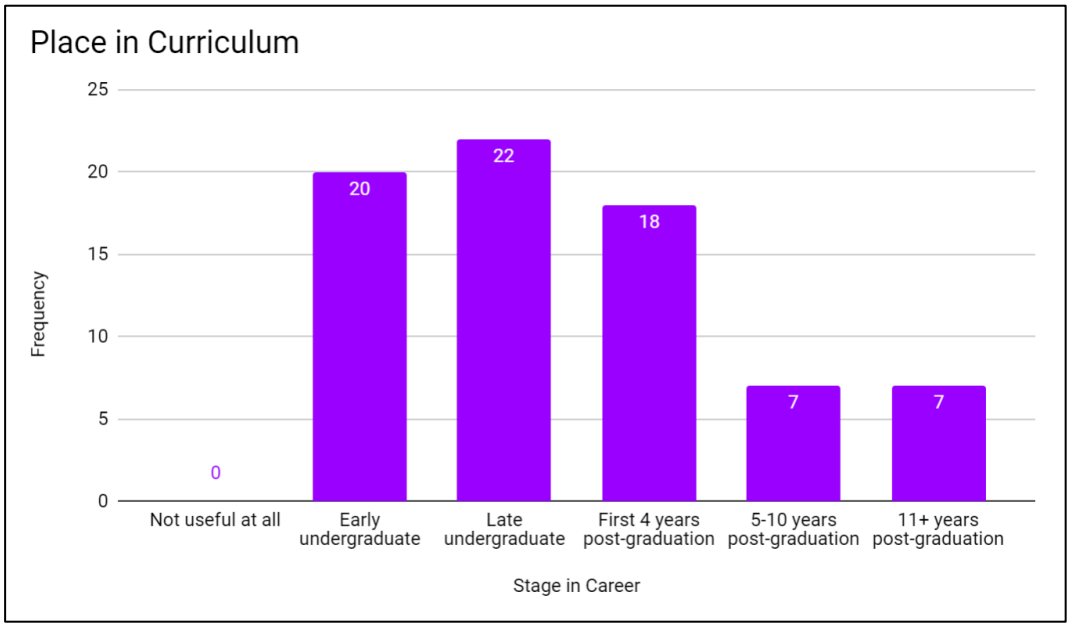

Figure 56 - VPs place in the curriculum (GPRs)

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical scenarios following your use of the virtual patient programme?

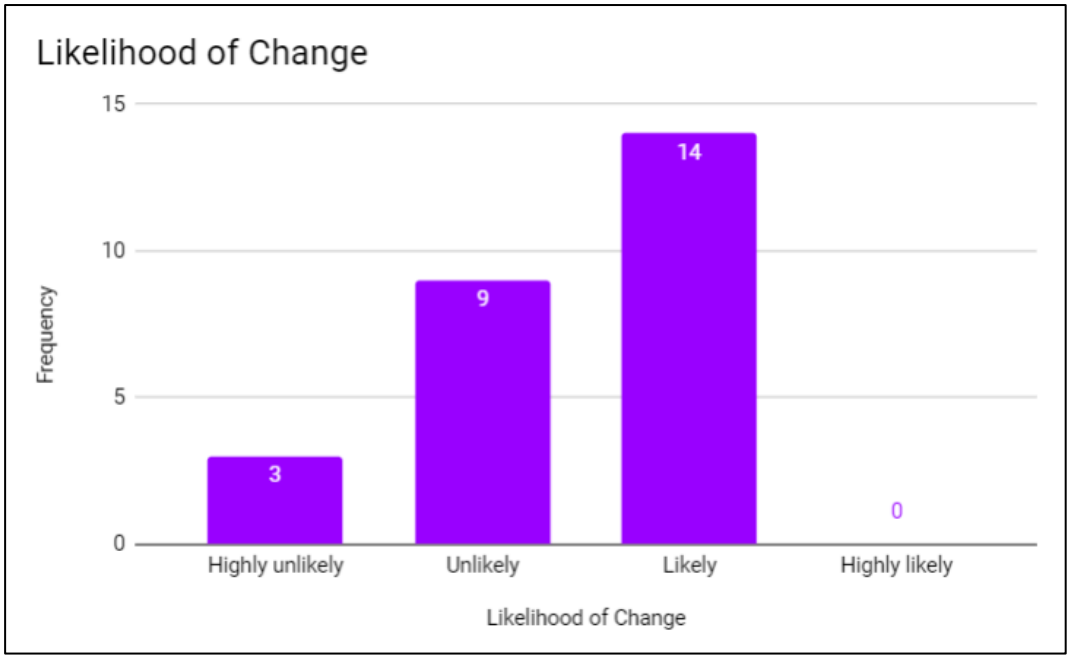

Figure 57 - Likelihood of change in practice (GPRs)

Question 7b: If you think there will be any changes, what do you think these will be?

Table 53 - Suggested changes in practice (GPRs)

Specific wording	n=3	Three participants suggested that they would use "something" rather than "anything" when eliciting any hidden agendas
	"Using something rather than anything" [Participant 24]	
Open questions	n=2	Two participant responses suggested that they would ask more open questions
	"More open questions" [Participant 9]	
Involve the patient	n=2	Two participants reported that they would involve the patient more
	"Positive, listening and involving patient more" [Participant 4]	
Less numbers	n=1	At one point in the VP interaction, the user could decide to provide an explanation of risk which was heavily laden with statistics. It seems this participant was suggesting that they would use less numbers to explain risk
	"Discuss fewer numbers" [Participant 3]	
Consultation structure	n=1	One participant said that they would have an improved structure to their consultations
	"Improved structure for consultations" [Participant 11]	

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

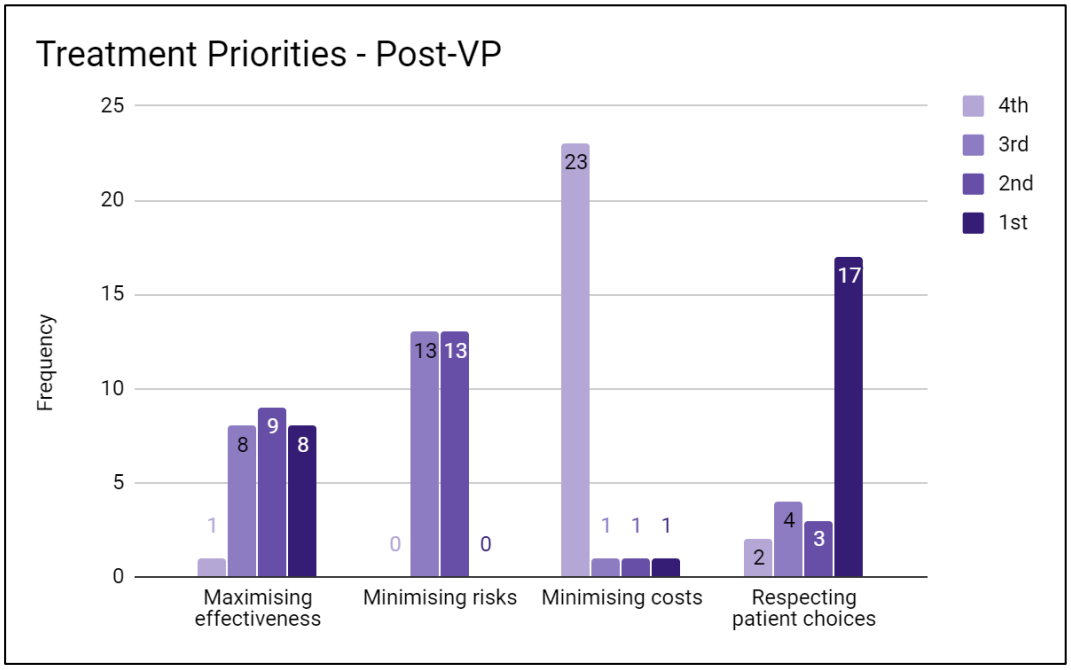

Figure 58 - Treatment priorities post-VP (GPRs)

While slightly more participants rated “respecting patient choices” as their first priority when comparing pre- and post-VP (n=13 and n=17 respectively) this change was not statistically significant (p=0.499).

Question 9: How would you rate the format of the feedback given to you at the end of the simulation? (1 = very poor, 5 = very good)

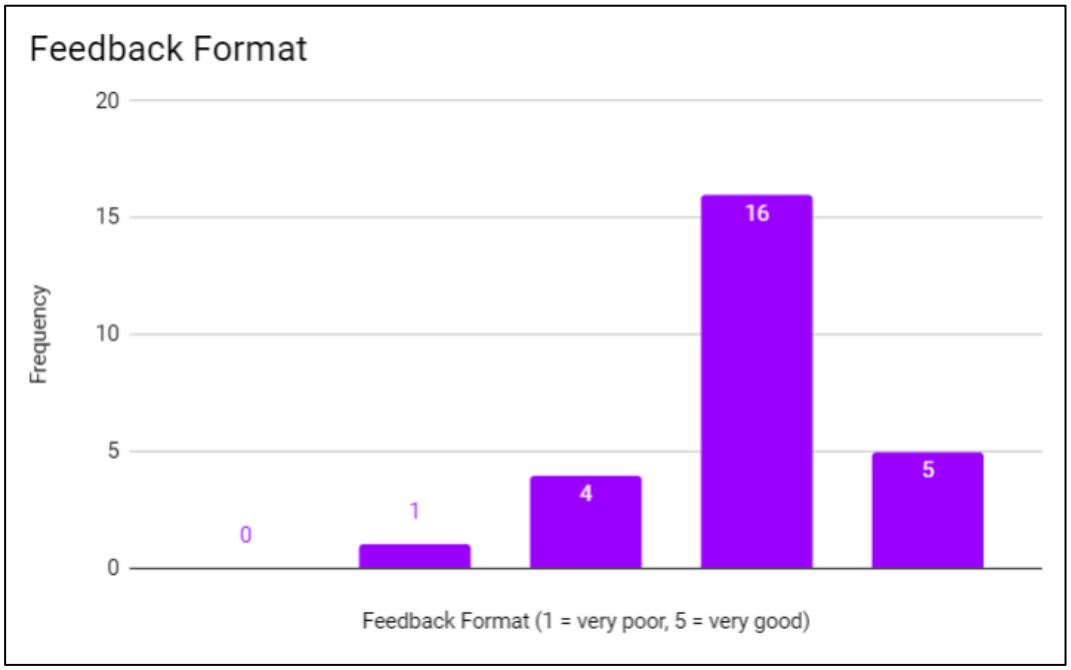

Figure 59 - Format of the VP feedback (GPRs)

Question 10: How much feedback did the virtual patient provide?

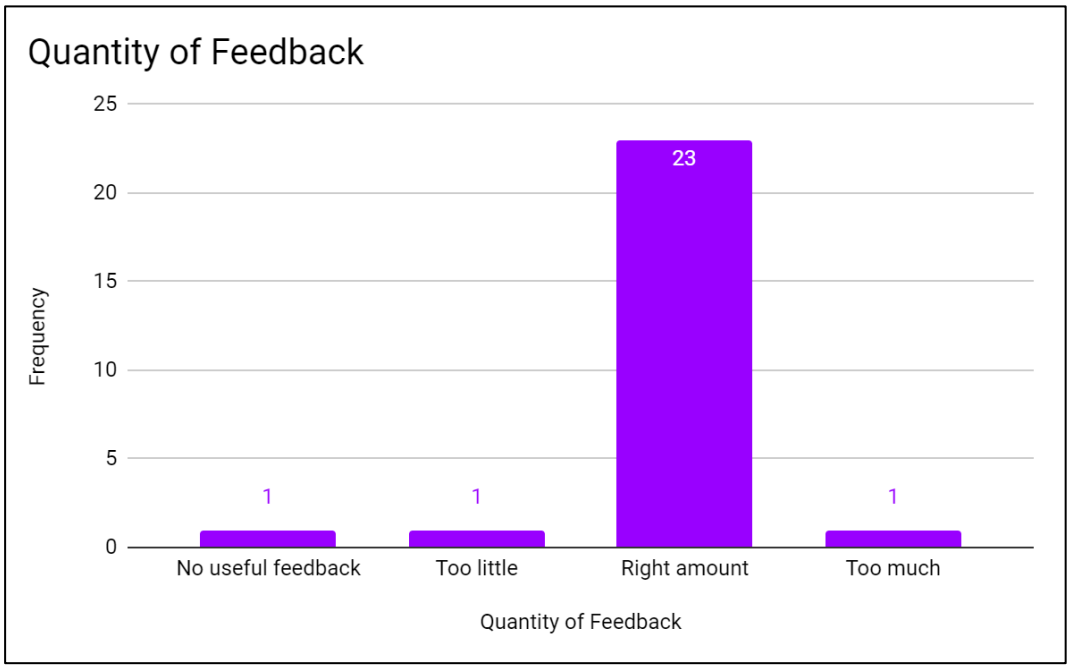

Figure 60 - Quantity of feedback provided by the VP (GPRs)

Question 11: Do you have any comments on the feedback given?

Table 54 - Comments on the feedback from the VP (GPRs)

Too simplistic	n=1	This participant felt the feedback was too simplistic for their level, but might have been OK for undergraduates
	"Too simple for our level. Can be useful for undergraduates." [Participant 6]	
Animation unnecessary	n=1	The feedback was provided first by the patient avatar and then as a list; this participant felt the text alone would have been sufficient.
	"Didn't need to be verbal a list would have been quicker and fine" [Participant 18]	

General comments

Questions 12, 13 and 14 from the post-questionnaire were analysed together and the resultant codes presented in Table 55.

Table 55 - General comments on the VP (GPRs)

Technical	n=11	This described general issues with the software and internet connection
	"Used on slow WiFi...so felt clunky" [Participant 24]	
Restriction	n=10	Restriction was touched on in previous answers and describes the multiple-choice system restricting what users could say
	"Limited options for responses, can't reflect personal style of consulting" [Participant 3]	
Graphics	n=10	The animation was rated highly by some of the participants
	"Good graphics" [Participants 8,16,24]	
Ease	n=5	The VP was easy to use
	"It was easy to use" [Participant 12]	
Experiment	n=4	The VP allowed the user to experiment with different techniques or paths

		through the consultation
	"Theory of trying different options to see outcome" [Participant 18]	
Reality	n=3	Some participants reported that the VP could not match reality as it was not a real interaction but a virtual one; this was reported as a negative feature of the VP
	"Can't meet the complexity of real patients seen in GP eg social issues etc" [Participant 10]	
Repetition	n=2	The VP allowed users to repeat the consultation time and time again
	"Ability to do again and again" [Participant 4]	
Novelty	n=2	The fact that the VP was novel was a positive feature
	"It was some new welcomed experience for me" [Participant 8]	
Prompt	n=1	The multiple-choice system prompted the user with suggestions of what to say
	"can see examples of good responses" [Participant 3]	
Expectation	n=1	For one participant the avatar exceeded expectation; it is unclear whether they mean the VP package as a whole or the quality of the animation
	"Better avatar than expecting!" [Participant 9]	
Utility of animation	n=1	One participant questioned the utility of the animation i.e. was the animation an important part
	"does it need animation? ...maybe makes its slower without much gain." [Participant 14]	
Uncanny valley	n=1	The 'uncanny valley' is an uncomfortable feeling associated with a humanoid which is incredibly lifelike (Mori, 1970); one participant reported a similar feeling with the VP
	"Bit uncanny valley, some responses seem unrealistic" [Participant 21]	

Different use	n=1	The participant thought that the VP could work well in another application; this was also mentioned in Table 52.
	"Could be very useful for exploring management decisions and clinical decision making eg in ALS or acute care" [Participant 17]	
Fun	n=1	One participant liked that the VP was fun
	"fun" [Participant 14]	
Choice	n=1	While the reasoning was not clear, one participant reported that they liked the choices, presumably those provided by the multiple-choice system
	"Choice of responses" [Participant 22]	

8.2.4. Interview Data

Despite follow up emails, no participants consented to an interview for the study.

8.3. Discussion

The participants reported finding the VP easy to access; the median and modal ratings were 'easy to access', a 4/5 on the scale. It was also reported in the free-text answer fields that the VP was easy to use (n=5) as per Table 55. This was a positive finding as it is important to ensure that any educational technology is easy to use (Volery and Lord, 2000). As well as being easy to access and use, the VP was rated as enjoyable (Figure 52) with the modal and median rating being 4/5; '1' on the scale was "not enjoyable at all" so as no participants selected this option, it can be surmised that all of the participants derived at least some enjoyment from the tool. The enjoyable nature of the VP is perhaps reflected in Figure 55 with 23 participants desiring to use the VP again, 14 of those provided improvements were made. The most common suggested improvement was related to the restrictive nature of the multiple-choice system (discussed later) and the desire for more options to choose

from when interacting with the VP. While the VP was reported as enjoyable, this enjoyment does not mean that the tool was successful at developing the skills of the participants; fun is suggested to be an important part of adult learning though, motivating attendance and engagement (Lucardie, 2014).

Just over half of the participants (n=14, 54%) suggested that it was "likely" that there would be a change in their practice as a result of using the VP. While none of the participants mentioned or described SDM specifically, two responses featured 'involving the patient'. These two coded responses were not specific about what the patient would be involved in but they could indicate a positive result; part of SDM is involving the patient in decisions about their care. The other changes suggested do not focus on or relate closely to SDM but are positive features of more general communication skills. This raises the issue of whether the VP was useful for developing SDM specifically or broader communication? The results in Table 53 and Figure 57 are quite mixed; half of the participants reported that they would change their practice. When one then reviews the changes that were suggested, many of them are not about SDM but more general communication skills. A caveat to this is that just because a participant did not mention a particular change, it does not necessarily mean that they were not thinking about it. As only 2 participants suggested changes that were perhaps loosely associated with SDM, this does not necessarily mean that the other participants were not thinking about SDM; they may not have been but they may also not have reported it. A shortcoming of this data is that it only tells us about the participants reported intentions; whether the participants said that they would change their practice or not, the effect of the VP on their actual practice is unknown and therefore so is the ultimate utility of the VP.

While there was a change in the cohorts ranking of "respecting patient choices" in a consultation, this change was not statistically significant. Part of the reason for this was that "respecting patient choices" was already ranked very highly for most of the participants prior to using the VP; perhaps this was due to the focus on consultation skills in GPR training (Cooper and Hassell, 2002). This question was an attempt to measure the priorities of the participants and whether the VP altered

them. Future research may need to be more sophisticated and aim to measure attitudes, a much more complex construct requiring more complex measurement (Eagly and Chaiken, 1993; Haidet et al., 2002). Any change also needs assessing for its durability as one-off interventions may not be sufficient for sustaining long-lasting change (Brown, 2012; Laidlaw et al., 2002). Research demonstrates that any improvements in communication skills may persist in a spiral curriculum but not after isolated interventions (Craig, 1992; Engler et al., 1981; Razavi et al., 2003; van Dalen et al., 2002). This links to the skill acquisition literature where repeated practice is required for skill development (Ericsson, 2015).

8.3.1. Restriction

As well as the VP being easy to access, easy to use and enjoyable, the format of reply was also rated highly; the median and modal ratings (n=16) were both 4/5 which corresponds to "Good". This majority view was not a consensus though as each point on the scale, from "very poor" (n=1) to "very good" (n=2), received support. The most common issue expressed with the format of reply was that of restriction; Table 50 shows 10 participant responses featuring this code. Due to the multiple-choice system, the participants could not do whatever they wanted in whatever order as they had to select from pre-defined options. This resulted in some of the participants reporting that they felt restricted, a negative feeling. The literature on VPs has made this observation, the feeling of restriction with a multiple-choice VP (Bearman, 2003; Liaw et al., 2000; Pantziaras et al., 2014). Registered nurses who used a multiple-choice VP reported that they felt restricted but that on balance, this was not too great an issue (Hurst & Marks-Maran, 2011). As the format of reply was rated largely positively by the participants in this study, it would seem that this was the case for this VP; the multiple-choice was not ideal but did not render the tool useless.

While the participants themselves did not express this, the restrictive nature of the VP could be linked to another code; "reality" (Table 55). Reality describes the VP not being true to life, not

encompassing the rich complexity of an interaction with a real human being. In reality, one can say whatever one wishes and not be confined to a few pre-defined options; thus, the restrictive nature of the multiple choice system may have resulted in a VP which did not reflect the richness of real human interaction.

Other findings perhaps linked to restriction are those concerning at what point in one's development the VP would be most useful. Figure 56 shows that there was the greatest support for the VP at an undergraduate level and the first four postgraduate years. In previous chapters, a four-step model for the structure of skill acquisition has been discussed; instruction, demonstration, practice and feedback (Maguire and Pitceathly, 2002; Rodriguez-paz et al., 2009). The practice and feedback starts with simple, low-fidelity simulations and after the assessment of competence at each stage, the complexity and fidelity of simulations increases (Miller, 1990). It is suggested that advanced learners gain little from low fidelity simulation and vice versa (Alessi, 1988). This implies that there is linear progression i.e. once one has progressed from a lower to a higher fidelity simulation, one should not regress to lower fidelity. As all of the participants had experienced interacting with SPs and real patients, one might assume that they would have found no use for the VP. The picture from the results was more nuanced than this though which shall now be elaborated upon.

The code 'experiment' describes the idea that with the VP, one can explore and try out different approaches to the consultation; 'repetition' describes the VP being used multiple times. Perhaps the combination of these two codes is why 7 participants felt the VP would be useful later in their career (5+ years post-graduation) as it offered the chance to experiment repetitively? The code 'multiple patients' is perhaps related to repetition as it suggested that one would benefit from interacting with different (virtual) patients to build skills. These ideas, experiment, repetition and multiple patients all tie together and link to skill acquisition theory; repeated practice is required to develop and refine a skill (Ericsson, 2015). Research with medical students found that returning to use SPs after interacting with real patients was a little strange and unnatural (Bokken et al., 2009). It was reported

SPs still played a role as they offered the students the chance to experiment and explore a consultation in a way that one could not with a real patient. In addition, the codes 'prompt' (Table 55) and 'specific wording' (Table 53) suggest that the VP also helped the participants learn new phrases or words which they could use in their consultations. Thus, it seems that while the VP may be most useful in the undergraduate years of education, it could still have a place later in education; repetitive practice in tandem with language prompts to support the development of expertise.

8.3.2. Feedback

There were two parts to the feedback. The first was provided autonomously by the VP and featured the patient giving some personal feedback (e.g. "I felt…") which was followed by text-based feedback. The second part involved a debrief led by NM; during this debrief, the VP was used with the whole group and NM explained the reasoning behind why certain options were more optimal than others. A debrief activity is suggested in the literature to be a useful addition to any autonomous feedback from the VP itself (Edelbring et al., 2012), although there is a lack of research as to what types of activity are most appropriate.

The autonomous feedback provided by the VP was rated highly overall and also in terms of the amount of feedback (Figure 59 and Figure 60). 21 of the 26 participants rated the feedback as 'good' or 'very good' overall which suggests the feedback was perceived as sufficient by the majority of the participants. A methodological shortcoming is that these results only apply to the automated feedback. The post-questionnaire was administered prior to the debrief, immediately after using the VP so the debrief was not evaluated in anyway. The rationale for this ordering was to mimic the method from the service evaluation and medical student workshop; if any participants had consented to an interview the debrief could have been discussed there. Thus, the results about the feedback focus solely on the automated feedback from the VP and did not touch on the debrief discussion NM led. As any debrief discussion is postulated to be an important addition to both VP

and more general simulation learning, the activity also requires evaluation (Kidd et al., 2012). This is an area future research can perhaps be focused on in isolation, the effectiveness of different debrief activities.

8.3.3. Connection Issues

The VP was used on smartphones, tablets or laptops and was accessed via a website so it thus required an internet connection. The Wi-Fi connection on the day of the workshop was not as strong as would be desired and some of the participants reported that the VP was running a little slow (Table 55). The VP had previously been used in large groups (50+) and there were no issues with internet connections in those instances. This would suggest that the fault lay with the venues connection so it is therefore not a fault of the VP per se but does still require consideration. Luckily in the case of the GPR workshop, the connection was adequate if not optimal but the VP would have been rendered useless if the internet connection had failed completely.

The Wi-Fi connection at the venue had been checked by NM a month prior to the workshop and the VP was working satisfactorily so it seems that the connection was experiencing some difficulties on that particular day. These concerns would need to be considered when planning future workshops i.e. what if the technology 'fails'? Is there a backup plan? There is a certain amount of context specificity as if one is using a VP in a previously tried and tested location, such as a university IT suite, then the internet connection would likely be robust and reliable; the case is different if one is travelling to a remote location to deliver training where the connection might be less reliable. There is the possibility of building the VP into an app rather than a website. Once downloaded the app does not require an internet connection so could be used with or without Wi-Fi. This is a potential way to resolve the connection/technical issues but comes with its own problems as the learners would have to download the app themselves prior to the session.

8.3.4. Recruitment

A sizeable section of the planned research, the interviews, did not take place due to no participants consenting. The questionnaire data provided a broad perspective of the cohorts views while the interviews purpose was to enable an in-depth evaluation of individual participants views, thus, the latter is missing. What this study has resulted in is a surface-level examination of the participants' views of the VP.

There may be several reasons why no GPR participants consented to an interview. The first considerations could be that participants were all GPRs, a group of professionals who report high rates of stress and disenfranchisement (GMC, 2018a); 41% of trainee doctors rated their work as either heavy or very heavy and 21% reported that their work left them feeling short of sleep. The report also stated that 57% of doctors in training "often" or "always" felt worn out at the end of their working day. As the participants had already used the VP, they would not have gained anything further from the interview experience, other than the potential satisfaction of contributing to an evaluation. Given the time pressures they are under it could be argued that if one is already busy and tired, the incentive of either professional or financial reward has to be sufficiently large to motivate them to consent and that incentive may not have been substantive enough in this case. One can increase the incentive by offering a financial reward or compensation. Fleming et al. (2009) paid their participants in a VP study up to $200 to participate and 8 randomly selected participants won an additional $500; the participants were from a range of professions and under- as well as postgraduates. While individuals may value money differently, this large reward could be what is required to recruit participants. A potential reason that no participants consented to an interview for this study was that they were asked to give their limited time for no substantial gain. One also has to negotiate the issue of an incentive to participate becoming either coercive or having an effect on the results, biasing the participants. This could all have implications for future research with GPRs.

8.4. Conclusions

The VP was reported to be enjoyable and easy to use. The multiple-choice caused some feelings of restriction but the data suggested that for the majority of the participants, the VP was still usable. While it was suggested that the VP may be more suitable for undergraduates or recent post-graduates, there were suggestions that the VP may still have a place with more experienced learners. It seemed that the VP could afford the opportunity for repetitive practice, exploring consultations and allowing learners to receive prompts on their choice of words or phrases.

The automated feedback from the VP was reported as appropriate overall and in terms of the quantity. This study did not evaluate the second part of the feedback, the debrief session. Future research is required to explore the utility of a post-simulation debrief/discussion.

Future research could look to interview GPRs about their experience of the VP to gain a deeper, richer insight into the VP. This study also raised questions about how research can recruit GPR participants; are incentives required, for example. Any further inquiry with GPR participants might involve a reflection upon methodology and method in terms of the practicalities of recruiting from this population.

9. Overall Discussion and Conclusions

There were three strands to the data collection for this project; a service evaluation with third-year pharmacy students, an evaluation with medical students and an evaluation with General Practice Registrars (GPRs). The purpose of this discussion chapter is to introduce the context in which the VP was created, summarise the main findings, set the findings within the evidence base, discuss the limitations and provide some potential directions for future research.

9.1. Clinical Decision-Making

Good clinical decision-making is comprised of various factors (Haynes et al., 2002); the four main components are displayed in Figure 61. Each of them is important and while one may exert a larger influence than others at any given time, they all require consideration. As an example, in a resource-poor setting, certain management options may be unavailable so the circumstantial issues predominate; a professional should still use the best available evidence to inform their decision as to which of the available options is suitable, along with the patient's preferences, and clinical expertise.

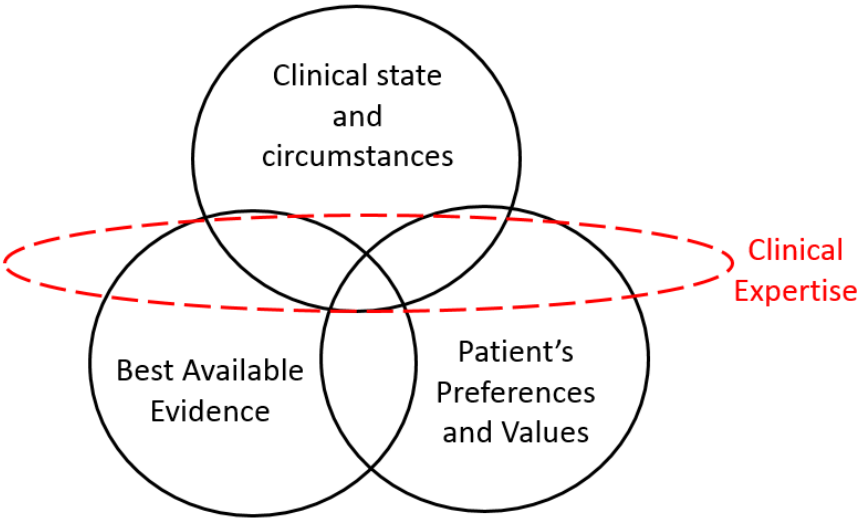

Figure 61 - Factors influencing clinical decision-making; adapted from Haynes et al., 2002

The "Best Available Evidence" section originated in 1992 with Evidence Based Medicine (EBM) (Evidence-Based Medicine Working Group, 1992). The movement was about using the highest quality evidence available to inform clinical decisions; prior to this, clinical decision making was guided largely by a professional's previous observations and education, often using pathophysiology and fundamental science as the rationale for a decision (Sackett et al., 1996). Based on appraisals of the literature evidence, clinical guidelines were written which made population-level recommendations about treatment options for individual conditions. These guidelines usually encompassed consideration of financial cost and value for money. Barber touches on this component with a description of "minimising costs" and is an important factor (Barber, 1995). Research shows that these population-level clinical guidelines and local quality improvement frameworks have led to improvements in outcomes for patients, including mortality rates (Gabel et al., 2018; Grimshaw and Russell, 1993); this is a positive outcome for EBM.

The challenge for clinical practice is to integrate these population-level recommendations, circumstantial considerations and the patient's preferences in order to arrive at a decision for the individual patient (Haynes et al., 2002). While Sackett et al.'s seminal 1996 editorial on EBM touches

on individual decision making, many suggest that EBM has actually resulted in the dogmatic application of guidelines to patients with little to no individualisation (Greenhalgh et al., 2014; McCartney et al., 2016). In response to this, SDM emerged as a process by which a patient and a professional can both share information to arrive at a decision that is in line with the patients preferences and values, but also supported by the best available evidence (Charles et al., 1997; Coulter and Collins, 2011).

Sharing the decision-making process with a patient in a consultation is a skill of communication (Bensing, 2000; Jack et al., 2018; Maskrey and Gordon, 2017). To acquire and develop a skill requires instruction, demonstration, practice and feedback (Ericsson, 2004; Kurtz et al., 2005; Maguire and Pitcheathly, 2002).

Research suggests that undergraduate courses have focused to a greater extent on technical knowledge rather than emotional skills like communication; in 2010, Hargie et al. found that the amount of time spent on communication skills in UK medical schools was between 0.15% and 5.5% of the curriculum. This is an increase from the latter half of the 20th century where there was less focus on this area of the curriculum (Hargie et al., 1998; Whitehouse, 1991). The literature also suggests that the development of SDM specifically is even less prevalent in both medical and pharmacy courses and in some cases, potentially non-existent (Durand et al., 2018; Oswald, 2018); a lack of data makes establishing a clear picture difficult. Postgraduate training is variable with different medical specialties devoting varying amounts of time to communication skills; while general practice and psychiatry have typically benefited from greater communication skills education, other specialities have received very little (Cooper and Hassell, 2002; Dacre et al., 2004). In post-registration pharmacy education, there is currently no formal requirement for communication skills training (GPhC, 2018b; HEE, 2018).

If there is a lack of SDM and communication skills training, it is perhaps not surprising that SDM is not as prevalent in practice as it ought to be (Couet et al., 2015; Santema et al., 2017 Stubenrouch et al.,

2017). In the 2017 results of the CQC annual inpatient survey, 44% of patients reported that they were not involved in decisions about their care as much as they would like to be. Not only is SDM not occurring to an appropriate extent, but professionals have been reported to misunderstand what SDM is. The MAGIC programme (Joseph-Williams et al., 2017) found a discrepancy between some professionals' perceptions of their consultations and the reality of what they were doing; they thought they were engaging in SDM, when in fact they were not. Other research has made similar findings with doctors reporting that they do SDM but the results showed that they did not understand what was involved (Hamann et al., 2012). This links to educational theory, particularly the four stage cycle of competence (Flower, 1999; Howell, 1982); one element of this describes how one can be 'unconsciously competent', using system 1 thinking to automatically carry out a process (Kahneman, 2003). From this stage in the cycle, one can move to become 'unconsciously incompetent'; a problematic position as one is automatically carrying out the process but unaware that one is doing so incorrectly. This is perhaps why physicians are noted to struggle to identify their own development needs (Davis et al., 2006); the adage that they do not know what they don't know.

Thus, the ability to share decisions with a patient about their care and individualise population level guidelines requires development; since this is a skill, the previously mentioned stages of instruction, demonstration, practice and feedback are required (Ericsson, 2004; Kurtz et al., 2005; Maguire and Pitcheathly, 2002). Rodriguez-Paz et al. (2009) propose a structure for skill development within a medical curriculum whereby the learner starts with the acquisition of the basic knowledge, the instruction phase of learning. After some demonstration, a learner uses different simulations to practice, acquire and hone their skills. Rodriguez-Paz et al. suggest starting with simpler, lower fidelity simulations before progressing to higher fidelity ones and finally, real patients. At each stage, one practices repeatedly until they become unconsciously competent, utilising system 1 thinking (Flower, 1999; Kahneman, 2003). After this, the learner progresses to the next level of fidelity and so on; this process is underlined by the assessment of competence at each stage as per Millers pyramid

(Miller, 1990). Increasing simulation fidelity as the learners' skills develop is recommended by guidance on simulation education (AAMC, 2007).

9.2. Aims

The main aim of this thesis was to;

- To evaluate the use of a virtual patient for developing the shared decision-making skills of undergraduate medical and pharmacy students, and General Practice Registrars.

The secondary aims were;

- To evaluate students and General Practice registrars' perceptions of at which stages of development the virtual patient for shared decision-making is appropriate.

- To evaluate students' and General Practice registrars views of the multiple-choice format for the virtual patient.

- To evaluate student's self-reported treatment priorities within a clinical consultation, immediately before and after exposure to the virtual patient.

- To evaluate the views of students and GPRs towards the style of feedback delivery from the virtual patient.

9.3. Summary of the Main Findings

9.3.1. Accessibility and Enjoyment

Generally, the participants in all three stands – pharmacy students, medical students and GP registrars – reported that the VP was easy to access; the modal rating was 'accessible' for the medical students and 'very accessible' for the pharmacy students and GPRs. Content analysis of the free-text fields showed participants responding that the VP was easy to use. The results of all three strands also suggested that the participants enjoyed using the VP. Option 1 on the response scale was "not enjoyable at all" and no single participant selected this option; this suggests that all of the participants reported deriving at least some enjoyment from the VP.

In all three strands of the project, there was a reported desire to use the VP again. For the service evaluation, the majority of the pharmacy undergraduates reported that they desired to use the VP again without improvements. For the medical students and GPRs, the modal rating was that they desired to use it again but with improvements. The most common suggestion for improvement in all three strands was related to 'restriction'; this described the restrictive nature of the multiple-choice system. Participants suggested that the system of interaction limited what they could say and in which directions they could take a consultation. It was suggested that were it to be opened up with more options or for the learner to type their chosen response, the VP could have been improved.

The VP was reported by the participants to be accessible and easy to use. In addition to this, the VP was suggested to be enjoyable to use with the majority of the participants also desiring to use the VP again, some with and some without improvements. These are proposed as positive findings for the VP.

9.3.2. Changes

9.3.2.1. Change in Practice

Designing interventions that learners find enjoyable and wish to use again can be an important aim; an intervention also needs to develop the learners in some way. It was reported by the participants in all three strands that it was "likely" there would be changes in their practice; while not every participant reported it was "likely" there would be changes in their practice, this was the modal suggestion. When evaluating an intervention, it is also important that any changes that participants make are positive ones. Many of the changes suggested by the participants related to involving the patient more or placing them at the centre of their care. While no participant used the phrase 'shared decision-making', many of their responses described the concepts involved in SDM and were broadly positive attitudes that would want to be encouraged. Thus, the participants suggested that they thought it was likely that they would change their practice broadly in line with the aims of the VP; this is a positive outcome.

9.3.2.2. Priorities in a Consultation

A second way in which a change was to be evaluated was a pre and post-VP measurement of the participants self-reported priorities within a consultation. Both before and after using the VP the participants were asked to rank their priorities in a consultation, taken from Barber's prescribing priorities (1995); maximising effectiveness, minimising risk, minimising costs and respecting patient choices. For both the pharmacy and the medical student evaluations, the rank position of "respecting patient choices" changed significantly ($p=0.026$ and $p=0.038$ respectively); in both instances the median position shifted from 2nd to 1st when comparing pre- and post-VP. While there was a statistically significant change in two of the strands, there was not a change in the third strand, the

GPRs (p=0.499). One reason for this is that “respecting patient choices” was already ranked highly; the modal rank was 1st with the median tied between 2nd and 1st prior to using the VP.

Aim 4 was: To evaluate students’ and GPRs’ self-reported treatment priorities within a clinical consultation, before and after exposure to the virtual patient. The results show that there was a statistically significant change in the rank position of “respecting patient choices” with the pharmacy and medical undergraduates. The rank position of “respecting patient choices” did not change in a statistically significant fashion for the GPRs.

9.3.3. Feedback

Aim 5 of the project was to explore the views of students and GPRs towards the feedback delivered by the virtual patient. There was a common view expressed towards the format and the quantity of the feedback provided autonomously by the VP. In all three strands of data collection, the median ratings for the format and the quantity of the feedback were the same; “good” (4/5) for the former and “Right amount” for the latter. For all of the strands of this project, it seemed the participants were content with the format and amount of feedback. With regards to content, the free-text answers, particularly those reported in chapters 6 and 7, suggested that the content was vague and not constructive. It was suggested that the feedback told the participants where they had made less optimal choices but did not inform them of how to improve. This could mean that while the feedback was delivered appropriately and in the right quantity, it was not as useful as it could have been for the participants.

One key finding from the interview transcripts was participants’ desire for a debrief activity. The data suggested that the participants still had further questions and points that they wanted to discuss after receiving the feedback from the VP; the automated VP feedback did not meet all the participants’ feedback needs or desires in isolation. This could have been related to the previous

finding, that the automated feedback was a little vague but some of the participants suggested that a post-VP discussion of some description may have been useful.

9.3.4. System of Interaction and Place in Learning

As the VP was a multiple-choice system, at each stage the participants could choose what to say from pre-determined options. The data suggested that some of these options included words or phrases that the participants may not have thought of or considered. This prompted the participants with suggestions of what they could choose to say. The multiple-choice thus provided support if a participant was not sure what to say and was suggested as a form of practice to be used early in one's development. The VP allowed the participants to focus on the content of their speech and not have to worry about combing body language and tone.

Some participants reported that by using the VP prior to interactions with real patients or SPs, they thought they would learn what phrases to use and how to order a consultation. Then, when they encountered real people, they could focus on their body language, tone and other issues as the content of the speech would have already been developed. Thus, the VP could help learners 'bridge' from the theoretically focused early stages of education to the patient interaction later on.

The prompts the multiple-choice system offered were suggested to be useful for less experienced consulters. In all three strands of the project, the participants reported that they thought this system of interaction was restrictive, not allowing one to converse with the patient in a natural way. Many of the participants thought that it would not have been restrictive when they were earlier in their development though, as they would not have developed their own consultation styles. This was a further reason that the participants reported favouring the use of the VP earlier in their development; the multiple-choice system would usefully prompt less experienced consulters but restrict more experienced ones.

The data in chapters 6 and 7 suggested that routine, real-world practice does not allow one to practice in a way that is safe and repeatable. The participants reported that because the VP did offer this, a safe and repeatable way to explore a consultation, it could have a role later in the curriculum; this role was trying out new techniques and pathways in a consultation. One could see a further role for the VP in allowing more experienced learners a chance to experiment with different techniques without the risk of harming a real patient. When the questionnaire data is viewed alongside these findings, this further role in the curriculum has less support from all three groups of participants. The number of participants suggesting that the VP would be useful 5+ years post-graduation was much lower than for the stages before this. This could suggest that the primary role of the VP was early in the acquisition of skills and a secondary role was for more experienced professionals to experiment and explore in a low-risk setting.

9.4. Relating the Findings to the Literature

9.4.1. Acceptance

When evaluating the VP, it was a positive outcome that the participants found the VP to be easy and enjoyable to use. The enjoyment derived from the VP is also something evaluations of other VPs have found (Pantziaras et al., 2014) as well as ease of use (Kleinert et al., 2015). While the evaluations of this VP did not explore why it was enjoyable, the literature suggests that it may be due to the interactive and immersive nature, particularly when compared to paper-based cases (Johnsen et al., 2005; Pantziaras et al., 2012). Not only is this a positive finding in its own right, but enjoyment is suggested to be important in adult learning as it can increase engagement and also motivate attendance to sessions (Lucardie, 2014). A further positive finding was that the participants desired to use the VP again, either as it stood or with improvements. This could be further evidence that the

participants enjoyed using the VP and/or that it was useful for the development; if one wishes to repeat an experience then it could be surmised that they had gotten something from it.

9.4.2. Changes in Practice

While it was positive that the participants generally found the VP easy and enjoyable to use, it was also important that the VP benefited their professional development in some way. The content analysis showed some of the changes that the participants reported they would make but most of these suggestions were very nebulous. As an example, "Positive, listening and involving patient more" (GPR participant 4) seemed to describe positive changes; if one is going to participate in SDM with a patient, one would have to listen to the patient and involve them in the process. The description is quite vague though; what exactly does "involving patient more" mean? Research shows that professionals have used partnership talk as a way to maintain their own agenda (Robertson et al., 2011; Upton et al., 2011); this ostensibly involves the patient but is not SDM. With a few exceptions, such as the code "Specific wording", most of the suggested changes were a broad change in attitude or approach to a consultation rather than a specific change in practice. It is still proposed that this a positive finding; after an interaction with the VP the modal number of participants suggested that it was "likely" they would change their practice seemingly in line with some of the ideals of SDM.

A second way change was evaluated was the ranking of four priorities within a consultation. For both the pharmacy and medical student evaluations, "respecting patient choices" was ranked more highly after using the VP than before. This was statistically significant ($p=0.026$ and $p=0.038$ respectively). The introduction to this chapter outlined that good clinical decision-making should incorporate a patient's preferences and values, best available evidence, circumstantial issues and clinical expertise (Haynes et al., 2002). It also explored the concerns that clinicians might be overlooking the importance of the patient's values and preferences and dogmatically applying population-level

guidelines to individuals instead (Greenhalgh et al., 2014; McCartney et al., 2016). An important part of SDM is the professional surrendering power to respect the patient as a partner in the decision making process; failing to respect a patient's choices is identified as a problem for SDM (Hamann et al., 2012; Towle and Godolphin, 1999). Thus it was viewed positively that the undergraduates ranked "respecting patient choices" more highly after using the VP.

9.4.3. Interaction with the Patient

9.4.3.1. Bridge

The VP was designed as a tool to enable participants to practice their skills and receive feedback; it was not designed to replace other methods but as a complementary technique. The results from the pharmacy and medical students suggested that the VP may have a place relatively early in learning. This is when learners have completed the instruction and demonstration phases and are moving on to practice for the first time (Kurtz et al., 2005; Maguire and Pitcheathly, 2002; Rodriguez-Paz et al., 2009). The medical and pharmacy student results suggested this was because the body language and tone of voice was missing from the VP interaction and was thus of lower fidelity. A second reason why the VP was perhaps useful in the early stages of practice was the prompts from the multiple-choice system providing support to the learners as it suggested words or phrases one could use. After practicing with this system, one could then progress to practicing with SPs and real patients. The literature also suggests that the content of speech is a particular aspect of communication that a VP could develop which includes the words and phrases used as well as the order (Dickerson et al., 2006; Raij et al., 2007). SPs are proposed as more suitable for developing a learner's body language after having used a VP (Deladisma et al., 2007). Research has previously suggested that VPs may be used before SPs or real patients as VPs are of a lower fidelity than SPs or real patients (Sunnqvist et

al., 2016); using VPs prior to SPs can lead to increased confidence in the subsequent interactions (Kleinsmith et al., 2015).

An analogy used in chapter 6 was that of a child learning to ride a bicycle. When first starting out, a child may have stabilisers attached to their bike; in the analogy, this is the VP. The stabilisers allow a child to learn how to pedal, brake and steer the bicycle without having to focus on balance as well. As they develop and become more skilled, the stabilisers are removed and the child can practice riding without the guide, combing the skills they have learnt with the addition of balance. While the ultimate aim is to ride without stabilisers, they are still a useful step in learning how to ride a conventional bicycle. Therefore, the VP could be a useful initial step in practicing to acquire the communication skills necessary for SDM. What if a learner has already been practicing and using communication skills with real patients, would they then return to using a VP? Once a person can ride a bicycle without stabilisers, they would not ordinarily return to using them. Perhaps the VP is best suited to the earlier stages of skill acquisition, after the instruction and demonstration stages; this may be due to the multiple-choice system acting as a support for learners practicing SDM in a consultation for the first time but becoming restrictive as one's experience increases. Thus, when addressing aims 2 and 3 of the project, the outcomes were intertwined with one another; the multiple-choice system was one reason why the VP may be best suited to a particular place in the development of expertise.

Some VP researchers have suggested that efforts should be made to improve the phrase-recognition of free-text VPs as they are likely to be superior to multiple-choice VPs (Schittek Janda et al., 2004). The findings from chapter 6 and 7 would seem to examine this position in a new light; multiple-choice offers something beyond convenience and ease of use which free-text does not i.e. the prompts from the predetermined options. Other VP researchers also suggest that multiple-choice VPs may be more suitable for less experienced learners (Carnell et al., 2015; Huwendiek et al.,

2009b). Therefore, the suggestion that improvements in free-text may lead to it superseding multiple-choice may not be true in all contexts.

9.4.3.2. Experienced Consulters

Previous research has found that once a learner has started to interact with real patients, it can feel strange to revert back to using SPs (Bokken et al., 2009). There was an important caveat to this result though; one cannot experiment in a consultation with a real patient but this is possible with an SP. Thus, there is evidence that regressing back down the fidelity continuum can be advantageous as it allows one to practice in a way that does not affect a real patient. While the study looked at SPs, could the same be true of VPs? This may be particularly important when one considers that currently, many experienced professionals are not consulting in a way that is in line with the ideals of SDM (Couet et al., 2015; CQC, 2018; Santema et al., 2017 Stubenrouch et al., 2017). Some professionals are also unaware of what SDM involves, even if they think they engage in SDM (Hamann et al., 2012; Joseph-Williams et al., 2017); this alludes to unconscious incompetence, where the professional does not realise that what they are doing is not in line with best practice (Flower, 1999; Howell, 1982). McCartney and colleagues (2016) suggest that some experienced consulters may consequently have to change their approach to consultations which requires re-education. Related to this could be the issue of medical overconfidence which is concerned with doctors being excessively confident in their abilities, often in relation to diagnostic accuracy (Berner and Graber, 2008; Cassam, 2017).

It has already been suggested that the multiple-choice system might provide useful prompts for less experienced consulters but be restrictive for those more experienced. Perhaps the reason some of the participants could not choose their desired path in the VP consultation was because they were not used to consulting optimally. Overconfidence and unconscious incompetence might then lead them to suggest the tool was restrictive rather than considering, or even realising, that their desired

choice was perhaps less optimal, hence why it was unavailable. If some professionals are consulting in a way that is not considered optimal, and are perhaps overly confident in their abilities, they will require some re-education (McCartney et al., 2016). If many experienced consulters are not consulting optimally, they too could perhaps benefit from the multiple-choice prompts to suggest new phrases or approaches that they could be using. The VP can be used repetitively allowing one to practice multiple times and contribute towards the formation of new habits (Ericsson, 2004); this could help embed a new style of consultation as system 1 thinking (Kahneman, 2003). As the VP allowed users to learn suggested phrases and experiment with new approaches for a consultation, it seems that it could be a useful educational tool for helping with improving experienced professionals' abilities to engage in SDM. Further work could explore this further.

9.4.4. Feedback and Theoretical Considerations

As is outlined in the four stage process of skill acquisition, feedback is an important step. While the automated feedback was delivered appropriately and in sufficient quantity, the idea of a further, extended feedback activity was constructed.

The VP literature features only a few papers concerned with post-VP debriefs or discussions. Edelbring and colleagues (2012) trialled four different debrief sessions; a student led discussion, a facilitator led discussion, a mix of the two and a no follow-up group. They found that a more in-depth follow up session was perceived as useful by the students with the mixed follow-up suggested as the most useful. The importance of a post-simulation debrief is also identified in the wider simulation literature (Dreifuerst, 2009; Husebø et al., 2015). So why is an extended feedback discussion of importance? Knowles' (1980, pp43-44) conceptualisation of the adult learner includes a need to link and incorporate new learning within the framework of prior experiences. Both pharmacy and medicine degrees in the UK include practice based learning; this involves learning in real-world practice. It could be possible that the participants in this project valued a debrief to help link their

real-world and simulated experiences. For the evaluation with pharmacy undergraduates, a recommendation was made to incorporate an extended feedback discussion in the next year's workshop; this alteration would require further evaluation in future. Furthermore, the ideal composition of such an activity is unknown so this too requires additional inquiry.

It is suggested that the Kolb theory of experiential learning and reflective practice is a suitable base for VP and simulation education (Kaakinen and Arwood, 2009; Kleinert et al., 2016; Kolb and Kolb, 2005; Pantziaras et al., 2015). When used in simulation education, the theory states that the simulation provides the concrete experience to start the cycle. All of the learning, the reflective observation, abstract conceptualisation and active experimentation occur after the initial simulation (Zigmont et al., 2011). The prompts that the multiple-choice system provided would suggest that at least some of the learning occurred during the simulation with the VP. Therefore, taking Zigmont's interpretation, the Kolb theory did not perhaps apply very well to this VP. A more appropriate theory could be Schön's theory of reflection (1987); Schön differentiates between reflection "in" action and reflection "on" action. The latter concept entails reflecting after an event has occurred, much like the Kolb theory, but the former involves reflecting while the simulation is still occurring. Some of the interview participants suggested that during the simulation, the prompts caused them to think about their responses and what they might choose; this suggested a certain degree of reflection in action. Schön's theory of reflection thus seems a theory that is potentially suitable for the VP.

Reflective practice could be incorporated into a post-VP debrief. de la Croix and Veen (2018) have expressed concerns that reflective practice, a potentially useful endeavour, can be reduced to a checklist-style process that learners follow without engagement. They suggest that students need to be actively involved in critically reflecting rather than becoming, as they describe it, "reflective zombies". If a workshop with a VP is based on a theory of reflective practice, this could inform the design of any post-VP extended feedback activity, but it needs to be enacted in a meaningful way. As an example, Husebø et al. (2015) used the Gibbs cycle to link Kolb with educational practice to help

students reflect on their simulated experience (Healey and Jenkins, 2000). Thus, the theoretical foundation, multiple-choice design, format of delivery and the stage in the curriculum are all linked when considering the VP.

9.5. Limitations

9.5.1. Technological Issues

While the VP was found to be easy to use and accessible, there were some issues with internet connectivity. During the workshop with the GPRs, the issue became apparent. During the session, the Wi-Fi connection was not optimal meaning that the VP took a while to load and was reported as clunky to use. This did not happen in the first two workshops, with the pharmacy and medical students; this suggests that the fault was not with the VP per se but with the Wi-Fi connection. One must therefore consider the logistical factors to using a VP e.g. is there a robust and reliable internet connection at the venue? If the internet connection fails during a session, is there a backup plan? The VP can be downloaded to a computer or phone so no internet access is required but then the issue of the processing

9.5.2. Priorities in a Consultation

The pharmacy and medical student participants showed a statistically significant change in the rank position of “respecting patient choices” when comparing pre- and post-VP. This was a desired positive finding. There are caveats to this change which have been discussed within the previous chapters. In brief, they firstly include the notion that the longevity of any change is unknown; the literature would suggest that one-off interventions are unlikely to lead to sustained change (Brown, 2012; Laidlaw et al., 2002). Pantziaras et al. (2015) found that the beneficial effect on knowledge gain

that a VP delivered was not sustained 3 months later. Longitudinal development within a spiral curriculum is likely to be required for any change to be maintained (Craig, 1992; Engler et al., 1981; Razavi et al., 2003). Secondly, the effect of the change on real patient consultations is unknown; while the shift in priorities for the undergraduates is suggested as positive, no measurement of clinical practice was undertaken. Thirdly, the priorities have been taken from their original context of the features of good prescribing and applied to consultations (Barber, 1995); these priorities were not designed as a hierarchy but a set of criteria one should aim to meet in all prescribing decisions. Fourthly, "respecting patient choices" is not synonymous with SDM; if a participant rated "respecting patient choices" more highly after using the VP, it does not necessarily mean that they understand, value or intend to engage in SDM.

The GPRs did not show a statistically significant change in their consultation priorities. The measure used, the ranking of Barbers prescribing priorities, was perhaps too simplistic and insufficiently nuanced. An attitude was not measured as part of this project, opting instead for a simpler measure of priorities; an "attitude" is a complex construct which requires a complex, nuanced measurement (Eagly and Chaiken, 1993; Haidet et al., 2002). Future research could look to explore how the VP affects attitudes, potentially evaluating any change over time.

9.5.3. Level of Evaluation

The Kirkpatrick model details four levels of evaluation for an educational program (Kirkpatrick and Kirkpatrick, 2006); reaction, learning, behaviour and results. The methodology employed in this work was based mainly on level 1 (reaction) with a start on level 2 (learning). While the participants in all of the groups suggested they would make broadly positive changes to their practice, there was no evaluation of behaviour or results so the effects of the VP on the participants' practice is unknown. Kirkpatrick and Kirkpatrick (2006) suggest that one should start at the 'bottom' of their model and work up to the higher levels. The fact that no evidence was gathered about the participants' practice

is therefore not a shortcoming of the project; the evaluations simply had different aims. Future work can move on to the higher levels of the model, as is suggested by Kirkpatrick and Kirkpatrick. Evaluating simulated consultations might be an example of a level 3 (behaviour) measurement with real-world consultations being a level 4 (results) measure. Future work could build on this thesis and test whether the VP resulted in improvements in patient consultations.

9.5.4. Experienced Consulters

While the VP was suggested to be useful for less experienced consulters, the use of the VP with more experienced consulters was a point of discussion. It was postulated that a potential reason some of the participants found the VP to be restrictive was because they were not used to conducting an SDM consultation; they were perhaps unconsciously incompetent. For the more experienced professionals, the prompt function could perhaps prove useful in helping to re-educate them by suggesting new phrases or directions in a consultation. This is currently a tentative suggestion. To further explore the idea, one could investigate the restriction issue; by looking at which specific options the participants thought were missing, one could analyse whether these unavailable options were indeed suitable. If it was found that missing options were appropriate ones, then the VP may well have been restrictive; not allowing the participants to consult in an appropriate way. But, if the options that the participants desired were not prudent choices for the context of the consultation, then perhaps the restriction was not the chief issue; instead, the participants were not consulting optimally and did not realise this. As none of the participants routes through the VP consultation were recorded, both those chosen and those desired, this is currently unknown. Further evaluation could explore this issue. Secondly, the role of the VP with more experienced professionals is still unclear. This is due to the missing interview data for the GPRs. The suggestions in the above paragraph and section 9.4.3.2 are thus very tentative. The prompts could well be useful for aiding in the re-education of experienced consulters who are not currently practicing SDM; it could also be

true that the multiple-choice system was too restrictive and did not encompass each learner's individual consultation style. Without further inquiry, it is unknown which, if either, of these explanations is the accurate.

The three evaluations included participants from the pharmacy and medical professions. Nurses, particularly those working in advanced roles in primary care, were a professional group which could have been a suitable target for the VP. They were not included in the evaluations for two reasons. Firstly, the existing professional networks available to Simon and his supervisory team were pharmacy and medicine based. Secondly, there is a limited amount of work that one is able to complete within a thesis. A second group who were not included were postgraduate pharmacists. This was due to a difficulty accessing this group; Keele University's postgraduate pharmacy courses are all distance-learning based. Thus, these pharmacists do not attend workshops within which the VP could have been evaluated. Future work could evaluate the VP with these groups.

9.5.5. The Researcher

All of the interviews for this project were conducted by the researcher, Simon Jacklin, as was the analysis of all the data. At the time of the interviews (2018) Simon was a pharmacist registered to practice in Great Britain since 2016 with experience of both hospital and community practice. Prior to starting this project, Simon had two episodes of exposure to virtual patients; once in the first year of his undergraduate studies, and the second in a third-year examination. The first of these experiences was not very positive as the technology was clunky and difficult to use; the second experience was better and more enjoyable. This mix of experiences led to a fence-sitting situation; Simon had had mixed experiences and hence entered the project with conflicting views about virtual patients.

As the lead designer for the VP, Simon had a very strong potential bias. It took around nine months to complete the design and build of the VP so he had invested a great deal of time and effort in the

process. This could clearly affect the way he designed and analysed the project and results. It could have led to the promotion of findings expressing positive ideas about the VP or suppression of any negative ones. Being tightly bound to the creation of a piece of technology, one may formulate conscious or subconscious thoughts about it which could then be overlaid onto the data i.e. finding things in the data because they were being sought out. Boyatzis (1998) describes this as 'projection'. This is part of the reason that quotes and basic thematic maps were used; to provide evidence as to why the themes were established as they were. Subjectivity is in the nature of qualitative work and thematic analysis; Braun and Clarke use the analogy of a sculptor who finds what he will in a section of marble rather than an archaeologist searching for a single thing that lies in wait (2013). This is part of reflexivity and the nature of qualitative work, that a researcher is the instrument of the findings (Patton, 2002).

9.6. Reflexivity and Reflection

9.6.1. Interview Transcripts

Reflexivity is an important part of high-quality, rigorous qualitative work. It is linked to reflection and involves a researcher thinking about their relationship to the research in order to improve it (Finlay, 2008; McKay et al., 2008). It is not a process that is applied to quantitative, positivist research which was Simon's background. Prior to his PhD, Simon's experience was predominantly laboratory based, with a Masters project in the field of neuroscience/cell biology and practical experience in a laboratory researching the pathology of degenerative neuromuscular disorders. As a consequence, he initially thought that reflexivity might be a process or calculation one follows to test the results in some way. As Simon became more comfortable with the notion of reflexivity, reflecting on his professional history and its effect on his views of research, he appreciated that reflexivity is not a single test or process that can be followed step by step. There are "many routes that can be

followed" and ways that it can be carried out (McKay et al., 2008). Simon had to be reflexive about reflexivity.

Finlay states that however reflexivity is achieved or undertaken, it should help improve the work (Finlay, 2008). When thinking reflexively, it should aid in the analysis or interpretation of the results. One area where being reflexive improved the quality of the analysis was the thematic analysis (TA) of the interview transcripts. Initially, Simon analysed the data which resulted in themes that summarised what was discussed in the transcripts; these were not true themes but summaries of the areas of discussion. Themes require a central organising concept which tells one something meaningful about the data. As an example, "multiple-choice" was an initial theme for the service evaluation. This 'theme' did not tell a reader anything other than the topic areas that were featured in the transcripts; Braun and Clarke describe this as a 'feature' and not a 'theme' (Braun and Clarke, 2013).

In the film "The Barefoot Contessa", Humphrey Bogart's character makes the following comment when discussing film scripts; "A script has to make sense, and life doesn't" (Haum, 1980, p293). While not taken from academic literature, this quote was a spark in Simon's reflexive process as it caused him to realise why he had struggled to analyse the interview data. Due to his professional history, Simon thought that there would be a 'truth' to be found within the text which would be clearly presented. The transcripts were of real conversation so they contained digression and discursion; the participants did not speak like a film script where the 'truth' of the matter is presented clearly for one to understand. This relates to the sculptor/archaeologist analogy from Braun and Clarke used in a previous section (2013). After seeing the quote at the start of this paragraph and reflecting upon it, Simon realised that he had approached the TA as an archaeologist, expecting to find a clear truth in the transcripts that was waiting to be discovered. In reality, the TA had to be approached like a sculptor; the block of material (the data) provides some boundaries and limits to what can be found but it is acknowledged that different researchers will find different

themes within the data (Braun and Clarke, 2013). After this process of reflection, Simon re-analysed the interview data to result in the final themes.

9.6.2. Effect of the Researcher on the Findings

The notion of a post-VP extended feedback activity was both surprising and not readily-realised by Simon; upon reflection, this was perhaps affected by Simon's status as an educator. In a text on reflexivity, Sumsion discusses how her status as an occupational therapist affected her approach and reaction to her emerging results (McKay et al., 2008). Rather than being fixed, Simon's status as an educator changed across the course of the project. At the outset, Simon had no experience of practicing as an educator in Higher Education, aside from facilitating placements in a hospital setting. During the early and middle parts of the project, Simon acquired more responsibility for the education of students, starting with teaching in single sessions, moving on to designing sessions and close to the end of the project, starting as an academic member of staff and designing undergraduate and postgraduate modules. This change in the positionality of the researcher affected the way the VP as an educational tool was viewed. Initially, the VP was regarded as an enclosed educational unit; the VP was designed to provide the practice and feedback necessary for the learners and it was thought that it would not require much educator input, particularly afterwards. This is also how much of the literature on VPs views the situation; not viewing the technology from a broad perspective but focusing purely on the technology itself (Cook and Triola, 2009).

As Simon's educational experience and expertise grew during the PhD, he began to understand the need for integrated curriculums and the importance of session design. This lead to a re-examination of the data and an understanding that while the feedback the VP gave autonomously, both the patient and text-based feedback, was reported as appropriate by the majority of the participants in each of three strands, it was not complete. The inquiry and the analysis of the data initially focused on what the participants had said about the feedback that was included; the patient and text-based

feedback. What the analysis did not focus on was the feedback that was missing; a post-VP extended feedback activity. Hence, after a period of reflection on the part of the researcher, the data was re-examined and the importance of a post-VP debrief was constructed.

9.7. Future Direction

Evaluations of learning activities can be split into four different levels (Kirkpatrick and Kirkpatrick, 2006); level 1 (reaction) and 2 (learning) evaluations were undertaken for each strand of this project. As the results were promising, future work could build on this thesis to evaluate whether the VP led to any change in behaviour and results; level 3 and 4 evaluations. This could involve measuring learner performance with SPs (behaviour) or real patients in clinical practice (results). Not only could future evaluations be focused on the higher levels of behaviour and results, they could also explore the longevity of any change.

The results suggested that an extended feedback activity could be a useful addition to a VP workshop; for the pharmacy undergraduates, which was a service evaluation, the recommendation was made that the next year's workshop should incorporate a debrief activity. It is currently unclear how such an activity should be structured though. There a few suggestions from the literature, combing both facilitator and learner-led elements (Edelbring et al., 2012), but there is a dearth of research in this area. Thus, a future avenue to explore with the VP is how an extended feedback activity should be structured and whether it is beneficial.

The use of the multiple-choice system with more experienced learners was an issue raised in the evaluation; was it too restrictive, as some participants in all strands suggested, or would they benefit from the prompts it offered? It has been suggested here that a multiple-choice VP could prompt more experienced learners with more optimal phrasing, thus helping with re-education. As the GPR data was incomplete, the question was not explored to the desired extent. Therefore, this warrants

further evaluation. Future work could focus on the use of the VP with experienced consulters, such as pharmacists, nurses and GP registrars, to evaluate the utility of the multiple-choice system with these professionals.

9.7.1. Technological Change and the Role of VPs

In 1989, Sir Tim Berners-Lee proposed the World Wide Web (W3) for the purpose of linking supercomputers around the globe (Berners-Lee, 1989); at the time of writing, this was only 30 years ago. The W3 has changed the way human-beings work, shop and live, particularly in the Western world. Moore's law, proposed initially in the 1960s but refined in the 1970s (Moore, 1965, 1975), stated that "the number of transistors on a microprocessor chip will double every two years or so — which has generally meant that the chip's performance will, too" (Waldrop, 2016). While prophecy can be a risky endeavour, it is likely that technological innovation will continue and affect VPs in turn. What form will VPs take in the future?

The idea that the VP was restrictive and lacked the realness of a human interaction was raised in all three of the evaluations. Some participants suggested a free-text VP might be a better system of interaction; free-text VPs allow one to type in their chosen question or comment to interact with the VP. Natural Language Processors (NLP) are what enable a free-text VP to "understand" what a learner has said (Nirenburg et al., 2009). Relatively recently, Google showcased an example of their artificial intelligence technology named "Duplex" (Leviathan and Matias, 2018); while not a rigorous scientific study by any means, it showed a computer's ability to hold a "conversation", with the human party involved seemingly unaware that they were talking to a computer. Google themselves concede that this technology is still in development and does not yet work robustly but it gives a hint as to where it may lead.

Word and phrase recognition is noted as an issue for free-text VPs (Deladisma et al., 2008; Foster et al., 2015). If NLP technology can improve this, will free-text VPs replace multiple-choice VPs,

potentially solving the issue of restriction? There are some who suggest this to be the case (Schittek Janda et al., 2004). The evaluation results though suggest that this may not be the case as a key benefit of the multiple-choice system was that it prompted the learners with suggested phrases. If a free-text VP were to be used, learners may miss these helpful suggestions. This could be a particular issue for those practicing a skill for the first time or those more experienced with sub-optimal consulting habits; for both of these groups, the prompts might be a useful part of their learning. While these evaluations show that the multiple-choice VP provided some particular advantages, a free-text VP was not evaluated. Thus, future work could evaluate a free-text VP to explore the advantages and disadvantages of such a system.

Will improved VPs replace SPs and real patients in education? Cook and Triola (2009) pose this question about the balance between VPs and other methods in the curriculum. How does the VP work alongside these other methods? There are pros and cons of each so using them purposefully is important. The literature would suggest that SPs will still be needed (Bearman, 2003; Cook and Triola, 2009; Dickerson et al., 2006); no matter how realistic, if a learner knows something is not real then their reactions and feelings towards it could be different. The fear and nervousness of an interaction with a real person, whom one knows to be 'real', could be missing. Furthermore, VPs do not tend to encompass the body language of the learner either but there are some groups exploring this idea (Raij et al., 2007); visual and movement tracking could be used to record the learner's body language but this technology is currently at an embryonic stage. Another factor to consider is standardisation. Some of the undergraduate participants touched on the idea that SPs are not standardised. Because SPs are humans, their behaviour can change with each interaction whereas the VP was the same time after time. The participants suggested that this meant they could repetitively explore a consultation with the VP in a way that they could not with an SP. VPs and SPs both seem to have their place but each must be used purposefully. This thesis evaluated the VP and was not aimed at researching other methods or curriculum and course structure; future work could

aim to do this. Furthermore, as VP technology develops, the roles of the different methods will require ongoing evaluation.

Cost is also a factor when deciding on the balance between VPs and SPs in a curriculum. While the development costs of VPs can vary, they are often considerable and can be in excess of £10,000 (Huang et al., 2007). As was the case for this VP, the development cost is often a one-off; once the technology is created, it can be used time and time again. SPs and real patients do not tend to incur any substantial, initial financial investment but each time they are used, the actors/patients may require reimbursement. VPs ostensibly do not incur any running costs but this does not consider the time of IT technicians and the potential provision of hardware on which to use a VP; both could be recurring costs. For all the different methods of practice, is a facilitator required? This thesis suggests that it is not just the cost of developing the VP that is important but also the requirement for an educator's time which has an associated cost. If the results presented here are taken as being promising for the use of the VP in the training of SDM, any scale up and implementation should involve a consideration of finance as well as curricula structure.

9.7.2. Standards

The General Pharmaceutical Council (GPhC) set and maintain the initial education and training standards for pharmacists. Section 10.2.4 in the current standards is "Working with patients and the public" (GPhC, 2011); this section includes various outcomes related to SDM such as "Support the patient in choosing an option by listening and responding to their concerns and respecting their decisions". Aside from this, there is little focus on consultations, SDM or related concepts. In January 2019, the GPhC released a consultation on their new and updated standards. In the introduction, they acknowledge that the role of the pharmacist has changed extensively in the 8 years since the current standards were published. The consultation states that these changes mean that a greater emphasis should be placed on clinical skills in the initial education of pharmacists; "This includes

involving people in decisions about their care as well as advising them clearly and confidently about their use of medicines. It also includes making sure that students learn skills relating to prescribing such as consultation and physical examination."

In the new standards under consultation, "person-centered care" has become its own domain of learning outcomes rather than being placed under "Working with patients". SDM is not referenced explicitly in the outcomes but they are more closely aligned to the concepts involved. Point 1.1 is "Work in partnership with patients, carers and the public to support and empower them when making decisions about their health and wellbeing"; 1.5 is "Adapt their approach and communication style to meet the needs of each person".

It is not just the GPhC's learning outcomes that have/are changing but also the General Medical Council's (GMC). The 'Outcomes for graduates' (2018b) describes the outcomes that should be achieved by all graduates from UK medical schools. The latest version was published in 2018 and includes changes similar to those the GPhC are proposing. The 2009 version featured sections which drew on similar concepts to SDM; 13b for example was "Elicit patients' questions, their understanding of their condition and treatment options, and their views, concerns, values and preferences." A new section in the latest guidance was 6c; "demonstrate working collaboratively with patients, their relatives, carers or other advocates, in planning their care, negotiating and sharing information appropriately and supporting patient self-care". This does not describe SDM precisely but incorporates 'collaboration' and 'sharing' which are key features. Thirdly, the Nursing and Midwifery Council (NMC) also encourage SDM in their "Standards of proficiency for registered nurses". The most recent version (2018) includes 4.2; "work in partnership with people to encourage shared decision making." Going forward it would seem that the GPhC, GMC and NMC are including a focus on the same learning aims as the VP in this thesis; SDM and the communication skills required.

It is not only the latest educational standards that promote SDM and related concepts; there are groups and organisations in the UK trying to implement SDM in practice. Realistic Medicine is a

relatively new movement created by NHS Scotland which focuses on lots of different facets of medicine (WHO, 2017); 'medicine' does not mean the movement applies only to doctors but to all health professions. One of the ideas at the heart of it is promoting SDM. The National Institute for Health and Care Excellence (NICE) are currently working on their first ever guideline for SDM, predicted to be available by 2021 (NICE, 2019). Section 3.6.3 in the draft scope states that NICE are assessing the evidence for "changes in knowledge, intentions, ability and confidence about undertaking shared decision making"; this seems to allude to the training and education of professionals in SDM. NHS RightCare is a third organisation that has also been focusing on SDM over the past couple of years with a particular focus on embedding SDM into the NHS (NHS England, 2019); one of their four essential elements to achieving this is "Trained teams" within which they included "virtual" learning.

As the Narrative Review (chapter 2) outlined, the vast majority of previous VP research has not focused on the same learning aims as for this VP i.e. SDM within a patient consultation. There is therefore a link between the ideas in this section and future research with the VP; a relatively sparse research and development area combined with a potentially burgeoning need for it. As the results from this thesis are promising, future research could explore and evaluate further the role that VPs may have in training professionals to share the decision-making process with patients. In particular, future work could explore how this can be scaled up and how the VP could potentially be adopted more widely.

9.8. Concluding Thoughts

The VP was well accepted by the majority of the participants involved in all three strands of the project. It was reported as both enjoyable and easy to use. The VP led to a statistically significant change in the rank position of "respecting patient choices" for the pharmacy and medical undergraduates ($p=0.026$ and $p=0.038$ respectively); there was no statistically significant change for

the GPRs. This change in priorities is proposed as a positive result for the VP and was mirrored by some of the changes the participants suggested they would make to their practice after using the VP. To build on this project, future work could evaluate whether the VP leads to improvements in practice, perhaps with simulated patients first before moving on to real consultations.

The results suggested that the VP may be particularly beneficial for learners who are starting to practice SDM and patient interactions for the first time. The VP could act as a bridge from the instruction and demonstration phases to the higher fidelity methods of practice later on. The multiple choice style of interaction and the prompts that it provided were a key reason for this. There may also be a secondary role for the VP as it could afford experienced professionals the opportunity to explore a consultation; the VP allowed the participants to learn and try out new phrases or approaches in a safe environment. This leads to a discussion about the various merits of a multiple-choice system; future work could investigate this topic, particularly with postgraduate professionals.

The feedback provided by the VP was appropriate in terms of its format and quantity. The content of the feedback requires further investigation though; there were concerns that it may not have been specific enough to enable the participants to try to change their practice. The issue of an extended feedback session, a debrief discussion, was raised as something that may have been useful. This idea links to both adult learning theory and prior research with VPs and simulators; future research could explore the ideal composition of such an activity and whether learners find it useful.

These findings apply to the participants involved in the evaluations; they have not been generalised outside of this. If the VP, or any other VP, were to be used in a different context it would be prudent to evaluate it within that setting.

Bibliography

AAMC, Association of American Medical Colleges, 2007. Effective Use of Educational Technology in Medical Education. Summary Report of the 2006 AAMC Colloquium on Educational Technology. Washington, DC: Association of American Medical Colleges.

Abbey, L.M., 2002. Interactive multimedia patient simulations in dental and continuing dental education. *Dental Clinics*, 46(3), pp.575-587.

Agree Collaboration, 2001. Appraisal of guidelines for research & evaluation (AGREE) instrument. http://www. agreecollaboration.org/.

Ahern, N. and Wink, D.M., 2010. Virtual learning environments: second life. *Nurse Educator*, 35(6), pp.225-227.

Ahmed, M., Sherwani, Y., Al-Jibury, O., Najim, M., Rabee, R. and Ashraf, M., 2015. Gamification in medical education. *Medical Education Online*, 20, 29536.

Ajjawi, R. and Higgs, J., 2007. Using hermeneutic phenomenology to investigate how experienced practitioners learn to communicate clinical reasoning. *The Qualitative Report*, 12(4), pp.612-638.

Albright, G., Adam, C., Serri, D., Bleeker, S. and Goldman, R., 2016. Harnessing the power of conversations with virtual humans to change health behaviors. *mHealth*, 2(44).

Albright, G., Bryan, C., Adam, C., McMillan, J. and Shockley, K., 2018. Using virtual patient simulations to prepare primary health care professionals to conduct substance use and mental health screening and brief intervention. *Journal of the American Psychiatric Nurses Association*, 24(3), pp.247-259.

Alessi, S.M., 1988. Fidelity in the design of instructional simulations. *Journal of Computer-Based Instruction*. 15(2), pp.40-47.

Alexander, D.A., Knox, J.D.E. and Morrison, A.T., 1977. Medical students talking to patients. *Medical Education*, 11(6), pp.390-393.

Allen, D. and Harkins, K.J., 2005. Too much guidance? *The Lancet*, 365(9473), p.1768.

Andrade, A.D., Bagri, A., Zaw, K., Roos, B.A. and Ruiz, J.G., 2010. Avatar-mediated training in the delivery of bad news in a virtual world. *Journal of Palliative Medicine*, 13(12), pp.1415-1419.

Andrew, S. and Halcomb, E.J., 2007. Mixed methods research is an effective method of enquiry for community health research. *Contemporary Nurse*, 23(2), pp.145-153.

Aper, L., Reniers, J., Koole, S., Valcke, M. and Derese, A., 2012. Impact of three alternative consultation training formats on self-efficacy and consultation skills of medical students. *Medical Teacher*, 34(7), e500-e507.

Arain, M., Campbell, M.J., Cooper, C.L. and Lancaster, G.A., 2010. What is a pilot or feasibility study? A review of current practice and editorial policy. *BMC Medical Research Methodology*, 10(1), 67.

Argyris, C. and Schön, D.A., 1997. Organizational learning: a theory of action perspective. *Reis*, (77/78), pp.345-348.

Arneson, P., 2009a. Ontology. In: S. W. Littlejohn & K. A. Foss (Eds.). Encyclopedia of communication theory, 1, pp. 696-698. SAGE Publications, Thousand Oaks, CA.

Arneson, P., 2009b. Epistemology. In: S. W. Littlejohn & K. A. Foss (Eds.). Encyclopedia of communication theory, 1, pp. 351-353. SAGE Publications, Thousand Oaks, CA.

Arneson, P., 2009c. Axiology. In: S. W. Littlejohn & K. A. Foss (Eds.). Encyclopedia of communication theory, 1, pp. 70-73. SAGE Publications, Thousand Oaks, CA.

Aronson, J.K., 2007. Compliance, concordance, adherence. *British Journal of Clinical Pharmacology*, 63(4), pp.383-384.

Aspegren, K., 1999. BEME Guide No. 2: Teaching and learning communication skills in medicine-a review with quality grading of articles. *Medical Teacher*, 21(6), pp.563-570.

Atkins, S., Roberts, C., Hawthorne, K. and Greenhalgh, T., 2016. Simulated consultations: a sociolinguistic perspective. *BMC Medical Education*, 16(1), 16.

Avery, A.J. and Pringle, M., 2005. Extended prescribing by UK nurses and pharmacists: with more evidence and strict safeguards, it could benefit patients. *British Medical Journal*, 331(7526), p.1154.

Baerheim, A. and Malterud, K., 1995. Simulated patients for the practical examination of medical students: intentions, procedures and experiences. *Medical Education*, 29(6), pp.410-413.

Baird, B., Charles, A., Honeyman, M., Maguire, D. and Das, P., 2016. Understanding pressures in general practice. King's Fund, London.

Baker, S.E., Edwards, R. and Doidge, M., 2012. How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research. National Centre for Research Methods. Accessed here on 16/05/19: http://eprints.brighton.ac.uk/11632/1/how_many_interviews.pdf

Bakhit, M., Del Mar, C., Gibson, E. and Hoffmann, T., 2018. Shared decision making and antibiotic benefit-harm conversations: an observational study of consultations between general practitioners and patients with acute respiratory infections. *BMC Family Practice*, 19(1), 165.

Balint, M., 1957. The doctor, his patient and the illness. Pitman Medical Publishing, London.

Banks, J., Walter, F.M., Hall, N., Mills, K., Hamilton, W. and Turner, K.M., 2014. Decision making and referral from primary care for possible lung and colorectal cancer: a qualitative study of patients' experiences. *British Journal of General Practice*, 64(629), pp.775-782.

Barber, N., 1995. What constitutes good prescribing? *British Medical Journal*, 310(6984), pp.923-925.

Barr, P.J. and Elwyn, G., 2016. Measurement challenges in shared decision making: putting the 'patient'in patient-reported measures. *Health Expectations*, 19(5), pp.993-1001.

Barrett, B., Ricco, J., Wallace, M., Kiefer, D. and Rakel, D., 2016. Communicating statin evidence to support shared decision-making. *BMC Family Practice*, 17(1), 41.

Barrows, H.S., 1968. Simulated patients in medical teaching. *Canadian Medical Association Journal*, 98(14), p.674.

Barry, M.J. and Edgman-Levitan, S., 2012. Shared decision making—the pinnacle of patient-centered care. *New England Journal of Medicine*, 366(9), pp.780-781.

Barsky, A.J., 2017. The iatrogenic potential of the physician's words. *Journal of the American Medical Association*, 318(24), pp.2425-2426.

Bate, L., Hutchinson, A., Underhill, J. and Maskrey, N., 2012. How clinical decisions are made. *British Journal of Clinical Pharmacology*, 74(4), pp.614-620.

Bateman, J., Allen, M., Samani, D., Kidd, J. and Davies, D., 2013. Virtual patient design: exploring what works and why. A grounded theory study. *Medical Education*, 47(6), pp.595-606.

Baumann, A.O., Deber, R.B. and Thompson, G.G., 1991. Overconfidence among physicians and nurses: the 'micro-certainty, macro-uncertainty' phenomenon. *Social Science & Medicine*, 32(2), pp.167-174.

Beardsley, R.S., 2001. Communication skills development in colleges of pharmacy. *American Journal of Pharmaceutical Education*, 65(4), pp.307-314.

Bearman, M. and Cesnik, B., 2001. Comparing student attitudes to different models of the same virtual patient. *Studies in Health Technology and Informatics*, (2), pp.1004-1008.

Bearman, M., Cesnik, B. and Liddell, M., 2001. Random comparison of 'virtual patient'models in the context of teaching clinical communication skills. *Medical Education*, 35(9), pp.824-832.

Bearman, M., 2003. Is virtual the same as real? Medical students' experiences of a virtual patient. *Academic Medicine*, 78(5), pp.538-545.

Beauchamp, T.L. and Childress, J.F., 2001. Principles of biomedical ethics. Oxford University Press, USA.

Beaulac, G. and Kenyon, T., 2014. Critical thinking education and debiasing (AILACT Essay Prize Winner 2013). *Informal Logic*, 34(4), pp.341-363.

Beaulac, G. and Kenyon, T., 2016. The scope of debiasing in the classroom. *Topoi*, 37(1), pp.93-102.

Bechara, A., 2004. The role of emotion in decision-making: evidence from neurological patients with orbitofrontal damage. *Brain and Cognition*, 55(1), pp.30-40.

Beckman, H.B. and Frankel, R.M., 1994. The use of videotape in internal medicine training. *Journal of General Internal Medicine*, 9(9), pp.517-521.

Benner, P., 1982. From novice to expert. *The American Journal of Nursing*, 82(3), pp.402-407.

Bennett, S., Maton, K. and Kervin, L., 2008. The 'digital natives' debate: a critical review of the evidence. *British Journal of Educational Technology*, 39(5), pp.775-786.

Bensing, J., 2000. Bridging the gap: The separate worlds of evidence-based medicine and patient-centered medicine. *Patient Education and Counseling*, 39(1), pp.17-25.

Berger, Z.D., Brito, J.P., Ospina, N.S., Kannan, S., Hinson, J.S., Hess, E.P., Haskell, H., Montori, V.M. and Newman-Toker, D.E., 2017. Patient centred diagnosis: sharing diagnostic decisions with patients in clinical practice. *British Medical Journal* (Online), 359, j4218.

Bergh, A.M., Van Staden, C.W., Joubert, P.M., Krüger, C., Pickworth, G.E., Roos, J.L., Schurink, W.J., Du Preez, R.R., Grey, S.V. and Lindeque, B.G., 2006. Medical students' perceptions of their development of 'soft skills' Part II: The development of 'soft skills' through 'guiding and growing'. *South African Family Practice*, 48(8), pp.15-15d.

Bergin, R., Youngblood, P., Ayers, M.K., Boberg, J., Bolander, K., Courteille, O., Dev, P., Hindbeck, H., Leonard, E.E., Stringer, J.R. and Thalme, A., 2003. Interactive simulated patient: experiences with collaborative e-learning in medicine. *Journal of Educational Computing Research*, 29(3), pp.387-400.

Bergin, R.A. and Fors, U.G., 2003. Interactive simulated patient—an advanced tool for student-activated learning in medicine and healthcare. *Computers & Education*, 40(4), pp.361-376.

Berkhof, M., van Rijssen, H.J., Schellart, A.J., Anema, J.R. and van der Beek, A.J., 2011. Effective training strategies for teaching communication skills to physicians: an overview of systematic reviews. *Patient Education and Counseling*, 84(2), pp.152-162.

Berman, N.B., Durning, S.J., Fischer, M.R., Huwendiek, S. and Triola, M.M., 2016. The role for virtual patients in the future of medical education. *Academic medicine*, 91(9), pp.1217-1222.

Berner, E.S. and Graber, M.L., 2008. Overconfidence as a cause of diagnostic error in medicine. The *American Journal of Medicine*, 121(5), pp.S2-S23.

Berners-Lee, T.J., 1989. Information management: A proposal (No. CERN-DD-89-001-OC).

Beyer-Berjot, L., Patel, V., Ziprin, P., Taylor, D., Berdah, S., Darzi, A. and Aggarwal, R., 2015. Enhanced recovery simulation in colorectal surgery: design of virtual online patients. *Surgical Endoscopy*, 29(8), pp.2270-2277.

Biddle, C. and Schafft, K.A., 2015. Axiology and anomaly in the practice of mixed methods work: pragmatism, valuation, and the transformative paradigm. *Journal of Mixed Methods Research*, 9(4), pp.320-334.

Biesta, G., 2010. Pragmatism and the philosophical foundations of mixed methods research. In: Tashakkori, A., Teddlie, C. (Eds.). Sage handbook of mixed methods in social and behavioral research. 2nd edition, chapter 4, pp.95-118. Sage, California.

Billingham, S.A., Whitehead, A.L. and Julious, S.A., 2013. An audit of sample sizes for pilot and feasibility trials being undertaken in the United Kingdom registered in the United Kingdom Clinical Research Network database. *BMC Medical Research Methodology*, 13(1), 104.

Birt, L., Scott, S., Cavers, D., Campbell, C. and Walter, F., 2016. Member checking: a tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research*, 26(13), pp.1802-1811.

Bishop, P.A. and Herron, R.L., 2015. Use and misuse of the likert item responses and other ordinal measures. *International Journal of Exercise Science*, 8(3), p.297-302.

Blackmore, A., Kasfiki, E.V. and Purva, M., 2018. Simulation-based education to improve communication skills: a systematic review and identification of current best practice. *BMJ Simulation and Technology Enhanced Learning*, 4(4), pp.159-164.

Bloodworth, T., Cairco, L., McClendon, J., Hodges, L.F., Babu, S., Meehan, N.K., Johnson, A. and Ulinski, A.C., 2012. Initial evaluation of a virtual pediatric patient system. *Carolinas Women in Computing*.

Bokken, L., Rethans, J.J., van Heurn, L., Duvivier, R., Scherpbier, A. and van der Vleuten, C., 2009. Students' views on the use of real patients and simulated patients in undergraduate medical education. *Academic Medicine*, 84(7), pp.958-963.

Bolam, V., 1957. Friern Hospital Management Committee. *Weekly Law Report*, 582.

Boone, H.N. and Boone, D.A., 2012. Analyzing likert data. *Journal of Extension*, 50(2), pp.1-5.

Borish, M., Cordar, A., Foster, A., Kim, T., Murphy, J., Chaudhary, N. and Lok, B., 2014. Utilizing real-time human-assisted virtual humans to increase real-world interaction empathy. In KEER2014. Proceedings of the 5th Kanesi Engineering and Emotion Research; International Conference; Linköping; Sweden; June 11-13 (No. 100, pp. 441-455). Linköping University Electronic Press.

Botezatu, M., Hult, H. and Fors, U.G., 2010a. Virtual patient simulation: what do students make of it? A focus group study. *BMC Medical Education*, 10(1), 91.

Botezatu, M., Hult, H., Tessma, M.K. and Fors, U., 2010b. Virtual patient simulation: knowledge gain or knowledge loss? *Medical Teacher*, 32(7), pp.562-568.

Botezatu, M., Hult, H., Tessma, M.K. and Fors, U.G., 2010c. Virtual patient simulation for learning and assessment: superior results in comparison with regular course exams. *Medical Teacher*, 32(10), pp.845-850.

Box, G.E., 1979. Robustness in the strategy of scientific model building. *Robustness in Statistics*, pp. 201-236.

Boyatzis, R.E., 1998. Transforming qualitative information: thematic analysis and code development. Sage, California.

Boynton, P.M. and Greenhalgh, T., 2004. Hands-on guide to questionnaire research: selecting, designing, and developing your questionnaire. *British Medical Journal*, 328(7451), pp.1312-1315.

Boynton, J.R., Green, T.G., Johnson, L.A., Nainar, S.H. and Straffon, L.H., 2007. The virtual child: evaluation of an internet-based pediatric behavior management simulation. *Journal of Dental Education*, 71(9), pp.1187-1193.

Bracegirdle, L. and Chapman, S., 2010. Programmable patients: simulation of consultation skills in a virtual environment. *Bio-algorithms and Med-systems*, 6(11), pp.111-115.

Bradley, C.P., 1992. Factors which influence the decision whether or not to prescribe: the dilemma facing general practitioners. *British Journal of General Practice*, 42(364), pp.454-458.

Bradley, P., 2006. The history of simulation in medical education and possible future directions. *Medical Education*, 40(3), pp.254-262.

Bradshaw, M., 2001. Contracts and member checks in qualitative research in human geography: reason for caution? *Area*, 33(2), pp.202-211.

Brand, P.L. and Stiggelbout, A.M., 2013. Effective follow-up consultations: the importance of patient-centered communication and shared decision making. *Paediatric Respiratory Reviews*, 14(4), pp.224-228.

Brand, P.L., Klok, T. and Kaptein, A.A., 2013. Using communication skills to improve adherence in children with chronic disease: the adherence equation. *Paediatric Respiratory Reviews*, 14(4), pp.219-223.

Braun, M., Wassmer, G., Klotz, T., Reifenrath, B., Mathers, M. and Engelmann, U., 2000. Epidemiology of erectile dysfunction: results of the 'Cologne Male Survey'. *International Journal of Impotence Research*, 12(6), pp.305-311.

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), pp.77-101.

Braun, V. and Clarke, V., 2013. Successful qualitative research: a practical guide for beginners. Sage, California.

Brenner, A.T., Malo, T.L., Margolis, M., Lafata, J.E., James, S., Vu, M.B. and Reuland, D.S., 2018. Evaluating shared decision making for lung cancer screening. *JAMA Internal Medicine*, 178(10), pp.1311-1316.

Brett, J., Staniszewska, S., Mockford, C., Herron-Marx, S., Hughes, J., Tysall, C. and Suleman, R., 2014. Mapping the impact of patient and public involvement on health and social care research: a systematic review. *Health Expectations*, 17(5), pp.637-650.

Briggs, G.W. and Banahan, B.F., 1979. A Training Workshop in Psychological Medicine for Teachers of Family Medicine. Handouts 1-3: therapeutic communication. Society of Teachers of Family Medicine, Denver, CO.

British Thoracic Society, Research Unit of the Royal College of Physicians of London, King's Fund Centre and National Asthma Campaign, 1990. Guidelines for management of asthma in adults: I: chronic persistent asthma. *British Medical Journal*, 301(6753), pp.651-653.

Britten, N., 1995. Qualitative research: qualitative interviews in medical research. *British Medical Journal*, 311(6999), pp.251-253.

Brown, J., 2008. How clinical communication has become a core part of medical education in the UK. *Medical Education*, 42(3), pp.271-278.

Brown, J.D., 2011. Likert items and scales of measurement. *Statistics*, 15(1), pp.10-14.

Brown, J., 2012. Perspective: clinical communication education in the United Kingdom: some fresh insights. *Academic Medicine*, 87(8), pp.1101-1104.

Bryman, A., 2006. Paradigm peace and the implications for quality. International Journal of Social *Research Methodology*, 9(2), pp.111-126.

Bryman, A., Becker, S. and Sempik, J., 2008. Quality criteria for quantitative, qualitative and mixed methods research: a view from social policy. *International Journal of Social Research Methodology*, 11(4), pp.261-276.

Bugeja, M.J., 2008. Second thoughts about second life. *The Education Digest*, 73(5), pp.18-22.

Burrell, G. and Morgan, G. 1979. Sociological paradigms and organisational analysis: elements of the sociology of corporate life. Heinemann, London.

Buus, N. and Agdal, R., 2013. Can the use of reporting guidelines in peer-review damage the quality and contribution of qualitative health care research? *International Journal of Nursing Studies*, 50(10), pp.1289-1291.

Byrne, P.S. and Long, B.E., 1976. Doctors talking to patients. A study of the verbal behaviour of general practitioners consulting in their surgeries. London: HMSO

Cain, J. and Piascik, P., 2015. Are serious games a good strategy for pharmacy education? *American Journal of Pharmaceutical Education*, 79(4), 47.

Cameron, R., 2011. Mixed methods research: the five Ps framework. *Electronic Journal of Business Research Methods*, 9(2), pp.96-108.

Campbell, D.T. and Fiske, D.W., 1959. Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), pp.81-105.

Campbell, M., 2015. Montgomery v Lanarkshire health board. *Common Law World Review*, 44(3), pp.222-228.

Campion, M.A., Pursell, E.D. and Brown, B.K., 1988. Structured interviewing: raising the psychometric properties of the employment interview. *Personnel Psychology*, 41(1), pp.25-42.

Cantillon, P. and Jones, R., 1999. Does continuing medical education in general practice make a difference? *British Medical Journal*, 318(7193), p.1276.

Carnell, S., Halan, S., Crary, M., Madhavan, A. and Lok, B., 2015. Adapting virtual patient interviews for interviewing skills training of novice healthcare students. In International Conference on Intelligent Virtual Agents (pp. 50-59). Springer, Cham.

Cassam, Q., 2017. Diagnostic error, overconfidence and self-knowledge. *Palgrave Communications*, 3, number 17025.

Cederberg, R.A., Bentley, D.A., Halpin, R. and Valenza, J.A., 2012. Use of virtual patients in dental education: a survey of U.S. and Canadian dental schools. *Journal of Dental Education*, 76(10), pp.1358-1364

Cendan, J. and Lok, B., 2012. The use of virtual patients in medical school curricula. *Advances in Physiology Education*, 36(1), pp.48-53.

Chaikoolvatana, A. and Goodyer, L., 2003. Evaluation of a multimedia case-history simulation program for pharmacy students. *American Journal of Pharmaceutical Education*, 67(1), 16.

Charles, C., Gafni, A. and Whelan, T., 1997. Shared decision-making in the medical encounter: what does it mean? (or it takes at least two to tango). *Social Science & Medicine*, 44(5), pp.681-692.

Charles, C., Whelan, T. and Gafni, A., 1999. What do we mean by partnership in making decisions about treatment? *British Medical Journal*, 319(7212), pp.780-782.

Charlin, B., Boshuizen, H., Custers, E.J. and Feltovich, P.J., 2007. Scripts and clinical reasoning. *Medical Education*, 41(12), pp.1178-1184.

Charmaz, K., 1990. 'Discovering'chronic illness: using grounded theory. *Social Science & Medicine*, 30(11), pp.1161-1172.

Charmaz, K., 1996. The searh for meanings - Grounded Theory. In: Smith, J.A., Harre, R. and Van Langenhove, L. (Eds.). Rethinking Methods in Psychology. Sage, London. pp.27-49.

Chen, D.C., Kirshenbaum, D.S., Yan, J., Kirshenbaum, E. and Aseltine, R.H., 2012. Characterizing changes in student empathy throughout medical school. *Medical Teacher*, 34(4), pp.305-311.

Cherryholmes, C.H., 1992. Notes on pragmatism and scientific realism. *Educational Researcher*, 21(6), pp.13-17.

Chew-Graham, C.A., Rasmussen, J. and Maskrey, N., 2016. Considering the healthcare needs of older people with multimorbidity: managing Alice. *Journal of Comorbidity*, 6(2), pp.53-55.

Choudhry, N.K., Stelfox, H.T. and Detsky, A.S., 2002. Relationships between authors of clinical practice guidelines and the pharmaceutical industry. *Journal of the American Medical Association*, 287(5), pp.612-617.

Chowdhury, R.R. and Kalu, G., 2004. Learning to give feedback in medical education. *The Obstetrician & Gynaecologist*, 6(4), pp.243-247.

Cioffi, J., 1997. Heuristics, servants to intuition, in clinical decision-making. *Journal of Advanced Nursing*, 26(1), pp.203-208.

Clark, A.M., 1998. The qualitative-quantitative debate: moving from positivism and confrontation to post-positivism and reconciliation. *Journal of Advanced Nursing*, 27(6), pp.1242-1249.

Clayman, M.L., Bylund, C.L., Chewning, B. and Makoul, G., 2016. The impact of patient participation in health decisions within medical encounters: a systematic review. *Medical Decision Making*, 36(4), pp.427-452.

Cleland, J., Bailey, K., McLachlan, S., McVey, L. and Edwards, R., 2007. Supplementary pharmacist prescribers' views about communication skills teaching and learning, and applying these new skills in practice. *International Journal of Pharmacy Practice*, 15(2), pp.101-104.

Clever, S.L., Jin, L., Levinson, W. and Meltzer, D.O., 2008. Does doctor–patient communication affect patient satisfaction with hospital care? Results of an analysis with a novel instrumental variable. *Health Services Research*, 43(5), pp.1505-1519.

Close, A., Goldberg, A., Helenowski, I., Schuller, M., DaRosa, D. and Fryer, J., 2015. Beta test of web-based virtual patient decision-making exercises for residents demonstrates discriminant validity and learning. *Journal of Surgical Education*, 72(6), e130-e136.

Cockburn, J. and Pit, S., 1997. Prescribing behaviour in clinical practice: patients' expectations and doctors' perceptions of patients' expectations—a questionnaire study. *British Medical Journal*, 315(7107), pp.520-523.

Cohen, H. and Britten, N., 2003. Who decides about prostate cancer treatment? A qualitative study. *Family Practice*, 20(6), pp.724-729.

Collin, K., Van der Heijden, B. and Lewis, P., 2012. Continuing professional development. *International Journal of Training and Development*, 16(3), pp.155-163.

Collins, J.A. and Fauser, B.C., 2005. Balancing the strengths of systematic and narrative reviews. *Human Reproduction Update*, 11(2), pp. 103-104.

Colliver, J.A., Conlee, M.J., Verhulst, S.J. and Dorsey, J.K., 2010. Reports of the decline of empathy during medical education are greatly exaggerated: a reexamination of the research. *Academic Medicine*, 85(4), pp.588-593.

Connelly, L.M., 2010. What is phenomenology? *Medsurg Nursing*, 19(2), pp.127-129.

Consorti, F., Mancuso, R., Nocioni, M. and Piccolo, A., 2012. Efficacy of virtual patients in medical education: a meta-analysis of randomized studies. *Computers & Education*, 59(3), pp.1001-1008.

Cook, D.A. and Triola, M.M., 2009. Virtual patients: a critical literature review and proposed next steps. *Medical Education*, 43(4), pp.303-311.

Cook, D.A., Erwin, P.J. and Triola, M.M., 2010. Computerized virtual patients in health professions education: a systematic review and meta-analysis. *Academic Medicine*, 85(10), pp.1589-1602.

Cook, J.M., 2012. Design and initial evaluation of a virtual pediatric primary care clinic in Second Life®. *Journal of the American Academy of Nurse Practitioners*, 24(9), pp.521-527.

Coonar, A.S., Dooley, M., Daniels, M. and Taylor, R.W., 2009. The use of role-play in teaching medical students obstetrics and gynaecology. *Medical Teacher*, 13(1), pp.49-53.

Cooper, K., Smith, B.H. and Hancock, E., 2008. Patient-centredness in physiotherapy from the perspective of the chronic low back pain patient. *Physiotherapy*, 94(3), pp.244-252.

Cooper, V. and Hassell, A., 2002. Teaching consultation skills in higher specialist training: experience of a workshop for specialist registrars in rheumatology. *Rheumatology*, 41(10), pp.1168-1171.

Corbin, J.M. and Strauss, A., 1990. Grounded theory research: procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), pp.3-21.

Correia, V., 2018. Contextual debiasing and critical thinking: reasons for optimism. *Topoi*, 37(1), pp.103-111.

Costa, P., Magalhães, E. and Costa, M.J., 2013. A latent growth model suggests that empathy of medical students does not decline over time. *Advances in Health Sciences Education*, 18(3), pp.509-522.

Côté, L. and Leclère, H., 2000. How clinical teachers perceive the doctor—patient relationship and themselves as role models. *Academic Medicine*, 75(11), pp.1117-1124.

Couët, N., Desroches, S., Robitaille, H., Vaillancourt, H., Leblanc, A., Turcotte, S., Elwyn, G. and Légaré, F., 2015. Assessments of the extent to which health-care providers involve patients in decision making: a systematic review of studies using the OPTION instrument. *Health Expectations*, 18(4), pp.542-561.

Coulter, A. and Collins, A., 2011. Making shared decision-making a reality. King's Fund, London.

Coulter, A., Hopkins, A. and Moulton, B., 2017. Montgomery v Lanarkshire Health Board: transforming informed consent. *The Bulletin of the Royal College of Surgeons of England*, 99(1), pp.36-38.

Council, G.P., 2011. Future pharmacists: Standards for the initial education and training of pharmacists. London: General Pharmaceutical Council.

Courteille, O., Josephson, A. and Larsson, L.O., 2014. Interpersonal behaviors and socioemotional interaction of medical students in a virtual clinical encounter. *BMC Medical Education*, 14(1), 64.

CQC, Care Quality Commission, 2018. Adult inpatient survey 2017. Accessed here on 10/05/19: https://www.cqc.org.uk/publications/surveys/adult-inpatient-survey-2017

Craig, J.L., 1992. Retention of interviewing skills learned by first-year medical students: a longitudinal study. *Medical Education*, 26(4), pp.276-281.

Crandall, S.J., George, G., Marion, G.S. and Davis, S., 2003. Applying theory to the design of cultural competency training for medical students: a case study. *Academic Medicine*, 78(6), pp.588-594.

Creswell, J.W., Clark, V.L., 2011. Designing and conducting mixed methods research. 2nd edition. Sage, Los Angeles.

Creswell, J.W., Klassen, A.C., Plano Clark, V.L. and Smith, K.C., 2011. Best practices for mixed methods research in the health sciences. Bethesda (Maryland): National Institutes of Health, pp.541-545.

Cresswell, K., Howe, A., Steven, A., Smith, P., Ashcroft, D., Fairhurst, K., Bradley, F., Magnusson, C., McArthur, M., Pearson, P. and Sheikh, A., 2013. Patient safety in healthcare preregistration educational curricula: multiple case study-based investigations of eight medicine, nursing, pharmacy and physiotherapy university courses. *BMJ Quality and Safety*, 22(10), pp.843-854.

Creswell, J.W., 2014. Research design: qualitative, quantitative, & mixed methods approaches. 4th edition. Sage, California.

Cronin, P., Ryan, F. and Coughlan, M., 2008. Undertaking a literature review: a step-by-step approach. *British Journal of Nursing*, 17(1), pp.38-43.

Croskerry, P., 2003. Cognitive forcing strategies in clinical decision-making. *Annals of Emergency Medicine*, 41(1), pp.110-120.

Croskerry, P., Abbass, A.A. and Wu, A.W., 2008. How doctors feel: affective issues in patients' safety. *The Lancet*, 372(9645), pp.1205-1206.

Croskerry, P., 2009. Clinical cognition and diagnostic error: applications of a dual process model of reasoning. *Advances in Health Sciences Education*, 14(1), pp.27-35.

Crotty, M., 1998. The foundations of social research: meaning and perspective in the research process. Sage, California

Cutchie, W.A., Cheung, N.W. and Simmons, D., 2006. Comparison of international and New Zealand guidelines for the care of pregnant women with diabetes. *Diabetic Medicine*, 23(5), pp.460-468.

Dacre, J., Richardson, J., Noble, L., Stephens, K. and Parker, N., 2004. Communication skills training in postgraduate medicine: the development of a new course. *Postgraduate Medical Journal*, 80(950), pp.711-715.

Dall'Alba, G. and Sandberg, J., 2006. Unveiling professional development: A critical review of stage models. *Review of Educational Research*, 76(3), pp.383-412.

Darbyshire, P., 1993. In defence of pedagogy: a critique of the notion of andragogy. *Nurse Education Today*, 13(5), pp.328-335.

Davidson, P.M., Jiwa, M., Goldsmith, A.J., McGrath, S.J., DiGiacomo, M., Phillips, J.L., Agar, M., Newton, P.J. and Currow, D.C., 2011. Decisions for lung cancer chemotherapy: the influence of physician and patient factors. *Supportive Care in Cancer*, 19(8), pp.1261-1266.

Davies, P., 2006. The beleaguered consultation. *British Journal of General Practice*, 56(524), pp.226-229.

Davis, D., O'brien, M.A.T., Freemantle, N., Wolf, F.M., Mazmanian, P. and Taylor-Vaisey, A., 1999. Impact of formal continuing medical education: do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? *Journal of the American Medical Association*, 282(9), pp.867-874.

Davis, D.A., Mazmanian, P.E., Fordis, M., Van Harrison, R.T.K.E., Thorpe, K.E. and Perrier, L., 2006. Accuracy of physician self-assessment compared with observed measures of competence: a systematic review. *Journal of the American Medical Association*, 296(9), pp.1094-1102.

Davis, R.H., Jenkins, M., Smail, S.A., Stott, N.C.H., Verby, J. and Wallace, B.B., 1980. Teaching with audiovisual recordings of consultations. *Journal of the Royal College of General Practitioners*, 30(215), pp.333-336.

Day-Black, C., Lois Konzelman MSN, R.N., Williams, T.T. and Natalie Hart, M.S.N., 2015. Gamification: an innovative teaching-learning strategy for the digital nursing students in a community health nursing course. *Association of Black Nursing Faculty Journal*, 26(4), p.90.

de la Croix, A. and Veen, M., 2018. The reflective zombie: problematizing the conceptual framework of reflection in medical education. *Perspectives on Medical Education*, 7(6), pp.394–400.

de Silva, D., Bamber, J., 2014. Improving quality in general practice. Health Foundation, London.

De Winter, J.C. and Dodou, D., 2010. Five-point Likert items: t test versus Mann-Whitney-Wilcoxon. Practical Assessment, *Research & Evaluation*, 15(11), p.1-12.

Degner, L.F., Kristjanson, L.J., Bowman, D., Sloan, J.A., Carriere, K.C., O'neil, J., Bilodeau, B., Watson, P. and Mueller, B., 1997. Information needs and decisional preferences in women with breast cancer. *Journal of the American Medical Association*, 277(18), pp.1485-1492.

Del Mar, C. and Isaacs, G., 1992. Teaching consultation skills by videotaping interviews: a study of student opinion. *Medical Teacher*, 14(1), pp.53-58.

Deladisma, A.M., Cohen, M., Stevens, A., Wagner, P., Lok, B., Bernard, T., Oxendine, C., Schumacher, L., Johnsen, K., Dickerson, R. and Raij, A., 2007. Do medical students respond empathetically to a virtual patient? *The American Journal of Surgery*, 193(6), pp.756-760.

Deladisma, A.M., Johnsen, K., Raij, A., Rossen, B., Kotranza, A., Kalapurakal, M., Szlam, S., Swinson, D., Lok, B. and Lind, D.S., 2008. Medical student satisfaction using a virtual patient system to learn history-taking communication skills. *Studies in Health Technology and Informatics*, 132, pp.101-105.

Denness, C., 2013. What are consultation models for? *InnovAit*, 6(9), pp.592-599.

Deterding, S., Dixon, D., Khaled, R. and Nacke, L., 2011, September. From game design elements to gamefulness: defining gamification. In Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments (pp. 9-15).

Detering, K., Silvester, W., Corke, C., Milnes, S., Fullam, R., Lewis, V. and Renton, J., 2014. Teaching general practitioners and doctors-in-training to discuss advance care planning: evaluation of a brief multimodality education programme. *BMJ Supportive & Palliative Care*, 4(3), 313-321.

Devine, C.P., 2018. Oral health: learning styles. *British Dental Journal*, 224(10), 758.

DiCicco-Bloom, B. and Crabtree, B.F., 2006. The qualitative research interview. *Medical Education*, 40(4), pp.314-321.

Dickerson, R., Johnsen, K., Raij, A., Lok, B., Hernandez, J., Stevens, A. and Lind, D.S., 2005. Evaluating a script-based approach for simulating patient-doctor interaction. In Proceedings of the International Conference of Human-Computer Interface Advances for Modeling and Simulation, 1, pp. 79-84.

Dickerson, R., Johnsen, K., Raij, A., Lok, B., Stevens, A., Bernard, T. and Lind, D.S., 2006. Virtual patients: assessment of synthesized versus recorded speech. *Studies in Health Technology and Informatics*, 119, pp.114-119.

Dierckx, K., Deveugele, M., Roosen, P. and Devisch, I., 2013. Implementation of shared decision making in physical therapy: observed level of involvement and patient preference. *Physical Therapy*, 93(10), pp.1321-1330.

Dovidio, J.F. and Fiske, S.T., 2012. Under the radar: how unexamined biases in decision-making processes in clinical interactions can contribute to health care disparities. *American Journal of Public Health*, 102(5), pp.945-952.

Dowrick, C., 2018. Patient-centred care for multimorbidity: an end in itself? *The Lancet*, 392(10141), pp.4-5.

Drake, R.E. and Deegan, P.E., 2009. Shared decision making is an ethical imperative. *Psychiatric Services*, 60(8), pp.1007-1007.

Draper, J., Silverman, J., Hibble, A., Berrington, R.M. and Kurtz, S.M., 2002. The East Anglia Deanery Communication Skills Teaching Project--six years on. *Medical Teacher*, 24(3), pp.294-298.

Dreifuerst, K.T., 2009. The essentials of debriefing in simulation learning: a concept analysis. *Nursing Education Perspectives*, 30(2), pp.109-114.

Dreyfus, S.E. and Dreyfus, H.L., 1980. A five-stage model of the mental activities involved in directed skill acquisition (No. ORC-80-2). California Univ Berkeley Operations Research Center.

Dubovsky, S.L., Antonius, D., Ellis, D.G., Ceusters, W., Sugarman, R.C., Roberts, R., Kandifer, S., Phillips, J., Daurignac, E.C., Leonard, K.E. and Butler, L.D., 2017. A preliminary study of a novel emergency department nursing triage simulation for research applications. *BMC Research Notes*, 10(1), 15.

Dukes, L.C., Pence, T.B., Hodges, L.F., Meehan, N. and Johnson, A., 2013. Sidnie: scaffolded interviews developed by nurses in education. In Proceedings of the 2013 international conference on Intelligent user interfaces (pp. 395-406).

Dumbreck, S., Flynn, A., Nairn, M., Wilson, M., Treweek, S., Mercer, S.W., Alderson, P., Thompson, A., Payne, K. and Guthrie, B., 2015. Drug-disease and drug-drug interactions: systematic examination of recommendations in 12 UK national clinical guidelines. *British Medical Journal*, 350, p.949.

Durand, M.A., DiMilia, P.R., Song, J., Yen, R.W. and Barr, P.J., 2018. Shared decision making embedded in the undergraduate medical curriculum: A scoping review. *PloS One*, 13(11), e0207012.

Dyche, L. and Epstein, R.M., 2011. Curiosity and medical education. *Medical Education*, 45(7), pp.663-668.

Eagly, A.H. and Chaiken, S., 1993. The psychology of attitudes. Harcourt Brace Jovanovich College Publishers, Florida.

Edelbring, S., Dastmalchi, M., Hult, H., Lundberg, I.E. and Dahlgren, L.O., 2011. Experiencing virtual patients in clinical learning: a phenomenological study. *Advances in Health Sciences Education*, 16(3), pp.331-345.

Edelbring, S., Broström, O., Henriksson, P., Vassiliou, D., Spaak, J., Dahlgren, L.O., Fors, U. and Zary, N., 2012. Integrating virtual patients into courses: follow-up seminars and perceived benefit. *Medical Education*, 46(4), pp.417-425.

Edwards, A. and Elwyn, G., 2006. Inside the black box of shared decision making: distinguishing between the process of involvement and who makes the decision. *Health Expectations*, 9(4), pp.307-320.

Ekblad, S., Mollica, R.F., Fors, U., Pantziaras, I. and Lavelle, J., 2013. Educational potential of a virtual patient system for caring for traumatized patients in primary care. *BMC Medical Education*, 13(1), 110.

Ellaway, R. and Masters, K., 2008. AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. *Medical Teacher*, 30(5), pp.455-473.

Ellaway, R., Poulton, T., Fors, U., McGee, J.B. and Albright, S., 2008. Building a virtual patient commons. *Medical Teacher*, 30(2), pp.170-174.

Ellingson, L.L., 1998. " Then you know how I feel": empathy, identification, and reflexivity in fieldwork. *Qualitative Inquiry*, 4(4), pp.492-514.

Elo, S. and Kyngäs, H., 2008. The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), pp.107-115.

Elsevier. Narrative Review Checklist. Accessed here on 10/05/19: https://www.elsevier.com/journals/journal-of-the-academy-of-nutrition-and-dietetics/2212-2672/guide-for-authors#nar

Elwyn, G., Edwards, A. and Kinnersley, P., 1999a. Shared decision-making in primary care: the neglected second half of the consultation. *British Journal of General Practice*, 49(443), pp.477-482.

Elwyn, G., Edwards, A., Gwyn, R. and Grol, R., 1999b. Towards a feasible model for shared decision making: focus group study with general practice registrars. *British Medical Journal*, 319(7212), pp.753-756.

Elwyn, G., 2004. Arriving at the postmodern medical consultation. *The European Journal of General Practice*, 10(3), pp.93-97.

Elwyn, G., Frosch, D.L. and Kobrin, S., 2016. Implementing shared decision-making: consider all the consequences. *Implementation Science*, 11(1), p.114.

Emanuel, E.J. and Emanuel, L.L., 1992. Four models of the physician-patient relationship. *Journal of the American Medical Association*, 267(16), pp.2221-2226.

Emerson, R.M. and Pollner, M., 1988. On the uses of members' responses to researchers' accounts. *Human Organization*, 47 (3), pp.189-198.

Engel, G.L., 1977. The need for a new medical model: a challenge for biomedicine. *Science*, 196(4286), pp.129-136.

Engelhardt, E.G., Pieterse, A.H., van der Hout, A., de Haes, H.J., Kroep, J.R., van Ufford-Mannesse, P.Q., Portielje, J.E., Smets, E.M. and Stiggelbout, A.M., 2016. Use of implicit persuasion in decision making about adjuvant cancer treatment: a potential barrier to shared decision making. *European Journal of Cancer*, 66, pp.55-66.

Engler, C.M., Saltzman, G.A., Walker, M.L. and Wolf, F.M., 1981. Medical student acquisition and retention of communication and interviewing skills. *Journal of Medical Education*, 56(7), pp.572-579.

Epstein, R.M., Franks, P., Fiscella, K., Shields, C.G., Meldrum, S.C., Kravitz, R.L. and Duberstein, P.R., 2005. Measuring patient-centered communication in patient–physician consultations: theoretical and practical issues. *Social Science & Medicine*, 61(7), pp.1516-1528.

Ericsson, K.A., Krampe, R.T. and Tesch-Römer, C., 1993. The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, 100(3), pp.363-406.

Ericsson, K.A., 2004. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Academic Medicine*, 79 (10, Suppl.), S70-S81.

Ericsson, K.A., 2015. Acquisition and maintenance of medical expertise: a perspective from the expert-performance approach with deliberate practice. *Academic Medicine*, 90(11), pp.1471-1486.

Eva, K.W. and Norman, G.R., 2005. Heuristics and biases− a biased perspective on clinical reasoning. *Medical Education*, 39(9), pp.870-872.

Evans, B.J., Stanley, R.O., Burrows, G.D. and Sweet, B., 1989. Lectures and skills workshops as teaching formats in a history-taking skills course for medical students. *Medical Education*, 23(4), pp.364-370.

Evidence-Based Medicine Working Group, 1992. Evidence-based medicine. A new approach to teaching the practice of medicine. *Journal of the American Medical Association*, 268(17), pp.2420.

Farrell, A.M. and Brazier, M., 2016. Not so new directions in the law of consent? Examining Montgomery v Lanarkshire Health Board. *Journal of Medical Ethics*, 42(2), pp.85-88.

Feilzer, M.Y., 2010. Doing mixed methods research pragmatically: implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, 4(1), pp.6-16.

Ferrari, R., 2015. Writing narrative style literature reviews. *Medical Writing*, 24(4), pp.230-235.

Ferreira, A.P.R.B., Ferreira, R.F., Rajgor, D., Shah, J., Menezes, A. and Pietrobon, R., 2010. Clinical reasoning in the real world is mediated by bounded rationality: implications for diagnostic clinical practice guidelines. *PloS One*, 5(4), e10265.

Ferreira-Padilla, G., Ferrández-Antón, T., Baleriola-Júlvez, J., Braš, M. and Đorđević, V., 2015. Communication skills in medicine: where do we come from and where are we going? *Croatian Medical Journal*, 56(3), p.311.

Fielding, N.G., 2012. Triangulation and mixed methods designs: data integration with new research technologies. *Journal of Mixed Methods Research*, 6(2), pp.124-136.

Finlay, L., 2002. “Outing” the researcher: the provenance, process, and practice of reflexivity. *Qualitative Health Research*, 12(4), pp.531-545.

Finlay, L., 2008. The reflexive journey: mapping multiple routes. In: Finlay, L. and Gough, B. (Eds.). Reflexivity: a practical guide for researchers in health and social sciences. John Wiley & Sons.

Fleetwood, J., Vaught, W., Feldman, D., Gracely, E., Kassutto, Z. and Novack, D., 2000. MedEthEx Online: a computer-based learning program in medical ethics and communication skills. *Teaching and Learning in Medicine*, 12(2), pp.96-104.

Fleming, M., Olsen, D., Stathes, H., Boteler, L., Grossberg, P., Pfeifer, J., Schiro, S., Banning, J. and Skochelak, S., 2009. Virtual reality skills training for health care professionals in alcohol screening and brief intervention. *The Journal of the American Board of Family Medicine*, 22(4), pp.387-398.

Flower, J., 1999. In the mush. *Physician Executive*, 25(1), pp.64-66.

Floyd, M., Lang, F., Beine, K.L. and McCord, E., 1999. Evaluating interviewing techniques for the sexual practices history: use of video trigger tapes to assess patient comfort. *Archives of Family Medicine*, 8(3), p.218-223.

Ford, S., Schofield, T. and Hope, T., 2006. Observing decision-making in the general practice consultation: who makes which decisions? *Health Expectations*, 9(2), pp.130-137.

Forsetlund, L., Bjørndal, A., Rashidian, A., Jamtvedt, G., O'Brien, M.A., Wolf, F.M., Davis, D., Odgaard-Jensen, J. and Oxman, A.D., 2009. Continuing education meetings and workshops: effects on professional practice and health care outcomes. *The Cochrane Library*, CD003030.

Foster, A., Chaudhary, N., Murphy, J., Lok, B., Waller, J. and Buckley, P.F., 2015. The use of simulation to teach suicide risk assessment to health profession trainees—rationale, methodology, and a proof of concept demonstration with a virtual patient. *Academic Psychiatry*, 39(6), pp.620-629.

Foster, A., Chaudhary, N., Kim, T., Waller, J.L., Wong, J., Borish, M., Cordar, A., Lok, B. and Buckley, P.F., 2016. Using virtual patients to teach empathy: a randomized controlled study to enhance medical students' empathic communication. *Simulation in Healthcare*, 11(3), pp.181-189.

Fraenkel, L., Lim, J., Garcia-Tsao, G., Reyna, V., Monto, A. and Bridges, J.F., 2016. Variation in treatment priorities for chronic hepatitis C: a latent class analysis. *The Patient-Patient-Centered Outcomes Research*, 9(3), pp.241-249.

Freina, L. and Ott, M., 2015. A Literature Review on Immersive Virtual Reality in Education: State Of The Art and Perspectives. Proceedings of the 11th International Scientific Conference "eLearning and Software for Education", (1), pp.133-141

Fusch, P.I. and Ness, L.R., 2015. Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, 20(9), p.1408-1416.

Gabbay, J. and le May, A., 2004. Evidence based guidelines or collectively constructed "mindlines?" Ethnographic study of knowledge management in primary care. *British Medical Journal*, 329(7473), p1013.

Gabel, F., Chambers, R., Cox, T., Listl, S. and Maskrey, N., 2018. An evaluation of a multifaceted, local Quality Improvement Framework for long-term conditions in UK primary care. *Family practice*, cmy128.

Gale, E.A., 2011. Conflicts of interest in guideline panel members. *British Medical Journal*, 343, d5728.

Garrard, F., Ridd, M., Narayan, H. and Montgomery, A.A., 2015. Decisions, choice and shared decision making in antenatal clinics: an observational study. *Patient Education and Counseling*, 98(9), pp.1106-1111.

Geiger, F., Liethmann, K., Reitz, D., Galalae, R. and Kasper, J., 2017. Efficacy of the doktormitSDM training module in supporting shared decision making– Results from a multicenter double-blind randomized controlled trial. *Patient Education and Counseling*, 100(12), pp.2331-2338.

Georg, C. and Zary, N., 2014. Web-based virtual patients in nursing education: development and validation of theory-anchored design and activity models. *Journal of Medical Internet Research*, 16(4).

Gerard, K., Tinelli, M., Latter, S., Blenkinsopp, A. and Smith, A., 2012. Valuing the extended role of prescribing pharmacist in general practice: results from a discrete choice experiment. *Value in Health*, 15(5), pp.699-707.

Gibbs, G. 1988. Learning by doing: a guide to teaching and learning methods. Further Education Unit, London, UK.

Giddings, L.S., 2006. Mixed-methods research: positivism dressed in drag? *Journal of Research in Nursing*, 11(3), pp.195-203.

Gigerenzer, G. and Goldstein, D.G., 1996. Reasoning the fast and frugal way: models of bounded rationality. *Psychological Review*, 103(4), p.650.

Gigerenzer, G., 2008. Why heuristics work. *Perspectives on Psychological Science*, 3(1), pp.20-29.

Gigerenzer, G. and Brighton, H., 2009. Homo heuristicus: Why biased minds make better inferences. *Topics in Cognitive Science*, 1(1), pp.107-143.

Gigerenzer, G., Wegwarth, O. and Feufel, M., 2010. Misleading communication of risk. *British Medical Journal*, 341(7777), c4830.

Gillard, S., Benson, J. and Silverman, J., 2009. Teaching and assessment of explanation and planning in medical schools in the United Kingdom: cross sectional questionnaire survey. *Medical Teacher*, 31(4), pp.328-331.

Gioia, D.A. and Pitre, E., 1990. Multiparadigm perspectives on theory building. *Academy of Management Review*, 15(4), pp.584-602.

Glaser, B.G. and Strauss, A.L., 1967. The discovery of grounded theory. Weidenfeld and Nicolson, London.

Glöckner, A. and Betsch, T., 2012. Decisions beyond boundaries: when more information is processed faster than less. *Acta Psychologica*, 139(3), pp.532-542.

Glogowska, M., 2011. Paradigms, pragmatism and possibilities: mixed-methods research in speech and language therapy. *International Journal of Language & Communication Disorders*, 46(3), pp.251-260.

Glouberman, S. and Zimmerman, B., 2002. Complicated and complex systems: what would successful reform of Medicare look like? *Romanow Papers*, 2, pp.21-53.

GMC, General Medical Council, 2009. Tomorrow's Doctors: outcomes and standards for undergraduate medical education. Accessed on 10/05/19: http://www.ub.edu/medicina_unitateducaciomedica/documentos/TomorrowsDoctors_2009.pdf

GMC, General Medical Council, 2014. Good Medical Practice. Accessed here on 10/05/2019: https://www.gmc-uk.org/ethical-guidance/ethical-guidance-for-doctors/good-medical-practice

GMC, General Medical Council, 2016. The state of medical education and practice in the UK. Accesssed here on 31/07/18: https://www.gmc-uk.org/-/media/documents/SOMEP_2016_Full_Report_Lo_Res.pdf_68139324.pdf

GMC, General Medical Council, 2018a. National training surveys 2018: initial findings report. Accessed here on 10/05/2019: https://www.gmc-uk.org/-/media/documents/dc11391-nts-2018-initial-findings-report_pdf-75268532.pdf

GMC, General Medical Council, 2018b. Outcomes for graduates. Accessed on 10/05/19: https://www.gmc-uk.org/-/media/documents/outcomes-for-graduates-a4_pdf-77470228.pdf

Gobet, F., 1997. A pattern-recognition theory of search in expert problem solving. *Thinking & Reasoning*, 3(4), pp.291-313.

Golafshani, N., 2003. Understanding reliability and validity in qualitative research. *The Qualitative Report*, 8(4), pp.597-606.

Goles, T. and Hirschheim, R., 2000. The paradigm is dead, the paradigm is dead… long live the paradigm: the legacy of Burrell and Morgan. *Omega*, 28(3), pp.249-268.

Gorrindo, T., Baer, L., Sanders, K.M., Birnbaum, R.J., Fromson, J.A., Sutton-Skinner, K.M., Romeo, S.A. and Beresin, E.V., 2011. Web-based simulation in psychiatry residency training: a pilot study. *Academic Psychiatry*, 35(4), pp.232-237.

GPhC, General Pharmaceutical Council, 2011. Future Pharmacists: Standards for the initial education and training of pharmacists. Accessed here on 10/05/19: https://www.pharmacyregulation.org/initial-training

GPhC, General Pharmaceutical Council, 2017. Standards for pharmacy professionals. Accessed here on 10/05/19: https://www.pharmacyregulation.org/spp

GPhC, General Pharmaceutical Council, 2018a. Pre-registration Manual. Accessed here on 10/05/19: https://www.pharmacyregulation.org/preregmanual

GPhC, General Pharmaceutical Council, 2018b. Revalidation Framework. Accessed here on 10/05/19: https://www.pharmacyregulation.org/revalidation-glance

GPhC, General Pharmaceutical Council, 2019. Consultation on initial education and training standards for pharmacists. Accessed here on 10/05/19: https://www.pharmacyregulation.org/consultation-initial-education-and-training-standards-pharmacists

Graneheim, U.H. and Lundman, B., 2004. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2), pp.105-112.

Grant, M.J. and Booth, A., 2009. A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, 26(2), pp.91-108.

Greco, M., Brownlea, A. and McGovern, J., 2001. Impact of patient feedback on the interpersonal skills of general practice registrars: results of a longitudinal study. *Medical Education*, 35(8), pp.748-756.

Greenbaum, T.L., 1998. The handbook for focus group research. 2nd edition. Sage, California.

Greene, J.C., Caracelli, V.J. and Graham, W.F., 1989. Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis*, 11(3), pp.255-274.

Greene, J.C. and Caracelli, V.J., 2003. Making paradigmatic sense of mixed methods practice. In: Tashakkori, A., Teddlie, C. (Eds.). Handbook of mixed methods in social and behavioral research. Chapter 9, pp.91-110. Sage, California.

Greenhalgh, T., Howick, J. and Maskrey, N., 2014. Evidence based medicine: a movement in crisis? *British Medical Journal*, 348, g3725.

Greenhalgh, T., Thorne, S. and Malterud, K., 2018. Time to challenge the spurious hierarchy of systematic over narrative reviews? *European Journal of Clinical Investigation*, 48(6), e12931.

Greenhill, N., Anderson, C., Avery, A. and Pilnick, A., 2011. Analysis of pharmacist–patient communication using the Calgary-Cambridge guide. *Patient Education and Counseling*, 83(3), pp.423-431.

Grenvik, A. and Schaefer, J., 2004. From Resusci-Anne to Sim-Man: the evolution of simulators in medicine. *Critical Care Medicine*, 32(2), pp.S56-S57.

Griffith III, C.H. and Wilson, J.F., 2001. The loss of student idealism in the 3rd-year clinical clerkships. *Evaluation & the Health Professions*, 24(1), pp.61-71.

Grimshaw, J.M. and Russell, I.T., 1993. Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *The Lancet*, 342(8883), pp.1317-1322.

Groves, R.M., Fowler Jr, F.J., Couper, M.P., Lepkowski, J.M., Singer, E. and Tourangeau, R., 2011. Survey methodology. 2nd edition. John Wiley & Sons, New Jersey.

Guadagnoli, E. and Ward, P., 1998. Patient participation in decision-making. *Social Science and Medicine*, 47(3), pp.329-339.

Guba, E.G. and Lincoln, Y.S., 1994. Competing paradigms in qualitative research. *Handbook of Qualitative Research*, 2(105), pp.163-194

Guest, G., Bunce, A. and Johnson, L., 2006. How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, 18(1), pp.59-82.

Guise, V., Chambers, M. and Välimäki, M., 2012. What can virtual patient simulation offer mental health nursing education? *Journal of Psychiatric and Mental Health Nursing*, 19(5), pp.410-418.

Gulbrandsen, P., Dalby, A.M.L., Ofstad, E.H. and Gerwing, J., 2014. Confusion in and about shared decision making in hospital outpatient encounters. *Patient Education and Counseling*, 96(3), pp.287-294.

Gutek, G.L., 2013. Philosophical, ideological, and theoretical perspectives on education. 2nd edition. Pearson Higher Ed.

Ha, J.F. and Longnecker, N., 2010. Doctor-patient communication: a review. *The Ochsner Journal*, 10(1), pp.38-43.

Haidet, P., Dains, J.E., Paterniti, D.A., Hechtel, L., Chang, T., Tseng, E. and Rogers, J.C., 2002. Medical student attitudes toward the doctor–patient relationship. *Medical Education*, 36(6), pp.568-574.

Hall, R., 2012. Mixed methods: in search of a paradigm. Paper presented at International Conference: Innovative Research in a Changing and Challenging World, Phuket, Thailand. Accessed here on 10/05/19: http://auamii.com/proceedings_phuket_2012/hall.pdf

Halsted, W.S, 1904. The training of the surgeon. *Bulletin Johns Hopkins Hospital*. 15, pp.267–275.

Hamann, J., Mendel, R., Bühner, M., Kissling, W., Cohen, R., Knipfer, E. and Eckstein, H.H., 2012. How should patients behave to facilitate shared decision making–the doctors' view. *Health Expectations*, 15(4), pp.360-366.

Hammoud, M.M., Morgan, H.K., Edwards, M.E., Lyon, J.A. and White, C., 2012. Is video review of patient encounters an effective tool for medical student learning? A review of the literature. *Advances in Medical Education and Practice*, 3, pp.19-30.

Hanin, L., 2017. Why statistical inference from clinical trials is likely to generate false and irreproducible results. *BMC Medical Research Methodology*, 17(1), 127.

Hanna, M. and Fins, J.J., 2006. Power and communication: why simulation training ought to be complemented by experiential and humanist learning. *Academic Medicine*, 81(3), pp.265-270.

Harasym, P.H., Woloschuk, W. and Cunning, L., 2008. Undesired variance due to examiner stringency/leniency effect in communication skill scores assessed in OSCEs. *Advances in Health Sciences Education*, 13(5), pp.617-632.

Harden, R.M., 2006. Trends and the future of postgraduate medical education. *Emergency Medicine Journal*, 23(10), pp.798-802.

Hargie,O., Dickson, D., Boohan, M. and Hughes, K., 1998. A survey of communication skills training in UK Schools of Medicine: present practices and prospective proposals. *Medical Education*, 32, pp.25-34.

Hargie, O., Boohan, M., McCoy, M. and Murphy, P., 2010. Current trends in communication skills training in UK schools of medicine. *Medical Teacher*, 32(5), pp.385-391.

Hargraves, I., LeBlanc, A., Shah, N.D. and Montori, V.M., 2016. Shared decision making: the need for patient-clinician conversation, not just information. *Health Affairs*, 35(4), pp.627-629.

Harrison, J.D., Solomon, M.J., Young, J.M., Meagher, A., Butow, P., Salkeld, G., Hruby, G. and Clarke, S., 2008. Patient and physician preferences for surgical and adjuvant treatment options for rectal cancer. *Archives of Surgery*, 143(4), pp.389-394.

Hart, S.L., (1971). Axiology--Theory of Values. *Philosophy and Phenomenological Research*, 32(1), pp.29-41.

Haum, H., 1980. The Movie Quote Book. Lippincott & Crowell, New York.

Hayes, K.A. and Lehmann, C.U., 1996. The interactive patient: a multimedia interactive educational tool on the World Wide Web. MD computing: *Computers in Medical Practice*, 13(4), pp.330-334.

Hayes-Roth, B., Amano, K., Saker, R. and Sephton, T., 2004. Training brief intervention with a virtual coach and virtual patients. *Annual Review of CyberTherapy and Telemedicine*, 2, pp.85-96.

Haynes, R.B., Devereaux, P.J. and Guyatt, G.H., 2002. Physicians' and patients' choices in evidence based practice: evidence does not make decisions, people do. *British Medical Journal*, 324(7350), 1350.

Hayward, R.A., 2017. When to start a statin is a preference-sensitive decision. *Circulation*, 136(12), pp.1099–1101.

HCPC, Health and Care Professions Council, 2016. Standards of conduct, performance and ethics. Accessed here on 10/05/2019: https://www.hcpc-uk.org/publications/standards/index.asp?id=38

Healey, M. and Jenkins, A., 2000. Kolb's experiential learning theory and its application in geography in higher education. *Journal of Geography*, 99(5), pp.185-195.

HEE, Health Education England, 2018. Training for pharmacists. Accessed here on 10/05/19: https://www.hee.nhs.uk/printpdf/our-work/medicines-optimisation/training-pharmacists

Helman CG., 1984. Culture, health and illness. Oxford University Press, Oxford.

Henbest, R.J. and Stewart, M., 1990. Patient-centredness in the consultation. 2: Does it really make a difference? *Family Practice*, 7(1), pp.28-33.

Henderson, J.V., 1998. Comprehensive, technology-based clinical education: the "Virtual Practicum". *The International Journal of Psychiatry in Medicine*, 28(1), pp.41-79.

Hennink, M.M., Kaiser, B.N. and Marconi, V.C., 2017. Code saturation versus meaning saturation: how many interviews are enough? *Qualitative Health Research*, 27(4), pp.591-608.

Henschke, J.A., 2011. Considerations regarding the future of andragogy. *Adult Learning*, 22(1), pp.34-37.

Heritage, J., Robinson, J.D., Elliott, M.N., Beckett, M. and Wilkes, M., 2007. Reducing patients' unmet concerns in primary care: the difference one word can make. *Journal of General Internal Medicine*, 22(10), pp.1429-1433.

Hertzog, M.A., 2008. Considerations in determining sample size for pilot studies. *Research in Nursing & Health*, 31(2), pp.180-191.

Hewson, M.G. and Little, M.L., 1998. Giving feedback in medical education. *Journal of General Internal Medicine*, 13(2), pp.111-116.

Himmelstein, M.S. and Sanchez, D.T., 2016. Masculinity impediments: internalized masculinity contributes to healthcare avoidance in men and women. *Journal of Health Psychology*, 21(7), pp.1283-1292.

Hind, D., Reeves, B.C., Bathers, S., Bray, C., Corkhill, A., Hayward, C., Harper, L., Napp, V., Norrie, J., Speed, C. and Tremain, L., 2017. Comparative costs and activity from a sample of UK clinical trials units. *Trials*, 18(1), 203.

Hitchen, L., 2007. Conflicting guidelines on same topics cause doctors confusion, say MPs. *British Medical Journal*, 335(7628), p.1012.

Hoffman, R.M., Elmore, J.G., Fairfield, K.M., Gerstein, B.S., Levin, C.A. and Pignone, M.P., 2014. Lack of shared decision making in cancer screening discussions. *American Journal of Preventive Medicine*, 47(3), pp.251-259.

Hoffmann, T.C., Montori, V.M. and Del Mar, C., 2014. The connection between evidence-based medicine and shared decision making. *Journal of the American Medical Association*, 312(13), pp.1295-1296.

Hojat, M., Vergare, M.J., Maxwell, K., Brainard, G., Herrine, S.K., Isenberg, G.A., Veloski, J. and Gonnella, J.S., 2009. The devil is in the third year: a longitudinal study of erosion of empathy in medical school. *Academic Medicine*, 84(9), pp.1182-1191.

Holmes, G. and Abington-Cooper, M., 2000. Pedagogy vs. andragogy: A false dichotomy. *The Journal of Technology Studies*, 26(2), pp.50-55.

Homer, K., Boomla, K., Hull, S., Dostal, I., Mathur, R. and Robson, J., 2015. Statin prescribing for primary prevention of cardiovascular disease: a cross-sectional, observational study. *British Journal of General Practice*, 65(637), e538-e544.

Hong, P., Maguire, E., Purcell, M., Ritchie, K.C. and Chorney, J., 2017. Decision-making quality in parents considering adenotonsillectomy or tympanostomy tube insertion for their children. *JAMA Otolaryngology–Head & Neck Surgery*, 143(3), pp.260-266.

Hope, A., Garside, J. and Prescott, S., 2011. Rethinking theory and practice: pre-registration student nurses experiences of simulation teaching and learning in the acquisition of clinical skills in preparation for practice. *Nurse Education Today*, 31(7), pp.711-715.

Horstmann, M., Renninger, M., Hennenlotter, J., Horstmann, C.C. and Stenzl, A., 2009. Blended E-learning in a Web-based virtual hospital: a useful tool for undergraduate education in urology. *Education for Health*, 22(2), pp.269-280.

Howard-Jones, P.A., 2014. Neuroscience and education: myths and messages. *Nature Reviews Neuroscience*, 15(12), pp.817-825.

Howell, W.S., 1982. The empathic communicator. Wadsworth Pub Co.

Howells, R.J., Davies, H.A. and Silverman, J.D., 2006. Teaching and learning consultation skills for paediatric practice. *Archives of Disease in Childhood*, 91(4), pp.367-370.

Howie, J.G.R., Heaney, D. and Maxwell, M., 2004. Quality, core values and the general practice consultation: issues of definition, measurement and delivery. *Family Practice*, 21(4), pp.458-468.

Hsieh, H.F. and Shannon, S.E., 2005. Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), pp.1277-1288.

Huang, G., Reynolds, R. and Candler, C., 2007. Virtual patient simulation at US and Canadian medical schools. *Academic Medicine*, 82(5), pp.446-451.

Hubal, R.C., Kizakevich, P.N., Guinn, C.I., Merino, K.D. and West, S.L., 2000. The virtual standardized patient. *Medicine Meets Virtual Reality* (pp. 133-138).

Hubal, R.C., Deterding, R.R., Frank, G.A., Schwetzke, H.F. and Kizakevich, P.N., 2003. Lessons learned in modeling virtual pediatric patients. *Medicine Meets Virtual Reality*, 11, pp.127-130.

Hubal, R.C., Frank, G.A. and Guinn, C.I., 2003, January. Lessons learned in modeling schizophrenic and depressed responsive virtual humans for training. In Proceedings of the 8th international conference on Intelligent user interfaces (pp. 85-92).

Hugo, J.F.M. and Couper, I.D., 2006. Teaching consultation skills using juggling as a metaphor: open forum. *South African Family Practice*, 48(5), pp.5-7.

Hulsman, R.L., Harmsen, A.B. and Fabriek, M., 2009. Reflective teaching of medical communication skills with DiViDU: Assessing the level of student reflection on recorded consultations with simulated patients. *Patient Education and Counseling*, 74(2), pp.142-149.

Hulsman, R.L., Pranger, S., Koot, S., Fabriek, M., Karemaker, J.M. and Smets, E.M., 2010. How stressful is doctor–patient communication? Physiological and psychological stress of medical students in simulated history taking and bad-news consultations. *International Journal of Psychophysiology*, 77(1), pp.26-34.

Hurst, H.M. and Marks-Maran, D., 2011. Using a virtual patient activity to teach nurse prescribing. *Nurse Education in Practice*, 11(3), pp.192-198.

Husebø, S.E., O'Regan, S. and Nestel, D., 2015. Reflective practice and its role in simulation. *Clinical Simulation in Nursing*, 11(8), pp.368-375.

Huwendiek, S., De Leng, B.A., Zary, N., Fischer, M.R., Ruiz, J.G. and Ellaway, R., 2009a. Towards a typology of virtual patients. *Medical Teacher*, 31(8), pp.743-748.

Huwendiek, S., Reichert, F., Bosse, H.M., De Leng, B.A., Van Der Vleuten, C.P., Haag, M., Hoffmann, G.F. and Tönshoff, B., 2009b. Design principles for virtual patients: a focus group study among students. *Medical Education*, 43(6), pp.580-588.

Iqbal, A., Schloss, S., George, D. and Isonaka, S., 2002. Worldwide guidelines for chronic obstructive pulmonary disease: a comparison of diagnosis and treatment recommendations. *Respirology*, 7(3), pp.233-239.

Irwin A., Slay J., Raymond Choo K.K. and Lui L. (2014). Money laundering and terrorism financing in virtual environments: a feasibility study. *Journal of Money Laundering Control*, 17(1), pp.50-75.

Issenberg, S.B., McGaghie, W.C., Petrusa, E.R., Lee Gordon, D. and Scalese, R.J., 2005. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Medical Teacher*, 27(1), pp.10-28.

Ives, J., Papanikitas, A., Myres, P. and Gregory, S., 2018. Shared decision making: a need for honesty? *British Journal of General Practice*, 68(671), pp.292-293.

Jack, E., Maskrey, N., Byng, R., 2018. SHERPA: a new model for clinical decision making in patients with multimorbidity. *Lancet*, 392, pp.1397-1399.

Jalal, Z., Cox, A., Goel, N., Vaitha, N., King, K. and Ward, J., 2018. Communications Skills in the Pharmacy Profession: A Cross Sectional Survey of UK Registered Pharmacists and Pharmacy Educators. *Pharmacy*, 6(4), p.132.

Jamieson, S., 2004. Likert scales: how to (ab)use them. *Medical Education*, 38(12), pp.1217-1218

Janda, M.S., Mattheos, N., Nattestad, A., Wagner, A., Nebel, D., Färbom, C., Lê, D.H. and Attström, R., 2004. Simulation of patient encounters using a virtual patient in periodontology instruction of dental students: design, usability, and learning effect in history-taking skills. *European Journal of Dental Education*, 8(3), pp.111-119.

Jenkins, V. and Fallowfield, L., 2002. Can communication skills training alter physicians' beliefs and behavior in clinics? *Journal of Clinical Oncology*, 20(3), pp.765-769.

Jick, T.D., 1979. Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly*, 24(4), pp.602-611.

Jin, H.K., Choi, J.H., Kang, J.E. and Rhie, S.J., 2017. The effect of communication skills training on patient-pharmacist communication in pharmacy education: a meta-analysis. *Advances in Health Sciences Education*, 23(3), pp.1-20.

Johanson, G.A. and Brooks, G.P., 2010. Initial scale development: sample size for pilot studies. *Educational and Psychological Measurement*, 70(3), pp.394-400.

Johnsen, K., Dickerson, R., Raij, A., Lok, B., Jackson, J., Shin, M., Hernandez, J., Stevens, A. and Lind, D.S., 2005. Experiences in using immersive virtual characters to educate medical communication skills. *Virtual Reality*. (pp.179-186).

Johnson, R.B. and Onwuegbuzie, A.J., 2004. Mixed methods research: a research paradigm whose time has come. *Educational Researcher*, 33(7), pp.14-26.

Johnson, R.B., Onwuegbuzie, A.J. and Turner, L.A., 2007. Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), pp.112-133.

Joint Formulary Committee, 2018. British National Formulary (online) London: BMJ Group and Pharmaceutical Press. Accessed here on 10/05/19: http://www.medicinescomplete.com

Jones, A., Powell, T., Watkins, D. and Kelly, D., 2015. Realising their potential? Exploring interprofessional perceptions and potential of the advanced practitioner role: a qualitative analysis. *BMJ Open*, 5(12), e009740.

Jones, C. and Shao, B., 2011. The net generation and digital natives: implications for higher education. A literature review commissioned by the Higher Education Academy.

Joseph-Williams, N., Elwyn, G. and Edwards, A., 2014. Knowledge is not power for patients: a systematic review and thematic synthesis of patient-reported barriers and facilitators to shared decision making. *Patient Education and Counseling*, 94(3), pp.291-309.

Joseph-Williams, N., Lloyd, A., Edwards, A., Stobbart, L., Tomson, D., Macphail, S., Dodd, C., Brain, K., Elwyn, G. and Thomson, R., 2017. Implementing shared decision making in the NHS: lessons from the MAGIC programme. *British Medical Journal*, 357, j1744.

Julious, S.A., 2005. Sample size of 12 per group rule of thumb for a pilot study. *Pharmaceutical Statistics*, 4(4), pp.287-291.

Junius-Walker, U., Stolberg, D., Steinke, P., Theile, G., Hummers-Pradier, E. and Dierks, M.L., 2011. Health and treatment priorities of older patients and their general practitioners: a cross-sectional study. *Quality in primary care*, 19(2), pp.67-76.

Kaakinen, J. and Arwood, E., 2009. Systematic review of nursing simulation literature for use of learning theory. *International Journal of Nursing Education Scholarship*, 6(1), Epub.

Kable, A.K., Pich, J. and Maslin-Prothero, S.E., 2012. A structured approach to documenting a search strategy for publication: a 12 step guideline for authors. *Nurse Education Today*, 32(8), pp.878-886.

Kachalia, A. and Mello, M.M., 2013. Breast cancer screening: conflicting guidelines and medicolegal risk. *Journal of the American Medical Association*, 309(24), pp.2555-2556.

Kahan, B.C., Rehal, S. and Cro, S., 2015. Risk of selection bias in randomised trials. *Trials*, 16(1), p.405.

Kahneman, D., 2003. Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review*, 93(5), pp.1449-1475.

Kaplan, A.M. and Haenlein, M., 2009. The fairyland of Second Life: virtual social worlds and how to use them. *Business Horizons*, 52(6), pp.563-572.

Karnieli-Miller, O. and Eisikovits, Z., 2009. Physician as partner or salesman? Shared decision-making in real-time encounters. *Social Science & Medicine*, 69(1), pp.1-8.

Keele University. Research Ethics Approval Processes. Accessed here on 10/05/19: https://www.keele.ac.uk/raise/researchsupport/projectassurance/researchethics/

Kelly, M.P. and Capewell, S., 2004. Relative contributions of changes in risk factors and treatment to the reduction in coronary heart disease mortality. Health Development Agency, briefing paper. Accessed here on 10/05/2019: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.605.5747&rep=rep1&type=pdf

Kelly, M., 2009. The role of theory in qualitative health research. *Family Practice*, 27(3), pp.285-290.

Kenny, P., Parsons, T.D., Gratch, J. and Rizzo, A.A., 2008. Evaluation of Justina: a virtual patient with PTSD. In International Workshop on Intelligent Virtual Agents (pp. 394-408). Springer, Berlin, Heidelberg.

Kerfoot, B.P. and Kissane, N., 2014. The use of gamification to boost residents' engagement in simulation training. *JAMA Surgery*, 149(11), pp.1208-1209.

Kharb, P., Samanta, P.P., Jindal, M. and Singh, V., 2013. The learning styles and the preferred teaching—learning strategies of first year medical students. *Journal of Clinical and Diagnostic Research*, 7(6), pp.1089-1092.

Kidd, J., Patel, V. and Peile, Y.C., 2005. Clinical and communication skills: need to be learnt side by side. *British Medical Journal*, 330(7488), p.374.

Kidd, L.I., Knisley, S.J. and Morgan, K.I., 2012. Effectiveness of a Second Life® simulation as a teaching strategy for undergraduate mental health nursing students. *Journal of Psychosocial Nursing and Mental Health Services*, 50(7), pp.28-37.

King, L. and Clark, J.M., 2002. Intuition and the development of expertise in surgical ward and intensive care nurses. *Journal of Advanced Nursing*, 37(4), pp.322-329.

Kirkpatrick, D.L. and Kirkpatrick, J.D., 2006. Evaluating Training Programs; the Four Levels. 3rd edition. Berrett-Koehler, San Francisco.

Kirschner, P.A., 2017. Stop propagating the learning styles myth. *Computers & Education*, 106, pp.166-171.

Kitto, S.C., Chesters, J. and Grbich, C., 2008. Quality in qualitative research. *Medical Journal of Australia*, 188(4), p.243.

Kitzinger, J., 1994. The methodology of focus groups: the importance of interaction between research participants. *Sociology of Health & Illness*, 16(1), pp.103-121.

Kitzinger, J., 1995. Qualitative research. Introducing focus groups. *British Medical Journal*, 311(7000), p.299-302.

Kleinert, R., Heiermann, N., Wahba, R., Chang, D.H., Hölscher, A.H. and Stippel, D.L., 2015. Design, realization, and first validation of an immersive web-based virtual patient simulator for training clinical decisions in surgery. *Journal of Surgical Education*, 72(6), pp.1131-1138.

Kleinert, R., Plum, P., Heiermann, N., Wahba, R., Chang, D.H., Hölscher, A.H. and Stippel, D.L., 2016. Embedding a virtual patient simulator in an interactive surgical lecture. *Journal of Surgical Education*, 73(3), pp.433-441.

Kleinsmith, A., Rivera-Gutierrez, D., Finney, G., Cendan, J. and Lok, B., 2015. Understanding empathy training with virtual patients. Computers in Human *Behavior*, 52, pp.151-158.

Kleven, N.F., Prasolova-Førland, E., Fominykh, M., Hansen, A., Rasmussen, G., Sagberg, L.M. and Lindseth, F., 2014. Training nurses and educating the public using a virtual operating room with Oculus Rift. In Virtual Systems & Multimedia, 2014 International Conference (pp. 206-213).

Knowles, M.S., 1980. The modern practice of adult education (revised and updated). Follett Publishing Corporation. New York, Cambridge.

Knowles, M.S., Holton III, E.F. and Swanson, R.A., 2015. The adult learner: the definitive classic in adult education and human resource development. 8th edition. Routledge, Abingdon.

Koh, K.T.C., Goh, L.G. and Tan, T.C., 1991. Using role-play to teach consultation skills—the Singapore experience. *Medical Teacher*, 13(1), pp.55-61.

Kolb, A.Y. and Kolb, D.A., 2005. Learning styles and learning spaces: enhancing experiential learning in higher education. *Academy of Management Learning & Education*, 4(2), pp.193-212.

Kon, A.A., 2010. The shared decision-making continuum. *Journal of the American Medical Association*, 304(8), pp.903-904.

Kononowicz, A.A., Zary, N., Edelbring, S., Corral, J. and Hege, I., 2015. Virtual patients-what are we talking about? A framework to classify the meanings of the term in healthcare education. *BMC Medical Education*, 15(1), 11.

Kothari, C.R., 2004. Research methodology: methods and techniques. 2nd edition. New Age International.

Kravitz, R.L. and Melnikow, J., 2001. Engaging patients in medical decision making: the end is worthwhile, but the means need to be more practical. *British Medical Journal*, 323(7313) p584.

Kron, F.W., Fetters, M.D., Scerbo, M.W., White, C.B., Lypson, M.L., Padilla, M.A., Gliva-McConvey, G.A., Belfore II, L.A., West, T., Wallace, A.M. and Guetterman, T.C., 2017. Using a computer simulation for teaching communication skills: a blinded multisite mixed methods randomized controlled trial. *Patient Education and Counseling*, 100(4), pp.748-759.

Krosnick, J.A., Presser, S., 2010. Question and Questionnaire Design. In: Marsden, P.V. and Wright, J.D. (Eds.). Handbook of survey research. 2nd edition, pp.263-314.

Kruglanski, A.W. and Gigerenzer, G., 2011. Intuitive and deliberate judgments are based on common principles. *Psychological Review*, 118(1), p.97.

Kuhn, T., 1996. The structure of scientific revolutions. 3rd edition. University of Chicago Press, Chicago, IL.

Kunneman, M., Marijnen, C.A., Baas-Thijssen, M.C., van der Linden, Y.M., Rozema, T., Muller, K., Geijsen, E.D., Stiggelbout, A.M. and Pieterse, A.H., 2015. Considering patient values and treatment preferences enhances patient involvement in rectal cancer treatment decision making. *Radiotherapy and Oncology*, 117(2), pp.338-342.

Kurtz, S.M., 1990. Attending rounds: a format and techniques for improving teaching and learning. In 3rd International Conference on Teaching and Assessing Clinical Competence, Groningen, the Netherlands, pp.61-65.

Kurtz, S.M. and Silverman, J.D., 1996. The Calgary—Cambridge referenced observation guides: an aid to defining the curriculum and organizing the teaching in communication training programmes. *Medical Education*, 30(2), pp.83-89.

Kurtz, S., Silverman, J. and Draper, J., 2005. Teaching and learning communication skills in medicine. 2nd edition. Radcliffe, Oxford.

Laidlaw, T.S., MacLeod, H., Kaufman, D.M., Langille, D.B. and Sargeant, J., 2002. Implementing a communication skills programme in medical school: needs assessment and programme change. *Medical Education*, 36(2), pp.115-124.

Lancaster, G.A., Dodd, S. and Williamson, P.R., 2004. Design and analysis of pilot studies: recommendations for good practice. *Journal of Evaluation in Clinical Practice*, 10(2), pp.307-312.

Lancaster, G.A., 2015. Pilot and feasibility studies come of age! *Pilot and Feasibility Studies*, 1(1), pp. 1.

Lane, C. and Rollnick, S., 2007. The use of simulated patients and role-play in communication skills training: a review of the literature to August 2005. *Patient Education and Counseling*, 67(1), pp.13-20.

Larbuisson, R., Pendeville, P., Nyssen, A.S., Janssens, M. and Mayné, A., 1999. Use of Anaesthesia Simulator: initial impressions of its use in two Belgian University Centers. *Acta Anaesthesiologica Belgica*, 50(2), pp.87-93.

Lee, A., 2017. Bolam'to 'Montgomery' is result of evolutionary change of medical practice towards 'patient-centred care. *Postgraduate Medical Journal*, 93(1095), pp.46-50.

Lefroy, J. and McKinley, R.K., 2011. Skilled communication: comments further to 'Creativity in clinical communication: from communication skills to skilled communication'. *Medical Education*, 45(9), pp.958-958.

Légaré, F. and Thompson-Leduc, P., 2014. Twelve myths about shared decision making. *Patient Education and Counseling*, 96(3), pp.281-286.

Légaré, F., Adekpedjou, R., Stacey, D., Turcotte, S., Kryworuchko, J., Graham, I.D., Lyddiatt, A., Politi, M.C., Thomson, R., Elwyn, G. and Donner-Banzhoff, N., 2018. Interventions for increasing the use of shared decision making by healthcare professionals. *The Cochrane database of systematic reviews*, 7, CD006732.

Lehman, R., 2018. Shared Decision Making: essential but hard to measure. Evidently Cochrane, Communication and Engagement. Accessed here on 10/05/2019: http://www.evidentlycochrane.net/shared-decision-making-essential-but-hard-to-measure/

Lenzer, J., Hoffman, J.R., Furberg, C.D. and Ioannidis, J.P., 2013. Ensuring the integrity of clinical practice guidelines: a tool for protecting patients. *British Medical Journal* (Online), 347.

Leon, A.C., Davis, L.L. and Kraemer, H.C., 2011. The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research*, 45(5), pp.626-629.

Letherby, G., 2003. Feminist research in theory and practice. McGraw-Hill Education (UK).

Leviathan, Y. and Matias, Y., 2018. Google Duplex: an AI system for accomplishing real-world tasks over the phone. Google AI blog. Accessed here on 10/05/19: https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html

Levinson, W. and Roter, D., 1995. Physicians' psychosocial beliefs correlate with their patient communication skills. *Journal of General Internal Medicine*, 10(7), pp.375-379.

Levinson, W., Roter, D.L., Mullooly, J.P., Dull, V.T. and Frankel, R.M., 1997. Physician-patient communication: the relationship with malpractice claims among primary care physicians and surgeons. *Journal of the American Medical Association*, 277(7), pp.553-559.

Levinson, W., Kao, A., Kuby, A. and Thisted, R.A., 2005. Not all patients want to participate in decision making. *Journal of General Internal Medicine*, 20(6), pp.531-535.

Liaw, T., Kennedy, G., Keppell, M., Marty, J. and McNair, R., 2000. Using multimedia to assist students with communication skills and biopsychosocial integration: an evaluation. Australasian *Journal of Educational Technology*, 16(2), pp.104-125.

Likert, R., 1932. A technique for the measurement of attitudes. *Archives of Psychology*, 22(140), pp.55.

Lim, B.T., Moriarty, H. and Huthwaite, M., 2011. "Being-in-role": a teaching innovation to enhance empathic communication skills in medical students. *Medical Teacher*, 33(12), e663-e669.

Lin, K., Travlos, D.V., Wadelin, J.W. and Vlasses, P.H., 2011. Simulation and introductory pharmacy practice experiences. *American Journal of Pharmaceutical Education*, 75(10), p.209.

Lin, P.J., Saret, C.J., Neumann, P.J., Sandberg, E.A. and Cohen, J.T., 2016. Assessing the value of treatment to address various symptoms associated with multiple sclerosis: results from a contingent valuation study. *PharmacoEconomics*, 34(12), pp.1255-1265.

Lipton, R.B., Cutrer, F.M., Goadsby, P.J., Ferrari, M.D., Dodick, D.W., McCrory, D., Liberman, J.N. and Williams, P., 2005. How treatment priorities influence triptan preferences in clinical practice: perspectives of migraine sufferers, neurologists, and primary care physicians. *Current Medical Research and Opinion*, 21(3), pp.413-424.

Lofland, J.H., Johnson, P.T., Ingham, M.P., Rosemas, S.C., White, J.C. and Ellis, L., 2017. Shared decision-making for biologic treatment of autoimmune disease: influence on adherence, persistence, satisfaction, and health care costs. *Patient Preference and Adherence*, 11, p.947.

Lok, B., Ferdig, R.E., Raij, A., Johnsen, K., Dickerson, R., Coutts, J., Stevens, A. and Lind, D.S., 2006. Applying virtual reality in medical communication education: current findings and potential teaching and learning benefits of immersive virtual patients. *Virtual Reality*, 10(3-4), pp.185-195.

Longhurst, R, 2016. Semi-Structured Interviews and Focus Groups. In: Clifford, N., Cope, M., Gillespie, T., French S. (Eds.). Key Methods in Geography. Sage, London.

Longo, M.F., Cohen, D.R., Hood, K., Edwards, A., Robling, M., Elwyn, G. and Russell, I.T., 2006. Involving patients in primary care consultations: assessing preferences using discrete choice experiments. *British Journal of General Practice*, 56(522), pp.35-42.

Loue, S., 2000. Textbook of research ethics: theory and practice. 1st edition. Springer Science & Business Media, New York.

Lowes, S., Hamilton, G., Hochstetler, V. and Paek, S., 2013. Teaching communication skills to medical students in a virtual world. *Journal of Interactive Technology and Pedagogy*, 3, e1.

Lucardie, D., 2014. The impact of fun and enjoyment on adult's learning. *Procedia-Social and Behavioral Sciences*, 142, pp.439-446.

Ludolph, R. and Schulz, P.J., 2017. Debiasing health-related judgments and decision making: a systematic review. *Medical Decision Making*, 38(1), pp.3-13.

Lujan, H.L. and DiCarlo, S.E., 2006. First-year medical students prefer multiple learning styles. *Advances in Physiology Education*, 30(1), pp.13-16.

Lunt, P. and Livingstone, S., 1996. Rethinking the focus group in media and communications research. *Journal of Communication*, 46(2), pp.79-98.

Mackenzie, N. and Knipe, S., 2006. Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research*, 16(2), pp.193-205.

Madan, A.K., Caruso, B.A., Lopes, J.E. and Gracely, E.J., 1998. Comparison of simulated patient and didactic methods of teaching HIV risk assessment to medical residents. *American Journal of Preventive Medicine*, 15(2), pp.114-119.

Maguire, G.P. and Rutter, D.R., 1976. History-taking for medical students: I—Deficiencies in performance. *The Lancet*, 308(7985), pp.556-558.

Maguire, P., Fairbairn, S. and Fletcher, C., 1986. Consultation skills of young doctors: I--Benefits of feedback training in interviewing as students persist. *BMJ: Clinical Research Edition*, 292(6535), pp.1573-1576.

Maguire, P. and Pitceathly, C., 2002. Key communication skills and how to acquire them. *British Medical Journal*, 325(7366), pp.697-700.

Maicher, K., Danforth, D., Price, A., Zimmerman, L., Wilcox, B., Liston, B., Cronau, H., Belknap, L., Ledford, C., Way, D. and Post, D., 2017. Developing a conversational virtual standardized patient to enable students to practice history-taking skills. *Simulation in Healthcare*, 12(2), pp.124-131.

Majeed, A., Ferguson, J. and Field, J., 1999. Prescribing of beta-2 agonists and inhaled steroids in England: trends between 1992 and 1998, and association with material deprivation, chronic illness and asthma mortality rates. *Journal of Public Health*, 21(4), pp.395-400.

Makoul, G., 2001. The SEGUE Framework for teaching and assessing communication skills. *Patient Education and Counseling*, 45(1), pp.23-34.

Malekzadeh, S., Pfisterer, M.J., Wilson, B., Na, H. and Steehler, M.K., 2011. A novel low-cost sinus surgery task trainer. *Otolaryngology--Head and Neck Surgery*, 145(4), pp.530-533.

Malterud, K., Siersma, V.D. and Guassora, A.D., 2016. Sample size in qualitative interview studies: guided by information power. *Qualitative Health Research*, 26(13), pp.1753-1760.

Mamede, S., Schmidt, H.G., Rikers, R.M., Custers, E.J., Splinter, T.A. and van Saase, J.L., 2010. Conscious thought beats deliberation without attention in diagnostic decision-making: at least when you are an expert. *Psychological Research*, 74(6), pp.586-592.

Mannion, L., 1999. Teaching psychiatric consultation skills by video interview: a survey of student opinion. *Medical Teacher*, 21(1), pp.85-86.

Mansfield, F., 1991. Supervised role-play in the teaching of the process of consultation. *Medical Education*, 25(6), pp.485-490.

Mapp, T., 2008. Understanding phenomenology: the lived experience. *British Journal of Midwifery*, 16(5), pp.308-311.

Marewski, J.N. and Gigerenzer, G., 2012. Heuristic decision making in medicine. *Dialogues in Clinical Neuroscience*, 14(1), p.77.

Margaryan, A., Littlejohn, A. and Vojt, G., 2011. Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, 56(2), pp.429-440.

Marsden, P.V. and Wright, J.D., 2010. Handbook of survey research. Emerald Group Publishing.

Marshall, B., Cardon, P., Poddar, A. and Fontenot, R., 2013. Does sample size matter in qualitative research? A review of qualitative interviews in IS research. *Journal of Computer Information Systems*, 54(1), pp.11-22.

Maskrey, N., Hutchinson, M.A. and Underhill, M.J., 2009. Getting a better grip on research: the comfort of opinion. *InnovAiT*, 2(12), pp.739-749.

Maskrey, N. and Gordon, A., 2017. Shared understanding with patients. *JAMA Internal Medicine*, 177(9), pp.1247-1248.

Mason, M., 2010. Sample size and saturation in PhD studies using qualitative interviews. In Forum: *Qualitative Social Research*, 11(3), Art. 8.

Matthys, J., De Meyere, M., van Driel, M.L. and De Sutter, A., 2007. Differences among international pharyngitis guidelines: not just academic. *The Annals of Family Medicine*, 5(5), pp.436-443.

Maxcy, S.J., 2003. Pragmatic threads in mixed methods research in the social sciences: the search for multiple modes of inquiry and the end of the philosophy of formalism. Handbook of Mixed Methods in Social and Behavioral Research, pp.51-89.

Maxwell, J.A., 2016. Expanding the history and range of mixed methods research. *Journal of Mixed Methods Research*, 10(1), pp.12-27.

Mays, N. and Pope, C., 2000. Assessing quality in qualitative research. *British Medical Journal*, 320(7226), pp.50-52.

McCartney, M., Treadwell, J., Maskrey, N. and Lehman, R., 2016. Making evidence based medicine work for individual patients. *British Medical Journal*, 353, i2452.

McCoy, L., Lewis, J.H. and Dalton, D., 2016. Gamification and multimedia for medical education: a landscape review. *Journal of the American Osteopathic Association*, 116(1), pp.22-34.

McCullough, M., 2012. Bringing drama into medical education. *The Lancet*, 379(9815), pp.512-513.

McCusker, K. and Gunaydin, S., 2015. Research using qualitative, quantitative or mixed methods and choice based on the research. *Perfusion*, 30(7), pp.537-542.

McGaghie, W.C., Issenberg, S.B., Petrusa, E.R. and Scalese, R.J., 2010. A critical review of simulation-based medical education research: 2003–2009. *Medical Education*, 44(1), pp.50-63.

McGaghie, W.C., Issenberg, S.B., Cohen, M.E.R., Barsuk, J.H. and Wayne, D.B., 2011. Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. *Academic medicine: journal of the Association of American Medical Colleges*, 86(6), p.706.

McGrath, J.M., 2013. Not all studies with small samples are pilot studies. *The Journal of Perinatal & Neonatal Nursing*, 27(4), pp.281-283.

McKay, E., Ryan, S. and Sumsion, T., 2008. Three journeys towards reflexivity. In: Finlay, L. and Gough, B. (Eds.). Reflexivity: a practical guide for researchers in health and social sciences. John Wiley & Sons.

McKinstry, B., 2000. Do patients wish to be involved in decision making in the consultation? A cross sectional survey with video vignettes. *British Medical Journal*, 321(7265), pp.867-871.

McLafferty, I., 2004. Focus group interviews as a data collecting strategy. *Journal of Advanced Nursing*, 48(2), pp.187-194.

Mead, N. and Bower, P., 2000. Patient-centredness: a conceptual framework and review of the empirical literature. *Social Science & Medicine*, 51(7), pp.1087-1110.

Meadow, R. and Hewitt, C., 1972. Teaching communication skills with the help of actresses and video-tape simulation. *Medical Education*, 6(4), pp.317-322.

Medley, C.F. and Home, C., 2005. Using simulation technology for undergraduate nursing education. *Journal of Nursing Education*, 44(1), p.31.

Meek-Prieto, C., 2007. Just age playing around-how second life aids and abets child pornography. *North Carolina Journal of Law & Technology*, 9(3), pp.88-111.

Meijers, M.C., Noordman, J., Spreeuwenberga, P. and van Dulmen, S., 2018. Shared decision-making in general practice: an observational study comparing 2007 with 2015. *Family Practice*. Epub.

Mennecke, B., Roche, E., Bray, D., Konsynski, B., Lester, J., Rowe, M. and Townsend, A., 2007. Second Life and other virtual worlds: a roadmap for research. *Communications of the Association for Information Systems*, 22(20), pp.371-388.

Merriam, S.B., 2001. Andragogy and self-directed learning: pillars of adult learning theory. *New Directions for Adult and Continuing Education*, 2001(89), pp.3-14.

Mertens, D.M., 2007. Transformative paradigm: mixed methods and social justice. *Journal of Mixed Methods Research*, 1(3), pp.212-225.

Mertens, D.M., 2012. What comes first? The paradigm or the approach? *Journal of Mixed Methods Research*, 6(4), pp255-257

Mertens, D.M., 2015. Research and evaluation in education and psychology: integrating diversity with quantitative, qualitative, and mixed methods. 4th edition. Sage.

Miller, G.E., 1990. The assessment of clinical skills/competence/performance. Academic Medicine, 65(9), pp.63-67.

Miller, K.K., Riley, W., Davis, S. and Hansen, H.E., 2008. In situ simulation: a method of experiential learning to promote safety and team behavior. *The Journal of Perinatal & Neonatal Nursing*, 22(2), pp.105-113.

Millet, D., 2016. NICE chairman outlines basic qualities of a good GP. GP online, accessed here on 10/05/19: https://www.gponline.com/nice-chairman-outlines-basic-qualities-good-gp/article/1411479

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P. and Stewart, L.A., 2015. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, 4(1), p.1.

Monaghan, T., 2015. A critical analysis of the literature and theoretical perspectives on theory–practice gap amongst newly qualified nurses within the United Kingdom. *Nurse Education Today*, 35(8), e1-e7.

Montgomery v Lanarkshire Health Board, 2015. UKSC 11.

Moore, G. E., 1965. *Electronics*, 38, pp.114–117.

Moore, G. E., 1975. *IEDM Technology Digest*, pp.11–13.

Moore, P., Gómez, G. and Kurtz, S., 2012. Doctor-patient communication: one of the basic competencies, but different. *Atención Primaria*, 44(6), pp.358-365.

Moore, P.M., Rivera, S., Bravo-Soto, G.A., Olivares, C. and Lawrie, T.A., 2018. Communication skills training for healthcare professionals working with people who have cancer. *Cochrane Database of Systematic Reviews*, (7), CD003751.

Moran, M., Khan, A., Sochart, D.H. and Andrew, G., 2003. Expect the best, prepare for the worst: surgeon and patient expectation of the outcome of primary total hip and knee replacement. *Annals of the Royal College of Surgeons of England*, 85(3), pp.204-206.

Morgan, D.L., 2007. Paradigms lost and pragmatism regained: methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1(1), pp.48-76.

Morgan, D.L., 2014. Pragmatism as a paradigm for social research. *Qualitative Inquiry*, 20(8), pp.1045-1053.

Mori, M., 1970. The uncanny valley. *Energy*, 7(4), pp.33-35.

Morrison, J.M., Sullivan, F., Murray, E. and Jolly, B., 1999. Evidence-based education: development of an instrument to critically appraise reports of educational interventions. *Medical Education*, 33(12), pp.890-893.

Morrison, J., 2003. ABC of learning and teaching in medicine: evaluation. *British Medical Journal*, 326(7385), pp.385-387.

Morse, J.M., 1991. Approaches to qualitative-quantitative methodological triangulation. *Nursing Research*, 40(2), pp.120-123.

Mulley, A.G., Trimble, C. and Elwyn, G., 2012. Stop the silent misdiagnosis: patients' preferences matter. *British Medical Journal*, 345, e6572.

Murphy, S., Imam, B., Whitehouse, L., 2016. Twelve tips for utilizing virtual patients to teach professionalism. *MedEdPublish*, 5(3), 21.

Muth, C., van den Akker, M., Blom, J.W., Mallen, C.D., Rochon, J., Schellevis, F.G., Becker, A., Beyer, M., Gensichen, J., Kirchner, H. and Perera, R., 2014. The Ariadne principles: how to handle multimorbidity in primary care consultations. *BMC Medicine*, 12(1), 223.

Neighbour, R., 2005. The inner consultation: how to develop an effective and intuitive consulting style. 2nd Edition. Radcliffe Publishing.

Nestel, D. and Tierney, T., 2007. Role-play for medical students learning about communication: guidelines for maximising benefits. *BMC Medical Education*, 7(1), 3.

Nestel, D. and Bearman, M., 2015. Theory and simulation-based education: definitions, worldviews and applications. *Clinical Simulation in Nursing*, 11(8), pp.349-354.

Newton, P.M. and Miah, M., 2017. Evidence-based higher education – is the learning styles 'myth' important? *Frontiers in Psychology*, 8(444), ePub.

NHS England, 2019. Shared Decision Making programme. Accessed here on 10/05/19: https://www.england.nhs.uk/rightcare/useful-links/shared-decision-making/

NICE, National Institute for Health and Care Excellence 2012. Patient experience in adult NHS services: improving the experience of care for people using adult NHS services. NICE guideline (CG138).

NICE, National Institute for Health and Care Excellence 2015. Lower urinary tract symptoms in men: management. NICE guideline (CG97).

NICE, National Institute for Health and Care Excellence 2016a. Multimorbidity: clinical assessment and management. NICE guideline (NG56).

NICE, National Institute for Health and Care Excellence 2016b. Cardiovascular disease: risk assessment and reduction, including lipid modification. NICE guideline (CG181).

NICE, National Institute for Health and Care Excellence, 2019. Shared decision making. GID-NG10120. Accessed here on 10/05/19: https://www.nice.org.uk/guidance/indevelopment/gid-ng10120

Nilsen, S. and Baerheim, A., 2005. Feedback on video recorded consultations in medical teaching: why students loathe and love it–a focus-group based qualitative study. *BMC Medical Education*, 5(1), 28.

Nirenburg, S., McShane, M., Beale, S., Jarrell, B. and Fantry, G., 2009. Integrating cognitive simulation into the Maryland virtual patient. *Medicine Meets Virtual Reality*, 17, pp.224-229.

NMC, Nursing and Midwifery Council, 2018. Future nurse: standards of proficiency for registered nurses. Accessed on 10/05/19: https://www.nmc.org.uk/globalassets/sitedocuments/education-standards/future-nurse-proficiencies.pdf

NMC, Nursing and Midwifery Council, 2018. The Code: Professional standards of practice and behaviour for nurses, midwives and nursing associates. Accessed here on 10/05/19: https://www.nmc.org.uk/standards/code/

Noble, H. and Smith, J., 2015. Issues of validity and reliability in qualitative research. *Evidence-Based Nursing*, 18(2), pp.34-35.

Norris, S.L., Burda, B.U., Holmer, H.K., Ogden, L.A., Fu, R., Bero, L., Schünemann, H. and Deyo, R., 2012. Author's specialty and conflicts of interest contribute to conflicting guidelines for screening mammography. *Journal of Clinical Epidemiology*, 65(7), pp.725-733.

Novack, D.H., Epstein, R.M. and Paulsen, R.H., 1999. Toward creating physician-healers: fostering medical students' self-awareness, personal growth, and well-being. *Academic Medicine*, 74, pp.516-520.

NPC, National Prescribing Center, 2011. Making decisions better. *MeReC Bulletin*. 22(1).

O'Keeffe, A.G., Nazareth, I. and Petersen, I., 2016. Time trends in the prescription of statins for the primary prevention of cardiovascular disease in the United Kingdom: a cohort study using The Health Improvement Network primary care data. *Clinical Epidemiology*, 8, pp.123-132.

Oh, J., Segal, R., Gordon, J., Boal, J. and Jotkowitz, A., 2001. Retention and use of patient-centered interviewing skills after intensive training. *Academic Medicine*, 76(6), pp.647-650.

O'hare, A.M., Rodriguez, R.A. and Bowling, C.B., 2015. Caring for patients with kidney disease: shifting the paradigm from evidence-based medicine to patient-centered care. *Nephrology Dialysis Transplantation*, 31(3), pp.368-375.

O'Neil, B., 2015. Enriching clinical communication teaching: A qualitative study of a curriculum field in UK medical schools. King's College London, PhD thesis.

Ong, S., Nakase, J., Moran, G.J., Karras, D.J., Kuehnert, M.J., Talan, D.A. and EMERGEncy ID NET Study Group, 2007. Antibiotic use for emergency department patients with upper respiratory infections: prescribing practices, patient expectations, and patient satisfaction. *Annals of Emergency Medicine*, 50(3), pp.213-220.

Opdenakker, R., 2006, September. Advantages and disadvantages of four interview techniques in qualitative research. In Forum Qualitative Sozialforschung/Forum: *Qualitative Social Research*, 7(4), Art. 11.

Oswald, K., 2018. Non-adherence: medicine's weakest link. Pharmaceutical Journal. Accessed on 10/05/19: https://www.pharmaceutical-journal.com/news-and-analysis/features/non-adherence-medicines-weakest-link/20204378.article

Ozcakar, N., Mevsim, V., Guldal, D., Gunvar, T., Yildirim, E., Sisli, Z. and Semin, I., 2009. Is the use of videotape recording superior to verbal feedback alone in the teaching of clinical skills? *BMC Public Health*, 9(1), 474.

Pan, X., Slater, M., Beacco, A., Navarro, X., Rivas, A.I.B., Swapp, D., Hale, J., Forbes, P.A.G., Denvir, C., Hamilton, A.F.D.C. and Delacroix, S., 2016. The responses of medical General Practitioners to unreasonable patient demand for antibiotics - a study of medical ethics using immersive virtual reality. *PloS One*, 11(2), e0146837.

Pan, X., Collingwoode-Williams, T., Antley, A., Brenton, H., Congdon, B., Drewett, O., Gillies, M.F.P., Swapp, D., Pleasence, P., Fertleman, C. and Delacroix, S., 2018. A study of professional awareness using immersive virtual reality: the responses of general practitioners to child safeguarding concerns. *Frontiers in Robotics and AI*, 5(80).

Pantziaras, I., Courteille, O., Mollica, R., Fors, U. and Ekblad, S., 2012. A pilot study of user acceptance and educational potentials of virtual patients in transcultural psychiatry. *International Journal of Medical Education*, 3, pp.132-140.

Pantziaras, I., Fors, U. and Ekblad, S., 2014. Virtual Mrs K: The learners' expectations and attitudes towards a virtual patient system in transcultural psychiatry. *Journal of Contemporary Medical Education*, 2(2), pp.109-115.

Pantziaras, I., Fors, U. and Ekblad, S., 2015. Training with virtual patients in transcultural psychiatry: do the learners actually learn? *Journal of Medical Internet Research*, 17(2).

Papadopoulos, L., Pentzou, A.E., Louloudiadis, K. and Tsiatsos, T.K., 2013. Design and evaluation of a simulation for pediatric dentistry in virtual worlds. *Journal of Medical Internet Research*, 15(10).

Papageorgiou, A., Miles, S., Fromage, M., Kemmy, J. and Leinster, S.J., 2011. Cross-sectional evaluation of a longitudinal consultation skills course at a new UK medical school. *BMC Medical Education*, 11(1), 55.

Parsons, T.D., Kenny, P. and Rizzo, A.A., 2008. Virtual human patients for training of clinical interview and communication skills. In Proceedings of the Virtual Reality and Associated Technology Conference 2008, pp.135-142.

Pashler, H., McDaniel, M., Rohrer, D. and Bjork, R., 2008. Learning styles: concepts and evidence. *Psychological Science in the Public Interest*, 9(3), pp.105-119.

Pataki, C., Pato, M.T., Sugar, J., Rizzo, A.S., Parsons, T.D., George, C.S. and Kenny, P., 2012. Virtual patients as novel teaching tools in psychiatry. *Academic Psychiatry*, 36(5), pp.398-400.

Patton, M.Q., 2002. Qualitative research and evaluation methods. 3rd edition. Sage, California.

Pawlikowska, T., Leach, J., Lavallee, P., Charlton, R. and Piercy, J., 2002. Consultation models. In: Charlton, R. (Ed). Learning to consult. Chapter 12, pp.178-215. Radcliffe Publishing, Abingdon.

Peddle, M., Bearman, M. and Nestel, D., 2016. Virtual patients and nontechnical skills in undergraduate health professional education: an integrative review. *Clinical Simulation in Nursing*, 12(9), pp.400-410.

Peña, A., 2010. The Dreyfus model of clinical problem-solving skills acquisition: a critical perspective. *Medical Education Online*, 15(1), p.4846.

Pendleton, D., Schofield, T., Tate, P., Havelock, P., 1984. The Consultation: an Approach to Learning and Teaching. Oxford University Press, Oxford.

Perry, W.G., 1999. Forms of ethical and intellectual development in the college years: A scheme. Jossey-Bass. California.

Phillips, D.L., 1975. Paradigms and incommensurability. *Theory and Society*, 2(1), pp.37-61.

Phillips, J. and Berge, Z.L., 2009. Second life for dental education. *Journal of Dental Education*, 73(11), pp.1260-1264.

Pillow, W., 2003. Confession, catharsis, or cure? Rethinking the uses of reflexivity as methodological power in qualitative research. *International Journal of Qualitative Studies in Education*, 16(2), pp.175-196.

Pilnick, A. and Dingwall, R., 2011. On the remarkable persistence of asymmetry in doctor/patient interaction: a critical review. *Social Science & Medicine*, 72(8), pp.1374-1382.

Plsek, P.E. and Greenhalgh, T., 2001. Complexity science: the challenge of complexity in health care. *British Medical Journal*, 323(7313), pp.625-628.

Poropata, A., 2000. Comparing apples with oranges: Teaching and the issue of incommensurability in organisational studies. Transcending boundaries: integrating people, processes and systems. Conference abstracts; p.325. Accessed here on 10/05/19: http://hdl.handle.net/10072/1213

Porta, M., 2015. A Dictionary of Epidemiology. 6th edition. Oxford University Press, Oxford.

Potts, A., 2000. "The essence of the hard on" hegemonic masculinity and the cultural construction of erectile dysfunction. *Men and Masculinities*, 3(1), pp.85-103.

Prabha, C., Silipigni Connaway, L., Olszewski, L. and Jenkins, L.R., 2007. What is enough? Satisficing information needs. *Journal of Documentation*, 63(1), pp.74-89.

Prietula, M.J. and Simon, H.A., 1989. The experts in your midst. *Harvard Business Review*, 67(1), pp.120-124.

Quine, W.V., 1948. On what there is. *The Review of Metaphysics*, 2(5), pp.21-38.

Rabiee, F., 2004. Focus-group interview and data analysis. *Proceedings of the Nutrition Society*, 63(4), pp.655-660.

Rachal, J.R. 1983. The andragogy-pedagogy debate: another voice in the fray. *Lifelong Learning: The Adult Years*, 6(9), pp.14–15

Rachal, J.R., 2002. Andragogy's detectives: a critique of the present and a proposal for the future. *Adult Education Quarterly*, 52(3), pp.210-227.

Raij, A., Johnsen, K., Dickerson, R., Lok, B., Cohen, M., Bernard, T., Oxendine, C., Wagner, P. and Lind, D.S., 2006. Interpersonal Scenarios: Virtual approx Real? In IEEE Virtual Reality Conference, 2006, pp. 59-66.

Raij, A.B., Johnsen, K., Dickerson, R.F., Lok, B.C., Cohen, M.S., Duerson, M., Pauly, R.R., Stevens, A.O., Wagner, P. and Lind, D.S., 2007. Comparing interpersonal interactions with a virtual human to those with a real human. IEEE transactions on visualization and computer graphics, 13(3), pp.443-457.

Rawnsley, M.M., 1998. Ontology, epistemology, and methodology: a clarification. *Nursing Science Quarterly*, 11(1), pp.2-4.

Razavi, D., Merckaert, I., Marchal, S., Libert, Y., Conradt, S., Boniver, J., Etienne, A.M., Fontaine, O., Janne, P., Klastersky, J. and Reynaert, C., 2003. How to optimize physicians' communication skills in cancer care: results of a randomized study assessing the usefulness of posttraining consolidation workshops. *Journal of Clinical Oncology*, 21(16), pp.3141-3149.

RCGP, Royal College of General Practitioners. COT: Detailed Guide to the Performance Criteria (PC). Accessed here on 10/05/2019: https://www.rcgp.org.uk/training-exams/training/mrcgp-workplace-based-assessment-wpba/cot-for-mrcgp-workplace-based-assessment.aspx

Rees, C., Sheard, C. and McPherson, A., 2004. Medical students' views and experiences of methods of teaching and learning communication skills. *Patient Education and Counseling*, 54(1), pp.119-121.

Reinders, M.E., Blankenstein, A.H., van Marwijk, H.W., Knol, D.L., Ram, P., van der Horst, H.E., de Vet, H.C. and van der Vleuten, C.P., 2011. Reliability of consultation skills assessments using standardised versus real patients. *Medical Education*, 45(6), pp.578-584.

Resnik, D.B., 2015. What is ethics in research & why is it important? National Institute of Environmental Health Sciences. Accessed here on 10/05/19: https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm

Rezaei, F. and Askari, H.A., 2014. Checking the relationship between physicians' communication skills and outpatients' satisfaction in the clinics of Isfahan Al-Zahra (S) Hospital in 2011. *Journal of Education and Health Promotion*, 3(28), pp. 1-8.

Riccardi, V.M. and Kurtz, S.M., 1983. Communication and counseling in health care. Charles C. Thomas Publisher.

Richards, L., 2014. Handling qualitative data: A practical guide. Sage, California.

Richards, T., 1998. Continuing medical education. *British Medical Journal*, 316(7127), p.246.

Richards, T., Coulter, A. and Wicks, P., 2015. Time to deliver patient centred care. *British Medical Journal*, 350(3), h530.

Richardson, A., Bracegirdle, L., McLachlan, S.I. and Chapman, S.R., 2013. Use of a three-dimensional virtual environment to teach drug-receptor interactions. *American Journal of Pharmaceutical Education*, 77(1), 11.

Rider, E.A. and Keefer, C.H., 2006. Communication skills competencies: definitions and a teaching toolbox. *Medical Education*, 40(7), pp.624-629.

Rieck, A.M., 2014. Exploring the nature of power distance on general practitioner and community pharmacist relations in a chronic disease management context. *Journal of Interprofessional Care*, 28(5), pp.440-446.

Robertson, M., Moir, J., Skelton, J., Dowell, J. and Cowan, S., 2011. When the business of sharing treatment decisions is not the same as shared decision making: a discourse analysis of decision sharing in general practice. *Health*, 15(1), pp.78-95.

Robinson, N., 1999. The use of focus group methodology—with selected examples from sexual health research. *Journal of Advanced Nursing*, 29(4), pp.905-913.

Robinson, O.C., 2013. Sampling in interview-based qualitative research: a theoretical and practical guide. *Qualitative Research in Psychology*, 11(1), pp.25-41.

Roche, A.M., Eccleston, P. and Sanson-Fisher, R., 1996. Teaching smoking cessation skills to senior medical students: a block-randomized controlled trial of four different approaches. *Preventive Medicine*, 25(3), pp.251-258.

Rodriguez-Paz, J., Kennedy, M., Salas, E., Wu, A.W., Sexton, J.B., Hunt, E.A. and Pronovost, P.J., 2009. Beyond “see one, do one, teach one”: toward a different training paradigm. *BMJ Quality & Safety*, 18(1), pp.63-68.

Roff, S., 2015. Reconsidering the “decline” of medical student empathy as reported in studies using the Jefferson Scale of Physician Empathy-Student version (JSPE-S). *Medical Teacher*, 37(8), pp.783-786.

Rogers, E.M. and Shoemaker, F.F., 1971. Communication of innovations; a cross-cultural approach.

Rogers, J.C. and Coutts, L., 2000. Do students' attitudes during preclinical years predict their humanism as clerkship students? *Academic Medicine*, 75(10), pp.S74-S77.

Rolfe, G., 1993. Closing the theory—practice gap: a model of nursing praxis. *Journal of Clinical Nursing*, 2(3), pp.173-177.

Rolfe, G., 2006. Validity, trustworthiness and rigour: quality and the idea of qualitative research. *Journal of Advanced Nursing*, 53(3), pp.304-310.

Roter, D.L., Hall, J.A., Kern, D.E., Barker, L.R., Cole, K.A. and Roca, R.P., 1995. Improving physicians' interviewing skills and reducing patients' emotional distress: a randomized clinical trial. *Archives of Internal Medicine*, 155(17), pp.1877-1884.

Roundtree, A.K., Kallen, M.A., Lopez-Olivo, M.A., Kimmel, B., Skidmore, B., Ortiz, Z., Cox, V. and Suarez-Almazor, M.E., 2009. Poor reporting of search strategy and conflict of interest in over 250 narrative and systematic reviews of two biologic agents in arthritis: a systematic review. *Journal of Clinical Epidemiology*, 62(2), pp.128-137.

Runeson, P. and Höst, M., 2009. Guidelines for conducting and reporting case study research in software engineering. *Empirical Software Engineering*, 14(2), 131.

Rutherford-Hemming, T., 2012. Simulation methodology in nursing education and adult learning theory. *Adult Learning*, 23(3), pp.129-137.

Sackett, D.L., Rosenberg, W.M., Gray, J.M., Haynes, R.B. and Richardson, W.S., 1996. Evidence based medicine: what it is and what it isn't. *British Medical Journal*, 312(7023), pp.71-72.

Sale, J.E. and Brazil, K., 2004. A strategy to identify critical appraisal criteria for primary mixed-method studies. *Quality and Quantity*, 38(4), pp.351-365.

Salisbury, C., Man, M.S., Bower, P., Guthrie, B., Chaplin, K., Gaunt, D.M., Brookes, S., Fitzpatrick, B., Gardner, C., Hollinghurst, S. and Lee, V., 2018. Management of multimorbidity using a patient-centred care model: a pragmatic cluster-randomised trial of the 3D approach. *The Lancet*, 392 (10141), pp.41-50.

Salti, I.S., 1995. Continuing medical education. *Medical Education*, 29(s1), pp.97-99.

Sandelowski, M., 1995. Sample size in qualitative research. *Research in Nursing & Health*, 18(2), pp.179-183.

Santema, T.K., Stoffer, E.A., Kunneman, M., Koelemay, M.J. and Ubbink, D.T., 2017. What are the decision-making preferences of patients in vascular surgery? A mixed-methods study. *BMJ Open*, 7(2), e013272.

Schibbye, A.L.L., 1993. The role of "recognition" in the resolution of a specific interpersonal dilemma. *Journal of Phenomenological Psychology*, 24(2), pp.175-189.

Schifferdecker, K.E. and Reed, V.A., 2009. Using mixed methods research in medical education: basic guidelines for researchers. *Medical Education*, 43(7), pp.637-644.

Schittek Janda, M., Mattheos, N., Nattestad, A., Wagner, A., Nebel, D., Färbom, C., Lê, D.H. and Attström, R., 2004. Simulation of patient encounters using a virtual patient in periodontology instruction of dental students: design, usability, and learning effect in history-taking skills. *European Journal of Dental Education*, 8(3), pp.111-119.

Schmidt, H., Norman, G. and Boshuizen, H., 1990. A cognitive perspective on medical expertise: theory and implications. *Academic Medicine*, 65(10), pp.611-621.

Schoenborn, N.L., Lee, K., Pollack, C.E., Armacost, K., Dy, S.M., Bridges, J.F., Xue, Q.L., Wolff, A.C. and Boyd, C., 2017. Older adults' views and communication preferences about cancer screening cessation. *JAMA Internal Medicine*, 177(8), pp.1121-1128.

Schoenthaler, A., Albright, G., Hibbard, J. and Goldman, R., 2017. Simulated conversations with virtual humans to improve patient-provider communication and reduce unnecessary prescriptions for antibiotics: a repeated measure pilot study. *JMIR medical education*, 3(1).

Scholl, I., Kriston, L., Dirmaier, J. and Härter, M., 2015. Comparing the nine-item Shared Decision-Making Questionnaire to the OPTION Scale–an attempt to establish convergent validity. *Health Expectations*, 18(1), pp.137-150.

Schon, D.A., 1987. Educating the Reflective Practitioner. Toward a New Design for Teaching and Learning in the Professions. The Jossey-Bass Higher Education Series. Jossey-Bass Publishers, San Francisco.

Schulz, K.F., Altman, D.G. and Moher, D., 2010. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMC Medicine*, 8(1), 18.

Scully, N.J., 2011. The theory-practice gap and skill acquisition: an issue for nursing education. *Collegian*, 18(2), pp.93-98.

Seo, M.G. and Barrett, L.F., 2007. Being emotional during decision making—good or bad? An empirical investigation. *Academy of Management Journal*, 50(4), pp.923-940.

Shah, H., Rossen, B., Lok, B., Londino, D., Lind, S.D. and Foster, A., 2012. Interactive virtual-patient scenarios: an evolving tool in psychiatric education. *Academic Psychiatry*, 36(2), pp.146-150.

Shannon-Baker, P., 2016. Making paradigms meaningful in mixed methods research. *Journal of Mixed Methods Research*, 10(4), pp.319-334.

Shawaqfeh, M.S., 2015. Gamification as a learning method in pharmacy education. *Journal of Pharmaceutical Care & Health Systems*, S2-004.

Shay, L.A. and Lafata, J.E., 2015. Where is the evidence? A systematic review of shared decision making and patient outcomes. *Medical Decision Making*, 35(1), pp.114-131.

Sidaway v. Board of Governors of the Bethlem Royal Hospital, 1985. AC 871

Silverman, J., Kurtz, S., and Draper, J., 2013. Skills for communitcating with patients. 3rd edition. Radcliffe, Oxford.

Sim, J. and Lewis, M., 2012. The size of a pilot study for a clinical trial should be calculated in relation to considerations of precision and efficiency. *Journal of Clinical Epidemiology*, 65(3), pp.301-308.

Simon, H.A., 1972. Theories of bounded rationality. In: McGuire, C.B. and Radner, R. (Eds). Decision and organization: a volume in honor of Jacob Marschak. Chapter 8, pp.161-176. North-Holland Publishing Company.

Skiba, D.J., 2009. Nursing education 2.0: a second look at Second Life. *Nursing Education Perspectives*, 30(2), pp.129-131.

Sluijs, E.M., Buijs, R. and Verhaak, P.F.M., 1984. Byrne and Long: a classification for rating the interview style of doctors. *Social Science & Medicine*, 19(7), pp.683-690.

Smith, C.M., Gephardt, E.G. and Nestel, D., 2015. Applying the theory of Stanislavski to simulation: stepping into role. *Clinical Simulation in Nursing*, 11(8), pp.361-367.

Smith, P.G., Morrow, R.H. and Ross, D.A., 2015. Preliminary studies and pilot testing. In: Smith, P.G., Morrow, R.H. and Ross, D.A. (Eds). Field trials of health interventions: a toolbox. 3rd edition, pp.216-223. Oxford University Press, Oxford.

Smyth, S.M., 2009. Back to the future: crime and punishment in second life. *Rutgers Computer & Technology Law Journal*, 36, pp.18-72.

Snowden, D., 2002. Complex acts of knowing: paradox and descriptive self-awareness. *Journal of Knowledge Management*, 6(2), pp.100-111.

Solomon, J., Knapp, P., Raynor, D.K. and Atkin, K., 2013. Worlds apart? An exploration of prescribing and medicine-taking decisions by patients, GPs and local policy makers. *Health Policy*, 112(3), pp.264-272.

Spencer, L. and Ritchie, J., 2002. Qualitative data analysis for applied policy research. In: Bryman, A. and Burgess, R.G. (Eds.). Analyzing qualitative data (pp. 173-194). Routledge, 2nd edition.

Srivastava, A. and Thomson, S. B., 2009. Framework analysis: A qualitative methodology for applied policy research. *Journal of Administration & Governance*, 4(2), pp.72-79.

Starks, H. and Trinidad, S.B., 2007. Choose your method: a comparison of phenomenology, discourse analysis, and grounded theory. *Qualitative Health Research*, 17(10), pp.1372-1380.

Starr, S., 2012. Survey research: we can do better. *Journal of the Medical Library Association*, 100(1), p.1.

Stegenga, J., 2011. Is meta-analysis the platinum standard of evidence? Studies in history and philosophy of science part C: *Studies in history and philosophy of biological and biomedical sciences*, 42(4), pp.497-507.

Steihaug, S., Gulbrandsen, P. and Werner, A., 2012. Recognition can leave room for disagreement in the doctor–patient consultation. *Patient Education and Counseling*, 86(3), pp.316-321.

Stevens, A., Hernandez, J., Johnsen, K., Dickerson, R., Raij, A., Harrison, C., DiPietro, M., Allen, B., Ferdig, R., Foti, S. and Jackson, J., 2006. The use of virtual patients to teach medical students history taking and communication skills. *The American Journal of Surgery*, 191(6), pp.806-811.

Stevens, S.S., 1946. On the theory of scales of measurement. *Science*, 103(2684), pp.677-680.

Stevenson, F.A., 2003. General practitioners' views on shared decision making: a qualitative analysis. *Patient Education and Counseling*, 50(3), pp.291-293.

Stewart, M., Brown, J.B., Weston, W.W., McWhinney, I.R., McWilliam, C.L., Freeman, T.R., 1995. Patient-centered medicine, transforming the clinical method. Sage, CA.

Stone, M.C. and Williams, H.C., 2015. Clinical pharmacists in general practice: value for patients and the practice of a new role. *British Journal of General Practice*, 65(634), pp.262-263.

Stott, N.C.H. and Davis, R.H., 1979. The exceptional potential in each primary care consultation. *Journal of the Royal College General Practitioners*, 29(201), pp.201-205.

Stubenrouch, F.E., Mus, E.M.K., Lut, J.W., Hesselink, E.M. and Ubbink, D.T., 2017. The current level of shared decision-making in anesthesiology: an exploratory study. *BMC Anesthesiology*, 17(1), 95.

Subedi, B.P., 2016. Using Likert type data in social science research: confusion, issues and challenges. *International Journal of Conterporary Applied Sciences*, 3(2), pp.36-49.

Suchman, A.L., 2003. Research on patient-clinician relationships: celebrating success and identifying the next scope of work. *Journal of General Internal Medicine*, 18(8), pp.677-678.

Sunnqvist, C., Karlsson, K., Lindell, L. and Fors, U., 2016. Virtual patient simulation in psychiatric care–A pilot study of digital support for collaborate learning. *Nurse Education in Practice*, 17, pp.30-35.

Svensberg, K., Brandlistuen, R.E., Björnsdottir, I. and Sporrong, S.K., 2018. Factors associated with pharmacy students' attitudes towards learning communication skills–A study among Nordic pharmacy students. *Research in Social and Administrative Pharmacy*, 14(3), pp.279-289.

Sweigart, L. and Hodson-Carlton, K., 2013. Improving student interview skills: the virtual avatar as client. *Nurse Educator*, 38(1), pp.11-15.

Sweigart, L., Burden, M., Carlton, K.H. and Fillwalk, J., 2014. Virtual simulations across curriculum prepare nursing students for patient interviews. *Clinical Simulation in Nursing*, 10(3), e139-e145.

Swinglehurst, D., Greenhalgh, T. and Roberts, C., 2012. Computer templates in chronic disease management: ethnographic case study in general practice. *BMJ Open*, 2(6), e001754.

Talbot, T.B., Sagae, K., John, B., Rizzo, A.A. and Playa Vista, C.A., 2012. Designing useful virtual standardized patient encounters. In Interservice/Industry Training, Simulation and Education Conference Proceedings, pp.3-6.

Tashakkori, A. and Creswell, J.W., 2007. The new era of mixed methods. *Journal of Mixed Methods Research*, 1(1), pp.3.

Taylor, B. and Kroth, M., 2009. Andragogy's transition into the future: meta-analysis of andragogy and its search for a measurable instrument. *Journal of Adult Education*, 38(1), p.1.

Taylor, D.C. and Hamdy, H., 2013. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Medical Teacher*, 35(11), e1561-e1572.

Taylor, K., 2009. Paternalism, participation and partnership—the evolution of patient centeredness in the consultation. *Patient Education and Counseling*, 74(2), pp.150-155.

Taylor, S., Bobba, S., Roome, S., Ahmadzai, M., Tran, D., Vickers, D., Bhatti, M., De Silva, D., Dunstan, L., Falconer, R. and Kaur, H., 2018. Simulated patient and role play methodologies for communication skills training in an undergraduate medical program: randomized, crossover trial. *Education for Health*, 31(1), p.10.

Teddlie, C. and Tashakkori, A., 2003. Major issues and controveries inthe use of mixed methods in the social and behvioral sciences. Handbook of mixed methods in social & behavioral research. Sage, California.

Teddlie, C. and Tashakkori, A., 2009. Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences. Sage, California.

Telio, S., Ajjawi, R. and Regehr, G., 2015. The “educational alliance” as a framework for reconceptualizing feedback in medical education. *Academic Medicine*, 90(5), pp.609-614.

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L.P., Robson, R., Thabane, M., Giangregorio, L. and Goldsmith, C.H., 2010. A tutorial on pilot studies: the what, why and how. *BMC Medical Research Methodology*, 10(1), 1.

Thompson, J., 2018. Clinical simulations using virtual patient avatars for pre-registration pharmacist training: a mixed methods evaluation. Doctoral thesis, Keele University.

Tickle-Degnen, L., 2013. Nuts and bolts of conducting feasibility studies. *American Journal of Occupational Therapy*, 67(2), pp.171-176.

Todd, P.M. and Gigerenzer, G., 2000. Précis of simple heuristics that make us smart. *Behavioral and Brain Sciences*, 23(5), pp.727-741.

Tong, A., Sainsbury, P. and Craig, J., 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, 19(6), pp.349-357.

Towle, A. and Godolphin, W., 1999. Framework for teaching and learning informed shared decision making. *British Medical Journal*, 319(7212), pp.766-771.

Towle, A., Bainbridge, L., Godolphin, W., Katz, A., Kline, C., Lown, B., Madularu, I., Solomon, P. and Thistlethwaite, J., 2010. Active patient involvement in the education of health professionals. *Medical Education*, 44(1), pp.64-74.

Triola, M., Feldman, H., Kalet, A.L., Zabar, S., Kachur, E.K., Gillespie, C., Anderson, M., Griesser, C. and Lipkin, M., 2006. A randomized trial of teaching clinical skills using virtual and live standardized patients. *Journal of General Internal Medicine*, 21(5), pp.424-429.

Trusky A.R., 2016. Friend or foe? The societal benefits and cyber risks of video games. Doctoral dissertation, Utica College.

Turner, M.K., Simon, S.R., Facemyer, K.C., Newhall, L.M. and Veach, T.L., 2006. Web-based learning versus standardized patients for teaching clinical diagnosis: A randomized, controlled, crossover trial. *Teaching and Learning in Medicine*, 18(3), pp.208-214.

Tversky, A. and Kahneman, D., 1974. Judgment under uncertainty: heuristics and biases. *Science*, 185(4157), pp.1124-1131.

Upton, J., Fletcher, M., Madoc-Sutton, H., Sheikh, A., Caress, A.L. and Walker, S., 2011. Shared decision making or paternalism in nursing consultations? A qualitative study of primary care asthma nurses' views on sharing decisions with patients regarding inhaler device selection. *Health Expectations*, 14(4), pp.374-382.

Vaillancourt, H., Légaré, F., Lapointe, A., Deschênes, S.M. and Desroches, S., 2014. Assessing patients' involvement in decision making during the nutritional consultation with a dietitian. *Health Expectations*, 17(4), pp.545-554.

Vaismoradi, M., Turunen, H. and Bondas, T., 2013. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. *Nursing & Health Sciences*, 15(3), pp.398-405.

Van Dalen, J., Kerkhofs, E., van Knippenberg-Van Den Berg, B.W., van Den Hout, H.A., Scherpbier, A.J.J.A. and Van der Vleuten, C.P.M., 2002. Longitudinal and concentrated communication skills programmes: two dutch medical schools compared. *Advances in Health Sciences Education*, 7(1), pp.29-40.

van Thiel, J., Ram, P. and van Dalen, J., 2000. MAAS-global manual. Maastricht University, Maastricht.

Vaz-Luis, I., O'neill, A., Sepucha, K., Miller, K.D., Baker, E., Dang, C.T., Northfelt, D.W., Winer, E.P., Sledge, G.W., Schneider, B. and Partridge, A.H., 2017. Survival benefit needed to undergo chemotherapy: patient and physician preferences. *Cancer*, 123(15), pp.2821-2828.

Veldhuijzen, W., Ram, P.M., Van Der Weijden, T., Wassink, M.R. and Van Der Vleuten, C.P.M., 2007. Much variety and little evidence: a description of guidelines for doctor-patient communication. *Medical Education*, 41(2), pp.138-145.

Venkatesh, V., Brown, S.A. and Bala, H., 2013. Bridging the qualitative-quantitative divide: guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 37(1), pp.21-54.

Voigt, I., Wrede, J., Diederichs-Egidi, H., Dierks, M.L. and Junius-Walker, U., 2010. Priority setting in general practice: health priorities of older patients differ from treatment priorities of their physicians. *Croatian Medical Journal*, 51(6), pp.483-492.

Volery, T. and Lord, D., 2000. Critical success factors in online education. *International Journal of Educational Management*, 14(5), pp.216-223.

von Elm, E.B., Röllin, A., Blümle, A., Huwiler, K., Witschi, M. and Egger, M., 2008. Publication and non-publication of clinical trials: longitudinal study of applications submitted to a research ethics committee. *Swiss Medical Weekly*, 138(13-14), pp.197-203.

Von Fragstein, M., Silverman, J., Cushing, A., Quilligan, S., Salisbury, H., Wiskin, C. and UK Council for Clinical Communication Skills Teaching in Undergraduate Medical Education, 2008. UK consensus statement on the content of communication curricula in undergraduate medical education. *Medical Education*, 42(11), pp.1100-1107.

Wahyuni, D., 2012. The research design maze: understanding paradigms, cases, methods and methodologies. *Journal of Applied Management Accounting Research*, 10(1), pp.69-80.

Waldrop, M.M., 2016. The chips are down for Moore's law. *Nature*, 530, pp.144–147

Wass, V., Van der Vleuten, C., Shatzer, J. and Jones, R., 2001. Assessment of clinical competence. *The Lancet*, 357(9260), pp.945-949.

Wasylko, Y. and Stickley, T., 2003. Theatre and pedagogy: using drama in mental health nurse education. *Nurse Education Today*, 23(6), pp.443-448.

Watling, C.J. and Brown, J.B., 2007. Education research: communication skills for neurology residents: structured teaching and reflective practice. *Neurology*, 69(22), e20-e26.

Weiss, M.C. and Peters, T.J., 2008. Measuring shared decision making in the consultation: a comparison of the OPTION and Informed Decision Making instruments. *Patient Education and Counseling*, 70(1), pp.79-86.

Wensing, M., Jung, H.P., Mainz, J., Olesen, F. and Grol, R., 1998. A systematic review of the literature on patient priorities for general practice care. Part 1: Description of the research domain. *Social Science & Medicine*, 47(10), pp.1573-1588.

Whitehead, A.L., Sully, B.G. and Campbell, M.J., 2014. Pilot and feasibility studies: is there a difference from each other and from a randomised controlled trial? *Contemporary Clinical Trials*, 38(1), pp.130-133.

Whitehouse, C., Morris, P. and Marks, B., 1984. The role of actors in teaching communication. *Medical Education*, 18(4), pp.262-268.

Whitehouse, C.R., 1991. The teaching of communication skills in United Kingdom medical schools. *Medical Education*, 25, pp.311-218.

WHO, World Health Organisation, 2017. Realistic medicine to improve the quality of care in Scotland. Bulletin of the World Health Organization, 95(6), pp.389-480.

Wieringa, S. and Greenhalgh, T., 2015. 10 years of mindlines: a systematic review and commentary. *Implementation Science*, 10(1), p.45.

Wilbur, K., Elmubark, A. and Shabana, S., 2018. Systematic review of standardized patient use in continuing medical education. *Journal of Continuing Education in the Health Professions*, 38(1), pp.3-10.

Wiley, J., Westbrook, M., Greenfield, J.R., Day, R.O. and Braithwaite, J., 2014. Shared decision-making: the perspectives of young adults with type 1 diabetes mellitus. *Patient Preference and Adherence*, 8, p.423.

Wilkinson, T., Boohan, M. and Stevenson, M., 2014. Does learning style influence academic performance in different forms of assessment? *Journal of Anatomy*, 224(3), pp.304-308.

Will, J.F., 2011. A brief historical and theoretical perspective on patient autonomy and medical decision making: Part II: The autonomy model. *Chest*, 139(6), pp.1491-1497.

Willis, S.C., Hassell, K., Seston, E.M. and Hann, M., 2009. Using learning outcomes for undergraduate pharmacy education to assess final-year students' perceptions of their preparedness for pharmacy practice. *International Journal of Pharmacy Practice*, 17(6), pp.351-358.

Wirtz, V., Cribb, A. and Barber, N., 2006. Patient–doctor decision-making about treatment within the consultation—A critical analysis of models. *Social Science & Medicine*, 62(1), pp.116-124.

Wisdom, J.P., Cavaleri, M.A., Onwuegbuzie, A.J. and Green, C.A., 2012. Methodological reporting in qualitative, quantitative, and mixed methods health services research articles. *Health Services Research*, 47(2), pp.721-745.

Witkowski, T., 2010. Thirty-five years of research on Neuro-Linguistic Programming. NLP research data base. State of the art or pseudoscientific decoration? *Polish Psychological Bulletin*, 41(2), pp.58-66.

Woloschuk, W., Harasym, P.H. and Temple, W., 2004. Attitude change during medical school: a cohort study. *Medical Education*, 38(5), pp.522-534.

Wood, B.P., 2000. Feedback: a key feature of medical training. *Radiology*, 215(1), pp.17-19.

Yang, R.L., Hashimoto, D.A., Predina, J.D., Bowens, N.M., Sonnenberg, E.M., Cleveland, E.C., Lawson, C., Morris, J.B. and Kelz, R.R., 2013. The virtual-patient pilot: testing a new tool for undergraduate surgical education and assessment. *Journal of Surgical Education*, 70(3), pp.394-401.

Yardley, S., W Irvine, A. and Lefroy, J., 2013. Minding the gap between communication skills simulation and authentic experience. *Medical Education*, 47(5), pp.495-510.

Yedidia, M.J., Gillespie, C.C., Kachur, E., Schwartz, M.D., Ockene, J., Chepaitis, A.E., Snyder, C.W., Lazare, A. and Lipkin Jr, M., 2003. Effect of communications training on medical student performance. *Journal of the American Medical Association*, 290(9), pp.1157-1165.

Yerrakalva, D. and Griffin, S.J., 2017. Statins for primary prevention in people with a 10% 10-year cardiovascular risk: too much medicine too soon? *British Journal of General Practice*, 67(654), pp.40-41.

Youngblood, P.L., Srivastava, S., Curet, M., Heinrichs, W.L., Dev, P. and Wren, S.M., 2005. Comparison of training on two laparoscopic simulators and assessment of skills transfer to surgical performance. *Journal of the American College of Surgeons*, 200(4), pp.546-551.

Zary, N., Johnson, G., Boberg, J. and Fors, U.G., 2006. Development, implementation and pilot evaluation of a Web-based Virtual Patient Case Simulation environment–Web-SP. *BMC Medical Education*, 6(1), 10.

Zigmont, J.J., Kappus, L.J. and Sudikoff, S.N., 2011. Theoretical foundations of learning through simulation. *Seminars in Perinatology*, 35(2), pp. 47-51.

Zohrabi, M., 2013. Mixed method research: instruments, validity, reliability and reporting findings. *Theory and Practice in Language Studies*, 3(2), p.254.

Zwolsman, S.E., van Dijk, N. and de Waard, M.W., 2013. Observations of evidence-based medicine in general practice. *Perspectives on Medical Education*, 2(4), pp.196-208.

Appendices

Appendix 1 – Narrative Review – Included Papers

Title	Author & Date	Focus of VP	Interaction	Patient Representation	Measure	Key Findings
Interactive multimedia patient simulations in dental and continuing dental education	Abbey (2002)	History taking and assessment	Multiple choice	Images	Descriptive	More of a case study. Limited interactivity; communication reduced to a technical skill
Virtual learning environments: second life.	Ahern & Wink (2010)	Review of Second Life	N/A	N/A	N/A	Used content provision, interaction and communication, and patient simulation
Harnessing the power of conversations with virtual humans to change health behaviors	Albright et al. (2016)	Behaviour change	Multiple choice, problem solving	Animation	Attitudinal measures	Users reported greater self-efficacy in managing behaviour change. Some change in real world behaviour; increase in referrals. Reads slightly like promotional material; authors employed by technology developer
Using Virtual Patient Simulations to Prepare Primary Health Care Professionals to Conduct Substance Use and Mental Health Screening and Brief Intervention.	Albright et al. (2018)	Communication skills for identifying substance abuse and motivational interviewing	Multiple choice but from within set categories	Animation	Pre- and post-VP surveys plus 3-month follow up survey	Improved knowledge scores when compared to control

Avatar-mediated training in the delivery of bad news in a virtual world	Andrade et al. (2010)	Delivery of bad news	Free-text	Second Life. Animation	Pre and post-questionnaires (self-efficacy) and informal interview	Volunteers played patient. Lack of non-verbal cues acknowledged by the participants; Authors felt that improvements in tech may help. Self-efficacy improved
Virtual patient design: Exploring what works and why. A grounded theory study	Bateman et al. (2013)	History taking and clinical reasoning, MSK	Multiple choice; branched and linear designs compared	Images	Grounded theory, Focus groups	Reportedly realistic; when students were scored they chased a good score at a loss to learning
Comparing student attitudes to different models of the same virtual patient.	Bearman & Cesnik (2001)	History taking, diagnosis and clinical reasoning	Multiple choice (narrative vs problem solving)	Video and images	Questionnaire	Narrative better for communication skills than problem-based.
Is Virtual the Same as Real? Medical Students' Experiences of a Virtual Patient	Bearman (2003)	Communication skills	Multiple choice (1 narrative and 1 problem solving)	Video	Phenomenology	Students responded as if the VP was real but still felt frustrated with fabrication; also frustration but understanding with the multiple choice. Narrative thought to be better for rapport than problem-solving style; seeing consequences of actions was important. Students forgot that it was a

						simulation after a while, suggesting realism
Random comparison of 'virtual patient' models in the context of teaching clinical communication skills	Bearman et al. (2001)	History taking, diagnosis and clinical reasoning	Multiple choice (narrative vs problem solving)	Video and images	SP assessment	Narrative better for communication skills. Communication skills are made up of sub-skills and not all of them are developed by a VP
Interactive simulated patient—an advanced tool for student-activated learning in medicine and healthcare	Bergin & Fors (2003)	ISP system (precursor to Web-SP). History taking, physical exam, diagnosis	Free-text	Video clips and images	Questionnaires and interviews	Setting not designed to replace human encounters. Free-text format very time consuming and difficult to create as well as phrase-recognition issues. Students enjoyed the VP.
Interactive simulated patient: experiences with collaborative e-learning in medicine	Bergin et al. (2003)	ISP system (precursor to Web-SP). History taking, physical exam, diagnosis	Free-text	Video clips and images	Questionnaires and focus group	VP was more engaging than paper based cases.
The Role for Virtual Patients in the Future of Medical Education	Berman et al. (2016)	Review	Review	Review	Review	Definitions of VPs in the literature are insufficient

Enhanced recovery simulation in colorectal surgery: design of virtual online patients.	Beyer-Berjot et al. (2015)	Pre and post-surgery simulation for history taking, examination and clinical reasoning.	Multiple choice, problem solving	Second Life. Animation	Descriptive	Focused communication on history taking.
Initial Evaluation of a Virtual Pediatric Patient System	Bloodworth et al. (2012)	History taking and assessment	Free-text speech recognition.	Animation	Questionnaire	Speech recognition issues. Still prefer speech rather than typing as more natural
Utilizing real-time human-assisted virtual humans to increase real-world interaction empathy	Borish et al. (2014)	Empathetic communication	Free-text	Graphic image	VP vs VP with empathy enhanced feedback. Survey, SP interview.	Empathy feedback useful in improving SP interaction.
Virtual patient simulation: what do students make of it? A focus group study.	Botezatu et al. (2010a)	Web-SP system. History taking, physical exam, diagnosis	Multiple choice, problem solving	Real images plus written description of body language	Focus group	VP important for both learning and assessment. VPs not thought to be useful for communication skills as it doesn't reflect the richness involved. The VP afforded the opportunity to make mistakes in a safe environment.
Virtual patient simulation systems: knowledge gain or knowledge loss?	Botezatu et al. (2010b)	Web-SP system. History taking, physical exam, diagnosis	Multiple choice, problem solving	Real images plus written description of body language	VP vs lecture. Assessed by VP and regular exam	Better knowledge retention with VP than lecture. Communication reduced to technical exercise

Virtual patient simulation for learning and assessment: superior results in comparison with regular course exams	Botezatu et al. (2010c)	Web-SP system. History taking, physical exam, diagnosis	Multiple choice, problem solving	Real images plus written description of body language	Assessment with VP, knowledge based	VP improved exam results. Communication a technical exercise.
The virtual child: evaluation of an internet-based pediatric behavior management simulation	Boynton et al. (2007)	Paediatric dental visit	Multiple choice, linear	Text description	Cohort study. Written exam. Lectures vs lectures+VP	Linear; cannot move on until correct option chosen. VP improved behaviour management knowledge to a greater extent. Students liked having both lecture and VP. Complement technique.
Programmable Patients: Simulation of Consultation Skills in a Virtual Environment	Bracegirdle and Chapman (2010)	Descriptive/Review	N/A	N/A	N/A	Type of simulation used in this thesis. Describes different design features
Adapting virtual patient interviews for interviewing skills training of novice healthcare students	Carnell et al. (2015)	History taking and assessment	Multiple choice vs free-text	Images	Survey and analytics from interaction	Evidence suggests that both free-text and multiple choice have a place. Perhaps free-text later in education.
Use of virtual patients in dental education: a survey of U.S. and Canadian dental schools	Cederberg et al. (2012)	Survey of institutional use of VPS	N/A	N/A	N/A	Wide range of uses. Very variable in the way they are used, viewed and incorporated. Range of definitions of VP; as VPs evolve, may need to alter definition
The use of virtual patients in medical school curricula	Cendan and Lok (2012)	Review/commentary	N/A	N/A	N/A	VPs useful for communication but complementary not replace

						SPs.
Evaluation of a multimedia case-history simulation program for pharmacy students.	Chaikoolvatana (2003)	History taking and patient assessment	Free-text	Video	Comparison of case profiles and care plans created from interview with either VP or SP	VP case profiles were more complete but care plans similar. VP could replace some placement time.
Beta Test of Web-Based Virtual Patient Decision-Making Exercises for Residents Demonstrates Discriminant Validity and Learning	Close et al. (2015)	Surgical history taking and assessment; focuses more on technical elements	Multiple choice narrative	Images	Performance during use of VP	Focuses mainly on assessment but suggest the VP could be useful for practice as it can provoke discussion in a workshop.
Efficacy of virtual patients in medical education: A meta-analysis of randomized studies	Consorti et al. (2012)	Meta-analysis	Meta-analysis	Meta-analysis	Meta-analysis	"When grouped for type of outcome, the pooled ES for studies addressing communication skills and ethical reasoning was lower than for clinical reasoning outcome."
Design and initial evaluation of a virtual pediatric primary care clinic in Second Life(®).	Cook (2012)	Paediatric communication and clinical reasoning	Multiple choice; choose the sentiment to express, not exact words	Second Life. Animation.	Descriptive, pilot questionnaire	"attention to the context, pedagogy, learner, and the capabilities of the technology is essential ". Communication appears to be the lowest form i.e. choosing the sentiment that is wished to

						express; "Introduce yourself".
Virtual patients: a critical literature review and proposed next steps	Cook and Triola (2009)	Review	N/A	N/A	N/A	"Regarding performance, although VPs have been used to teach and assess interviewing skills, students recognise the artificiality of such situations and do not demonstrate empathy and other important aspects of this skill. Standardised patients are superior. Performance of other skills will clearly require real patients or higher-fidelity simulations"
Computerized virtual patients in health professions education: A systematic review and meta-analysis	Cook et al. (2010)	Review	Review	Review	Systematic review and meta analysis	Most VPs focus on developing knowledge and clinical reasoning

Interpersonal behaviors and socioemotional interaction of medical students in a virtual clinical encounter	Courteille et al. (2014)	ISP system (precursor to Web-SP). History taking, physical exam, diagnosis	Free-text	Video clips and images	Observation of interactions. Questionnaires followed by semi-structured interviews.	Suggested to reside early in education to facilitate clinical encounters. Low stress. Felt life-like
Do medical students respond empathetically to a virtual patient?	Deladisma et al. (2007)	Empathetic communication	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Observed consultations with SPs and VPs	Body language may be better taught by SPs, VPs can augment curriculum offering repetitive practice, particularly early in education.
Medical student satisfaction using a virtual patient system to learn history-taking and communication skills.	Deladisma et al. (2008)	History taking and communication skills	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Questionnaire	Students accepted the VP as an adjunct but were also frustrated by phrase recognition issues. Realism thought to be important for learning. VP supported autonomy which was thought to be important.

Teaching general practitioners and doctors-in-training to discuss advance care planning: evaluation of a brief multimodality education programme.	Detering et al. (2014)	Advance care planning conversation	Multiple choice	Video	Pre- and post-vp evaluations and VP assessment	Improved confidence in advance care planning and performance on a VP improved with more attempts. Difficult to ascertain which components of the workshop were beneficial. Increase in knowledge of ACP when comparing pre- and post-intervention.
Evaluating a Script-Based Approach for Simulating Patient-Doctor Interaction	Dickerson et al. (2005)	Communication skills, history taking.	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Phrase recognition log	For history taking, a constrained problem, script based speech recognition is easier than something less constrained, such as empathy
Virtual patients: assessment of synthesized versus recorded speech.	Dickerson et al. (2006)	Communication skills, history taking.	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Expert analysis of VP interaction recording. Questionnaire.	For lower levels of learning, such as content of speech, VPs and synthetic speech are suggested as suitable. For higher order learning, how to ask questions, an SP and recorded speech is superior as synthesised speech lacked emotion and intonation.

A preliminary study of a novel emergency department nursing triage simulation for research applications	Dubovsky et al. (2017)	Emergency triage (history taking, examination and clinical reasoning)	Multiple choice, problem solving	Animation	Questionnaire and analysis of simulated performance	Participants would have preferred speech to typing for communication but found the VP similar to a real-life situation in all aspects apart from physical exertion.
SIDNIE: Scaffolded Interviews Developed by Nurses in Education	Dukes et al. (2013)	Communication with paediatric patient	Multiple choice, problem solving	Animation	Questionnaire and interview	Easy to use. Suggested less anxiety than with other methods and being able to select from options. Could take more seriously than role play.
Integrating virtual patients into courses: Follow-up seminars and perceived benefit	Edelbring et al. (2012)	Web-SP system. History taking, physical exam, diagnosis	Multiple choice, problem solving	Real images plus written description of body language	Questionnaire	"The findings suggest that a more intense follow-up pays off in terms of the benefit perceived by students. This study illustrates the need to consider VPs from the perspective of a holistic course design and not as isolated add-ons."
Educational potential of a virtual patient system for caring for traumatized patients in primary care	Ekblad et al. (2013)	History taking and assessment	Multiple choice, problem solving	Video clips and images	Questionnaire and follow up interview	A less intense version of a situation so it will be easier if experienced in reality. Easy to use. Authentic.
AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment	Ellaway & Masters (2008)	N/A	N/A	N/A	N/A	Useful definition of VPs "an interactive computer simulation of real–life clinical scenarios for the purpose of

						medical training, education, or assessment"
Building a virtual patient commons	Ellaway et al. (2008)	Review/classification	N/A	N/A	N/A	Useful classification; Knowledgebase contextualisation, branching, linear,
MedEthEx online: a computer-based learning program in medical ethics and communication skills	Fleetwood et al. (2000)	History taking and assessment	Free-text	Images	VP compared to small group discussion by final exam grades and live SP	Communication skills no different between the two when compared by SP.
Virtual reality skills training for health care professionals in alcohol screening and brief intervention	Fleming et al. (2009)	Substance abuse assessment and history taking	Multiple choice, problem solving	Video	VP vs no teaching on SP stations	VP group improved but not surprising considering no active comparator. Comparisons need to be life-like. Relatively large sums of money paid to participants
The use of simulation to teach suicide risk assessment to health profession trainees—Rationale, methodology, and a proof of concept demonstration with a virtual patient	Foster et al. (2015)	Suicide risk assessment	Free-text	Graphic image	Video module vs VP assessed with an SP interaction	Compared to an SP, a VP offers repetition and are complementary to SPs. Issues with phrase recognition. VP can evolve with student use as case author can view non-matched phrases and add a response for future use.

Using Virtual Patients to Teach Empathy: A Randomized Controlled Study to Enhance Medical Students' Empathic Communication	Foster et al. (2016)	Empathetic communication	Free-text	Animation	SP assessment. Empathy feedback VP vs backstory VP.	SP with empathy feedback training showed highest improvement in SP empathy score. Student ratings were mediocre; not hugely positive but not negative either. VP made some students reportedly feel less anxious. Empathy feedback seen as better than backstory but not always significantly.
Web-based virtual patients in nursing education: development and validation of theory-anchored design and activity models.	Georg & Zary (2014)	History taking and clinical reasoning	Multiple choice	Graphic image and sound	Questionnaire	Perceived as useful for clinical reasoning. Patient doesn't always answer questions directly to model reality more closely.
Web-based simulation in psychiatry residency training: a pilot study	Gorrindo et al. (2011)	Antipsychotic prescribing and consent for treatment	Multiple choice; choose the sentiment to express, not exact words	Video	SP assessment and pre/post questionnaire to assess confidence change	VP improved confidence. Complement technique
What can virtual patient simulation offer mental health nursing education?	Guise et al. (2012)	OpenLabyrinth. Mental health nursing assessment	Multiple choice narrative. Only interacting	Text description	Descriptive	Branched narrative VPs allow multiple paths through the case which are thought to help learning

			at certain points			
Training brief intervention with a virtual coach and virtual patients	Hayes-Roth (2004)	Motivational interviewing	Free-text	Graphic image and sound	Pre and post assessment and SP assessment	VP workshops outperformed standard education in assessment and SP interaction.
Comprehensive, technology-based clinical education: the `virtual practicum'	Henderson (1998)	Review of VPs - related to theory	N/A	N/A	N/A	Theory about VPs; links Kolb and Schon.
Blended E-learning in a Web-based Virtual Hospital: A Useful Tool for Undergraduate Education in Urology	Horstmann et al. (2009)	History taking and clinical reasoning	Multiple choice	Images; cartoon like	Questionnaire; learner reaction	Mixed emotions; some really liked, others did not. Most (72%) found it fun. Found the case useful for preparation but it should not replace placement time as real patients important.
Virtual patient simulation at U.S. and Canadian medical schools	Huang et al. (2007)	Review of US & Canada medical schools	Review	Review	Review	26 out of 108 respondents used VPs. VP production noted as expensive. Need to visualise consequences of actions. Different terms used to describe some different and some similar technologies.
The virtual standardized patient	Hubal et al. (2000)	History taking and patient assessment	Free-text	Graphic image	Descriptive	Patients are modifiable to any desired case

Lessons learned in modeling virtual pediatric patients.	Hubal et al. (2003)	Paediatric communication	Free-text	Animation	Descriptive	SPs cannot model children; place for VPs.
Lessons learned in modeling schizophrenic and depressed responsive virtual humans for training	Hubal et al. (2003)	History taking and assessment	Free-text	Animation	Descriptive	Want to replace synthetic speech with pre-recorded. Better animation as well as idle animations.
Using a virtual patient activity to teach nurse prescribing	Hurst & Marks-Maran (2011)	History taking, diagnosis and prescribing treatment	Multiple choice	No images, it appears to be solely text based	Student reflections and follow up questionnaire	Helpful for preparing for practice. Felt restricted with multiple choice but on balance enjoyed the VP
Towards a typology of virtual patients	Huwendiek et al. (2009a)	A typology of VPs	N/A	N/A	N/A	Useful typology of VPs
Design principles for virtual patients: a focus group study among students	Huwendiek et al. (2009b)	N/A	N/A	N/A	Focus group; students had encountered various VPs during their education	Student suggestion that multiple choice may be more suitable earlier in education, free-text later on. Feedback was essential. Effort should made to ensure a VP is a realistic as possible.
Money laundering and terrorism financing in virtual environments: a feasibility study	Irwin et al. (2014)	Review (Second Life)	N/A	N/A	N/A	Second Life has been linked to the funding of terrorism and money laundering from criminal enterprise.

Experiences in using immersive virtual characters to educate medical communication skills	Johnsen et al. (2005)	Empathetic communication	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Pre and post-questionnaires	Immersion helped learning, well accepted. Some restriction noted but also the realism of having to re-ask questions.
The fairyland of Second Life: virtual social worlds and how to use them	Kaplan and Haenlein (2009)	Review (Second Life)	N/A	N/A	N/A	Users of Second Life can access illegal gambling
Evaluation of Justina: a VP with PTSD	Kenny et al. (2008)	History taking and assessment of PTSD	Speech recognition free-text	Animation	Questionnaires and analysis of the interaction	Phrase recognition caused an issue.
Effectiveness of a Second Life? Simulation as a Teaching Strategy for Undergraduate Mental Health Nursing Students	Kidd et al. (2012)	Communication and assessment skills	Multiple choice, problem solving	Second Life. Animation.	Questionnaire	The VP afforded the opportunity to make mistakes in a safe environment.
Design, Realization, and First Validation of an Immersive Web-Based Virtual Patient Simulator for Training Clinical Decisions in Surgery.	Kleinert et al. (2015)	History taking and clinical reasoning. Design paper for Kleinert 2016	Multiple choice	Animation	Questionnaire and knowledge gain	Well accepted by students, easy to use. Adjunct teaching tool. Authors conclude that simulation of communication is very difficult, if not impossible.

Embedding a Virtual Patient Simulator in an Interactive Surgical lecture.	Kleinert et al. (2016)	History taking and clinical reasoning	Multiple choice. Used in lecture with majority vote to decide each decision	Animation	Pre- and post-lecture performance test plus questionnaire	Fun and motivated the students to learn. The VP was thought to not improve communication skills due to lacking emotional aspects. Could serve as a bridge in education. Based on the Kolb cycle.
Understanding empathy training with virtual patients	Kleinsmith et al. (2015)	Empathetic communication	Free-text	Animation	Questionnaire and measure of empathy compared to SP	VP interactions more empathetic than SP interactions due to more time to react. "Training with VPs first could make subsequent interactions with a real patient less stressful."
Virtual patients--what are we talking about? A framework to classify the meanings of the term in healthcare education	Kononowicz et al. (2015)	Proposed framework for VPs	N/A	N/A	N/A	Framework for VPs
Using a computer simulation for teaching communication skills: A blinded multisite mixed methods randomized controlled trial	Kron et al. (2017)	Breaking bad news	Multiple choice with speech recognition. System was able to read and feedback on certain non-	Animation	VP vs e-learning. Communication assessed in an OSCE and a questionnaire.	Students had a more positive attitude towards the VP than the e-learning. VP outperformed e-learning. VP is suggested to help prepare for practice.

			verbal behaviours.			
Using multimedia to assist students with communication skills andbiopsychosocial integration: an evaluation	Liaw et al. (2000)	History taking and assessment	Multiple choice, narrative-branched	Videos	Questionnaire	Restrictive nature of multiple choice. Some participants weren't restricted but unclear why. Difficult to script multiple choice
Applying virtual reality in medical communication education: current findings and potential teaching and learning benefits of immersive virtual patients	Lok et al. (2006)	Communication skills, history taking.	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Descriptive	
Teaching communication skills to medical students in a virtual world	Lowes et al. (2001)	Communication skills; end of life care	Free-text	Second Life. Animation	Questionnaires	Facilitator played patient. Some students not sure the computer aided experience. Others thought it reduced the anxiety of face to face. Some students liked, others did not.

Developing a Conversational Virtual Standardized Patient to Enable Students to Practice History-Taking Skills.	Maicher et al. (2017)	History taking and clinical reasoning	Speech or type free-text	Animation	Analysis of speech recognition fidelity	86% of questions asked were recognised. Fidelity thought important, free-text must recognise context of question, this system reportedly manages ambiguity.
Gamification and Multimedia for Medical Education: A Landscape Review	McCoy et al. (2016)	Review	Review	Review	Review	"Overall, improved learning outcomes have been demonstrated with virtual patient simulations" / "Although rigorous studies confirming learning gains are limited, the field of research is growing"
Just age playing around-how second life aids and abets child pornography	Meek-Prieto (2007)	Review (Second Life)	N/A	N/A	N/A	There is a risk that learners accessing Second Life may be exposed to child pornography within the wider environment.
Second Life and other virtual worlds: a roadmap for research	Mennecke et al. (2007)	Review (Second Life)	N/A	N/A	N/A	Users can access pornography via Second Life
Twelve Tips for Utilizing Virtual Patients to Teach Professionalism	Murphy et al. (2016)	Review	Review	Review	Review	Importance of context in which the VP is set is stressed

The Responses of Medical General Practitioners to Unreasonable Patient Demand for Antibiotics--A Study of Medical Ethics Using Immersive Virtual Reality.	Pan et al. (2016)	Communication skills about unreasonable patient demand.	Speech free-text; patient response cued by facilitator	Animation (VR headset)	Assessment of interaction; gaze tracking and outcome. Post-questionnaire	Participants seemed to treat simulation as real. They noted that the simulation was not real as their tone and body language were not picked up on. It was suggested as useful to practice a difficult interaction commonly experienced. Authors suggest that the ease with which they recruited GPs/GPRs is a positive finding in itself.
A Study of Professional Awareness Using Immersive Virtual Reality: The Responses of General Practitioners to Child Safeguarding Concerns	Pan et al. (2018)	Picking up cues of potential child safeguarding concerns	Speech free-text; patient response cued by facilitator	Animation (Cave environment)	Ability of GPs to pick up cues of potential child safeguarding issues; note of the consultation analysed by 10 experienced professionals	Established the variables which affected the quality of the post-consultation note. The authors surmise that the VP may be useful for training of GPs in the future.
A pilot study of user acceptance and educational potentials of virtual patients in transcultural psychiatry	Pantziaras et al. (2012)	History taking and assessment	Multiple choice, problem solving	Video clips and images	Questionnaire and interview	Well accepted. More interactive than a paper case. Desired own voice i.e. restriction.

Virtual Mrs K: The learners' expectations and attitudes towards a virtual patient system in transcultural psychiatry	Pantziaras et al. (2014)	History taking and assessment	Multiple choice, problem solving	Video clips and images	Pre and post questionnaire and interview	Well accepted. VP delivering feedback seen as good. Subtle notes of restriction.
Training with virtual patients in transcultural psychiatry: Do the learners actually learn?	Pantziaras et al. (2015)	Knowledge acquisition, decision-making and communication	Multiple choice, problem solving	Video clips and images	Knowledge test	Improvement in test scores. Base simulation on Kolb. Follow up test was better than pre-test but not as good as test immediately after VP. Conclude more than one session required.
Design and evaluation of a simulation for pediatric dentistry in virtual worlds	Papadopoulos et al. (2013)	Reassuring and treating a child at a dental appointment	Multiple choice	Second Life. Animation	Knowledge test compared between standard teaching with and without VP	VP improved scores. VP suggest as supplemental technique
Virtual human patients for training of clinical interview and communication skills.	Parsons et al. (2008)	History taking and assessment of PTSD	Speech recognition free-text	Animation	Pre and post-questionnaires; learner reaction to VP	People have different consulting styles which the VP needs to accommodate. Speech recognition may be able to pick up tone, which is an important part of communication.

Virtual patients as novel teaching tools in psychiatry	Pataki et al. (2012)	History taking and assessment of PTSD	Speech recognition free-text	Animation	Pre and post-questionnaires; learner reaction to VP	Enjoyable. VP used for rapport building
Virtual patients and nontechnical skills in undergraduate health professional education: an integrative review	Peddle et al. (2016)	Review	Review	Review	Integrative	VPs can develop communication. Two main definitions of VP. Two main types; narrative and problem solving.
Second life for dental education	Phillips & Berge (2009)	Description of second life	N/A	Second Life (animation)	Review/summary	Benefits: standardised, access 'rare' patient types, immersive, cost effective. An adjunct technique
Interpersonal scenarios: Virtual approx Real?	Raij et al. (2006)	Communication skills, history taking.	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	VP vs SP. Questionnaire. Analysis of questions asked during the interaction.	VPs seem less authentic than an SP but led to similar educational experiences. Effort should be placed into making VPs as expressive as possible.
Comparing interpersonal interactions with a virtual human to those with a real human	Raij et al. (2007)	Communication skills, history taking.	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	VP vs SP. Questionnaire. Analysis of questions asked during the interaction.	VP less expressive than and SP but content of interactions the same. Rapport building more difficult with VP compared to SP; VP could teach content.

Simulation of patient encounters using a virtual patient in periodontology instruction of dental students: design, usability, and learning effect in history-taking skills.	Schittek Janda et al. (2004)	Dental history taking, diagnosis and treatment	Free-text	Images	History taking with one real patient compared to regular teaching	VP used prior to patient encounter increased the number of relevant questions asked. Authors note phrase recognition was a problem. Free-text thought important due to recall rather than recognition as with multiple choice.
Simulated Conversations With Virtual Humans to Improve Patient-Provider Communication and Reduce Unnecessary Prescriptions for Antibiotics: A Repeated Measure Pilot Study	Schoenthaler et al. (2017)	Reducing antibiotic overuse, SDM and motivational interviewing	Multiple choice	Animation	Pre- and post-questionnaires, self reported changes and attitudes	Touches on SDM. No improvement in self-reported SDM scores but improved provider attitude to SDM and patient knowledge of antibiotics.
Interactive virtual-patient scenarios: an evolving tool in psychiatric education.	Shah et al. (2012)	Empathetic communication	Free-text	Graphic image in first instance and animation in the second iteration.	Questionnaire and analysis of simulated performance	Phrase recognition needs consideration; systems can "learn" with each learner. Thought to reside earlier in education.
Back to the future: crime and punishment in second life	Smyth (2009)	Review (Second Life)	N/A	N/A	N/A	Concerns about the material that is included in the wider world of second life.

The use of virtual patients to teach medical students history taking and communication skills.	Stevens et al. (2006)	Communication skills, history taking.	Free-text speech recognition. Attempted to measure non-verbal behaviour of student.	Animation projected onto a screen (DIANA)	Analysis of speech recognition fidelity, questionnaire and interviews.	VP recognised about 60% of student questions; this caused some frustration but other students recognised that this is like reality where doctors are often asked to repeat questions. VP thought to be a good introduction to interviewing a patient. VP only thought useful for simple communication tasks due to limited range of phrase recognition.
Virtual patient simulation in psychiatric care - A pilot study of digital support for collaborate learning	Sunnqvist et al. (2016)	Web-SP system. History taking, physical exam, diagnosis	Multiple choice, problem solving	Real images plus written description of body language	Questionnaire, oral evaluation (large focus group)	The VP helped students bridge the 'fear' prior to clinical practice. Students wanted to use again. Reflection the important part. Noted that most VPs do not allow the formation of a dialogue and they suggest theirs does.
Improving student interview skills: The virtual avatar as client	Sweigart et al. (2013)	History taking	Free-text	Second Life. Animation	Questionnaires; observation of interaction with real patients (VP vs no VP)	Volunteers played patient. Students felt more prepared. Those who used a VP asked more questions than those without

Virtual Simulations across Curriculum Prepare Nursing Students for Patient Interviews	Sweigart et al. (2014)	History taking and patient assessment	Free-text	Second Life. Animation.	Descriptive plus questionnaire	VPs are well aligned with Knowles theory of andragogy due to experiential nature. Volunteers played the part of patients. The students felt better prepared for face-to-face experience and improved confidence. Helped transition from classroom to clinic.
Designing useful virtual standardized patient encounters	Talbot et al. (2012)	Review/commentary	N/A	N/A	N/A	Open-ended, rapport building harder than just history taking and closed questions. That said, most consultations follow similar pathways.
A Randomized Trial of Teaching Clinical Skills Using Virtual and Live Standardized Patients	Triola et al. (2006)	History taking and diagnosis.	Multiple choice; mix of PBL and narrative. Some options are revealed after asking relevant questions	Videos	4 SPs vs 2 SPs+2 VPs. Pre and post survey and assessment	Both rated highly; no difference. "Learners who experience all 3 modalities may have better insight into the progression of and improvement in their clinical skills as they practice and reinforce them."

Web-based learning versus standardized patients for teaching clinical diagnosis: A randomized, controlled, crossover trial	Turner et al. (2006)	History taking and assessment. DXR Clinician	Multiple choice, problem solving	Images	VP vs SP (crossover trial) assessed by SP	SP and VP results comparable but students preferred SP. Compounded by comparator (SP) also being assessment mode.
The virtual-patient pilot: Testing a new tool for undergraduate surgical education and assessment	Yang et al. (2013)	Surgical history taking and assessment.	Mix of multiple choice and free text.	Images	Surgery shelf exam results compared to no VP and questionnaire	Easy to use, non-significant improvement in exam scores. Significant increase in confidence.
Development, implementation and pilot evaluation of a Web-based Virtual Patient Case Simulation environment – Web-SP	Zary et al. (2006)	Web-SP system. History taking, physical exam, diagnosis	Multiple choice, problem solving	Real images plus written description of body language	Questionnaire plus observation of students	A balance between realism and ease of creation. Multiple choice noted as easier to create than free text as for Bergin (2003). All students were very positive towards the VP.

Appendix 2 – Pilot Information Sheet

Information Sheet

Study Title: The use of virtual patients for developing the evidence informed, shared decision making of clinicians – Pilot Study

My name is Simon Jacklin and I am a pharmacist and PhD student. I am conducting research into using virtual patient animations to develop the consultation skills of clinicians. A clinician can communicate with the virtual patient to diagnose and explain/offer treatment options, allowing them to practice whenever and wherever using a smartphone, tablet or computer. I am looking to see how useful these types of software can be in helping develop patient centred, evidence informed decision-making skills in health professionals and I am inviting you to participate in this research. My work is being supervised by Professors Stephen Chapman and Neal Maskrey.

Before you decide whether or not you wish to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

Why have I been chosen?
You are a member of staff within the School of Pharmacy at Keele with a healthcare registration.

Do I have to take part?
You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to complete an online consent form. You are free to withdraw from this study up until you have completed the final evaluation. You do not have to provide reasons for withdrawal.

If I take part, what do I have to do?
If you agree to take part you will be provided with a web link to access the virtual patient programme. Using the software should take no more than 20 minutes and can be done at any place or time convenient to you and can be repeated after the system provides you with instantaneous feedback. Before and after using the software, we require you to fill out a short online questionnaire. Your participation should take a total of 30 minutes, including the time for the questionnaires.

What are the benefits of taking part?
You would be taking part in a pilot study to help ensure the smooth and effective running of the main study. The main study is trying to establish the potential of a new way to help develop consultation skills in students and clinicians. As well as hopefully refining your own skills, you will be contributing to the design of a future educational tool.

What are the risks of taking part?
There are no tangible risks associated with your participation in this project. The simulation is of routine clinical practice and nothing particularly emotive.

How will information about me be used?
Your data will form part of the research looking at how effective virtual patient programmes are at developing your decision making, evidence use and patient centered consulting; as a pilot study, this data will help inform the main study. It will not be passed on to third parties but may be published in the scientific literature, anonymised. Quotes may be used in publication but these will be anonymised.

Who will have access to information about me?
The data will be collected online using Google Forms software, a secure method of data transfer. Only the principal investigator (Simon Jacklin) and supervisor (Stephen Chapman) will have direct access to this via password protection. The data will be treated confidentially by the research team and only Jacklin will have access to identifiable data; Chapman and Maskrey will only view anonymous data.

Who is funding and organising the research?
The funding is derived from the National Institute for Clinical and Healthcare Excellence. The principal researcher is Simon Jacklin who is being supported by Stephen Chapman and Neal Maskrey, both professors at Keele University and registered health professionals.

What if there is a problem?
Please note, you cannot withdraw after you have submitted your final evaluation; you can do so at any time before this.

If you have a concern about any aspect of this study or wish to withdraw, you can contact either;
Simon Jacklin, principal researcher and PhD student, s.jacklin@keele.ac.uk, 0759793501
Professor Stephen Chapman, supervisor, s.r.chapman@keele.ac.uk

If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way that you have been approached or treated during the course of the study please write to Nicola Leighton who is the University's contact for complaints regarding research at the following address:-

Nicola Leighton
Research Governance Officer
Research & Enterprise Services
Dorothy Hodgkin Building
Keele University
ST5 5BG
E-mail: n.leighton@uso.keele.ac.uk
Tel: 01782 733306

Appendix 3 – Pilot Consent Form

Pilot Study: The use of virtual patients for developing the evidence informed, shared decision making of clinicians

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw up until I have completed the final evaluation.
3. I agree to take part in this study.
4. I understand that data collected about me during this study will be anonymised before it is submitted for publication.
5. I agree to the use of quotes from responses which will be anonymised in publication.

Full name:

Email address:

To agree to the above terms, please tick the box:

Appendix 4 – Pilot Pre-Questionnaire

To which gender do you identify?

Male / Female / Prefer not to say / Other

To which profession do you belong?

Medicine / Pharmacy

Question 1: How would you define a 'digital virtual patient'?

Question 2: Which statement would you say best suits yourself?

I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market
I enjoy new technology but am rarely the first to invest in a new product
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product
I have no desire for new technology, I tend to only adopt it after the majority of other people
I dislike change in technology and will only use a product when it has become mainstream

Question 3: Which of the following methods have you used or experienced in your professional education? Tick all that apply

Simulated Patients
Videos of others consultations
Video recordings (your own consultations)
Role plays
Digital virtual patients

Question 4: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful)

Healthcare education
Clinical decision making
Consultation skills
Patient centered care

Question 5a: Which of the following do you currently use to aid your professional learning or development and how many times per month do you use them?

	Webinars	**Social Media**	**Blogging sites**	**Online Simulation**	**MOOCS**
Don't use					
1-2 or less					
3-5					
6-8					
9+					

Question 5b: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Basic Science
Clinical decision making
Communication skills
Ethical issues
Other:

Question 6: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Appendix 5 – Pilot Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Consultation skills
Clinical decision making
Patient centered care
Communication skills
Managing medical complexity
Managing polypharmacy

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Question 6: At which stage(s) in your professional development do you think this type of programme could or could've been useful, or not? Tick all that apply.

Early undergraduate
Late undergraduate
First 4 years post-graduation
5-10 years post-graduation
11+ years post-graduation

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical practice following your use of the virtual patient programme?

Highly unlikely
Unlikely
Likely
Highly likely

Question 7b: If you think there will be any changes, what do you think these will be?

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Question 9: What did you like about the virtual patient experience?

Question 10: What did you dislike about the virtual patient experience?

Question 11: Do you have any other comments about the virtual patient?

Appendix 6 – Pilot Demographic Data

Demographics	
Male	Female
6	12
Pharmacy	Medicine
14	4

Appendix 7 – Pharmacy Undergraduate Information Sheet

Information Sheet

Evaluation Title: **The use of virtual patients for developing the evidence informed, shared decision making of clinicians**

My name is Simon Jacklin and I am a pharmacist and PhD student. I am conducting a service evaluation into using virtual patient animations to develop the consultation skills of clinicians. The clinician can communicate with the virtual patient to diagnose and explain/offer treatment options, allowing them to practice whenever and wherever using a smartphone, tablet or computer. I am looking to see how useful these types of software can be in helping develop patient centered, evidence informed decision-making skills in health professionals and I am inviting you to participate in this project. My work is being supervised by Professors Stephen Chapman and Neal Maskrey.

Before you decide whether or not you wish to take part, it is important for you to understand why this evaluation is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

Why have I been chosen?

You are a pharmacy student at Keele University.

Do I have to take part?

NB: You do not have to take part in the evaluation to participate in the workshop.

You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to complete an online consent form. You are free to withdraw from this evaluation up until a week after the workshop. You do not have to provide reasons for withdrawal.

If I take part, what do I have to do?

You will be using the virtual patient programme during the workshop, irrespective of whether you decide to take part in the study. If you participate in the evaluation, before and after using the software we require you to fill out a short online questionnaire. We may ask you to take part in a future interview but this further involvement is entirely optional and at your discretion.

What are the benefits of taking part?

By taking part in this evaluation you will be helping to develop the virtual patient teaching tool.

What are the risks of taking part?

There are no tangible risks associated with your participation in this project. The simulation is of routine clinical practice and nothing particularly emotive. The questionnaires relate to your experience of the simulation.

How will information about me be used?

Your data will form part of the evaluation looking at how effective virtual patient programmes are at developing your decision making, evidence use and patient centered consulting. It will not be passed on to third parties but will be published in the scientific literature, anonymised. Quotes may be used in publication but these will be anonymised.

Who will have access to information about me?

The data will be collected online using Google Forms software, a secure method of data transfer. Only the principal investigator and supervisor (Stephen Chapman) will have direct access to this via password protection. The data will be treated anonymously. Quotes may be used in publication but these will be anonymous.

Who is funding and organising the research?

The funding is derived from the National Institute for Clinical and Healthcare Excellence. The principal researcher is Simon Jacklin who is being supported by Stephen Chapman and Neal Maskrey, both professors at Keele University and registered health professionals.

What if there is a problem?

If you have a concern about any aspect of this study or wish to withdraw, you can contact either;
Simon Jacklin, principal researcher and PhD student, s.jacklin@keele.ac.uk, 0759793501
Professor Stephen Chapman, supervisor, s.r.chapman@keele.ac.uk

Please note, you cannot withdraw later than a week after you have submitted your final evaluation; you can do so at any time before this. If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way that you have been approached or treated during the course of the study please write to Nicola Leighton who is the University's contact for complaints regarding research at the following address:-

Nicola Leighton

Research Governance Officer
Research & Enterprise Services
Dorothy Hodgkin Building
Keele University
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E-mail: n.leighton@.keele.ac.uk
Tel: 01782 733306

Appendix 8 – Pharmacy Undergraduate Interview Information Sheet

Information Sheet

Evaluation Title: The use of virtual patients for developing the evidence informed, shared decision making of clinicians

My name is Simon Jacklin and I am a pharmacist and PhD student. I am conducting an evaluation into using virtual patient animations to develop the consultation skills of clinicians. The clinician can communicate with the virtual patient to diagnose and explain/offer treatment options, allowing them to practice whenever and wherever using a smartphone, tablet or computer. I am looking to see how useful these types of software can be in helping develop patient centred, evidence informed decision- making skills in health professionals and I am inviting you to participate in this evaluation. My work is being supervised by Professors Stephen Chapman and Neal Maskrey.

Before you decide whether or not you wish to take part, it is important for you to understand why this evaluation is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

Why have I been chosen?

You have previously participated in this evaluation by using the virtual patient.

Do I have to take part?

You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to complete an online consent form. You are free to withdraw from this study up until you a week after the interview. You do not have to provide reasons for withdrawal.

If I take part, what do I have to do?

You will be interviewed over the phone about your experience of the virtual patient software used in a recent workshop. All the questions will pertain to the educational usefulness of the virtual patient.

What are the benefits of taking part?

You will be contributing to an evaluation that will hopefully improve the quality of educational tools such as virtual patients. You will also receive a £10 Amazon voucher.

What are the risks of taking part?

There are no tangible risks associated with your participation in this project. The interview will only focus on the educational points of the virtual patient.

How will information about me be used?

Your data will form part of the evaluation looking at how effective virtual patient programmes are at developing your decision making, evidence use and patient centred consulting. It will not be passed on to third parties but will be published in an anonymised form in the scientific literature. Quotes may be used in publication but these will be anonymised.

Who will have access to information about me?

The interview will be recorded and stored on a password protected University computer and shared (using Google Drive) between Simon Jacklin and Stephen Chapman. Only the principal investigator and supervisor (Stephen Chapman) will have direct access to this via password protection. The data will be treated confidentially. Quotes may be used in publication but these will be anonymous.

Who is funding and organising the research?

The funding is derived from the National Institute for Clinical and Healthcare Excellence. The principal researcher is Simon Jacklin who is being supported by Stephen Chapman and Neal Maskrey, both professors at Keele University and registered health professionals.

What if there is a problem?

If you have a concern about any aspect of this study or wish to withdraw, you can contact either;
Simon Jacklin, principal researcher, s.jacklin@keele.ac.uk, 0759793501
Professor Stephen Chapman, supervisor, s.r.chapman@keele.ac.uk

Please note, you cannot withdraw one week after your interview; you can do so at any time before this. If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way that you have been approached or treated during the course of the study please write to Nicola Leighton who is the University's contact for complaints regarding research at the following address:-

Nicola Leighton
Research Governance Officer
Research & Enterprise Services
Dorothy Hodgkin Building
Keele University
ST5 5BG
E-mail: n.leighton@keele.ac.uk
Tel: 01782 733306

Appendix 9 – Pharmacy Undergraduate Consent Form

The use of virtual patients for developing the evidence informed, shared decision making of clinicians.

1. I confirm that I have read and understood the information sheet for the above evaluation and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw up until one week after the workshop on the 11th December.
3. I agree to take part in this evaluation.
4. I understand that data collected about me during this evaluation will be anonymised before it is submitted for publication.
5. I agree to be contacted about possible participation in an interview for this project; this future participation is entirely optional.
6. I agree to the use of quotes from responses which will be anonymised in publication.

To agree to the above terms, please tick the box:

Appendix 10 – Pharmacy Undergraduate Interview Consent Form

The use of virtual patients for developing the evidence informed, shared decision making of clinicians

1. I confirm that I have read and understood the information sheet for the above project and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw up until a week after my interview.
3. I agree to take part in an interview for this evaluation.
4. I understand that data collected about me during this evaluation will be anonymised before it is submitted for publication.
5. I agree to the recording of my interview and the use of quotes from responses which will be anonymised in publication.

Email address:

To agree to the above terms, please tick the box:

Appendix 11 – Pharmacy Undergraduate Pre-Questionnaire

Please provide your email address:

To which gender do you identify?

Male / Female / Prefer not to say / Other

Question 1: How would you define a 'digital virtual patient'?

Question 2: How useful do you think virtual patient technology could be in the development of your professional knowledge and skills?

1 = not at all useful, 5 = very useful

Question 3: Which statement would you say best suits yourself?

I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market
I enjoy new technology but am rarely the first to invest in a new product
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product
I have no desire for new technology, I tend to only adopt it after the majority of other people
I dislike change in technology and will only use a product when it has become mainstream

Question 4: Which of the following methods have you used or experienced in your education? Tick all that apply

Simulated Patients
Videos of others consultations
Video recordings (your own consultations)
Role plays
Digital virtual patients

Question 5: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful)

Healthcare education
Clinical decision making
Consultation skills
Patient centered care

Question 6: Which of the following do you currently use to aid your professional learning/development and how many times per month do you use them?

	Webinars	**Social Media**	**Blogging sites**	**Online Simulation**	**MOOCS**
Don't use					
1-2 or less					
3-5					
6-8					
9+					

Question 7: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Basic Science
Clinical decision making
Communication skills
Ethical issues
Other:

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Appendix 12 – Pharmacy Undergraduate Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Consultation skills
Clinical decision making
Patient centered care
Communication skills
Managing medical complexity
Managing polypharmacy

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Question 6: At which stage(s) in your professional development do you think this type of programme could be useful, or not? Tick all that apply.

Early undergraduate
Late undergraduate
First 4 years post-graduation
5-10 years post-graduation
11+ years post-graduation

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical scenarios following your use of the virtual patient programme?

Highly unlikely
Unlikely
Likely
Highly likely

Question 7b: If you think there will be any changes, what do you think these will be?

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Question 9: How would you rate the format of the feedback given to you at the end of the simulation? (1 = very poor, 5 = very good)

Question 10: How much feedback did the virtual patient provide?

No useful feedback
Too little
Right amount
Too much

Question 11: Do you have any comments on the feedback given?

Question 12: What did you like about the virtual patient experience?

Question 13: What did you dislike about the virtual patient experience?

Question 14: Do you have any other comments about the virtual patient?

Appendix 13 – Pharmacy Undergraduate Demographic Data

Gender	
Male	Female
25	29

Appendix 14 – Medical Undergraduate Information Sheet

Information Sheet

Study Title: The use of virtual patients for developing the evidence informed, shared decision making of clinicians

My name is Simon Jacklin and I am a pharmacist and PhD student. I am conducting research into using virtual patient animations to develop the consultation skills of clinicians. The clinician can communicate with the virtual patient to diagnose and explain/offer treatment options, allowing them to practice whenever and wherever using a smartphone, tablet or computer. I am looking to see how useful these types of software can be in helping develop patient centred, evidence informed decision-making skills in health professionals and I am inviting you to participate in this research. My work is being supervised by Professors Stephen Chapman and Neal Maskrey.

Before you decide whether or not you wish to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

Why have I been chosen?

The study population is delegates to the MMRSSoc annual conference.

Do I have to take part?

NB: You do not have to take part in the study to participate in the workshop.
You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to complete an online consent form. You are free to withdraw from this study up until you a week after the conference. You do not have to provide reasons for withdrawal.

If I take part, what do I have to do?

You will be using the virtual patient programme during the workshop, irrespective of whether you decide to join the study. If you participate in the study, before and after using the software we require you to fill out a short online questionnaire. We may invite you to take part in a future telephone interview but this further involvement is entirely optional and at your discretion.

What are the benefits of taking part?

You will be contributing to a research project that will hopefully improve the quality of educational tools such as virtual patients.

What are the risks of taking part?

There are no tangible risks associated with your participation in this project. The simulation is of routine clinical practice and nothing particularly emotive. The questionnaires relate to your views of the virtual patient.

How will information about me be used?

Your data will form part of the research looking at how effective virtual patient programmes are at developing your decision making, evidence use and patient centred consulting. It will not be passed on to third parties but will be published in an anonymised form in the scientific literature. Quotes may be used in publication but these will be anonymised.

Who will have access to information about me?

The data will be collected online using Google Forms software, a secure method of data transfer. Only the principal investigator and supervisor (Stephen Chapman) will have direct access to this via password protection. The data will be treated anonymously. Quotes may be used in publication but these will be anonymous.

Who is funding and organising the research?

The funding is derived from the National Institute for Clinical and Healthcare Excellence. The principal researcher is Simon Jacklin who is being supported by Stephen Chapman and Neal Maskrey, both professors at Keele University and registered health professionals.

What if there is a problem?

If you have a concern about any aspect of this study or wish to withdraw, you can contact either;
Simon Jacklin, principal researcher, s.jacklin@keele.ac.uk, 0759793501
Professor Stephen Chapman, supervisor, s.r.chapman@keele.ac.uk

Please note, you cannot withdraw a week after the conference; you can do so at any time before this. If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way that you have been approached or treated during the course of the study please write to Nicola Leighton who is the University's contact for complaints regarding research at the following address:-

Nicola Leighton
Research Governance Officer
Research & Enterprise Services
Dorothy Hodgkin Building
Keele University
ST5 5BG
E-mail: n.leighton@keele.ac.uk
Tel: 01782 733306

Appendix 15 – Medical Undergraduate Interview Information Sheet

Information Sheet

Study Title: The use of virtual patients for developing the evidence informed, shared decision making of clinicians

My name is Simon Jacklin and I am a pharmacist and PhD student. I am conducting research into using virtual patient animations to develop the consultation skills of clinicians. The clinician can communicate with the virtual patient to diagnose and explain/offer treatment options, allowing them to practice whenever and wherever using a smartphone, tablet or computer. I am looking to see how useful these types of software can be in helping develop patient centred, evidence informed decision-making skills in health professionals and I am inviting you to participate in this research. My work is being supervised by Professors Stephen Chapman and Neal Maskrey.

Before you decide whether or not you wish to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

Why have I been chosen?

You have previously participated in this study by using the virtual patient at the MMRSSoc annual conference.

Do I have to take part?

You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to complete an online consent form. You are free to withdraw from this study up until you a week after the interview. You do not have to provide reasons for withdrawal.

If I take part, what do I have to do?

You will be interviewed over the phone about your experience of the virtual patient software used in the MMRSSoc annual conference workshop. All the questions will pertain to the educational usefulness of the virtual patient.

What are the benefits of taking part?

You will be contributing to a research project that will hopefully improve the quality of educational tools such as virtual patients. You will also receive a £10 Amazon voucher.

What are the risks of taking part?

There are no tangible risks associated with your participation in this project. The interview will only focus on the educational points of the virtual patient.

How will information about me be used?

Your data will form part of the research looking at how effective virtual patient programmes are at developing your decision making, evidence use and patient centred consulting. It will not be passed on to third parties but will be published in an anonymised form in the scientific literature. Quotes may be used in publication but these will be anonymised.

Who will have access to information about me?

The interview will be recorded and stored on a password protected University computer and shared (using Google Drive) between Simon Jacklin and Stephen Chapman. Only the principal investigator and supervisor (Stephen Chapman) will have direct access to this via password protection. The data will be treated confidentially. Quotes may be used in publication but these will be anonymous.

Who is funding and organising the research?

The funding is derived from the National Institute for Clinical and Healthcare Excellence. The principal researcher is Simon Jacklin who is being supported by Stephen Chapman and Neal Maskrey, both professors at Keele University and registered health professionals.

What if there is a problem?

If you have a concern about any aspect of this study or wish to withdraw, you can contact either;
Simon Jacklin, principal researcher, s.jacklin@keele.ac.uk, 0759793501
Professor Stephen Chapman, supervisor, s.r.chapman@keele.ac.uk

Please note, you cannot withdraw one week after your interview; you can do so at any time before this. If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way that you have been approached or treated during the course of the study please write to Nicola Leighton who is the University's contact for complaints regarding research at the following address:-

Nicola Leighton
Research Governance Officer
Research & Enterprise Services
Dorothy Hodgkin Building
Keele University
ST5 5BG
E-mail: n.leighton@keele.ac.uk
Tel: 01782 733306

Appendix 16 – Medical Undergraduate Consent Form

The use of virtual patients for developing the evidence informed, shared decision making of clinicians.

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw up until one week after the MMRSSoc conference.
3. I agree to take part in this study.
4. I understand that data collected about me during this study will be anonymised before it is submitted for publication.
5. I agree to be contacted about possible participation in an interview for this project; this future participation is entirely optional.
6. I agree to the use of quotes from responses which will be anonymised in publication.

To agree to the above terms, please tick the box:

Appendix 17 – Medical Undergraduate Interview Consent Form

The use of virtual patients for developing the evidence informed, shared decision making of clinicians.

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw up until a week after my interview.
3. I agree to take part in an interview for this study.
4. I understand that data collected about me during this study will be anonymised before it is submitted for publication.
5. I agree to the recording of my interview and the use of quotes from responses which will be anonymised in publication.

Email address:

To agree to the above terms, please tick the box

Appendix 18 – Medical Undergraduate Pre-Questionnaire

Please provide your email address:

To which gender do you identify?

Male / Female / Prefer not to say / Other

What year of study are you in?

1st
2nd
3rd
4th
5th
6th

Question 1: How would you define a 'digital virtual patient'?

Question 2: How useful do you think virtual patient technology could be in the development of your professional knowledge and skills?

1 = not at all useful, 5 = very useful

Question 3: Which statement would you say best suits yourself?

I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market
I enjoy new technology but am rarely the first to invest in a new product
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product
I have no desire for new technology, I tend to only adopt it after the majority of other people
I dislike change in technology and will only use a product when it has become mainstream

Question 4: Which of the following methods have you used or experienced in your education? Tick all that apply

Simulated Patients (actors)
Videos of others consultations
Video recordings (your own consultations)
Role plays
Digital virtual patients

Question 5: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful)

Healthcare education
Clinical decision making
Consultation skills
Patient centered care

Question 6a: Which of the following do you currently use to aid your professional learning/development and how many times per month do you use them?

	Webinars	**Social Media**	**Blogging sites**	**Online Simulation**	**MOOCS**
Don't use					
1-2 or less					
3-5					
6-8					
9+					

Question 6b: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Basic Science
Clinical decision making
Communication skills
Ethical issues
Other:

Question 7: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Appendix 19 – Medical Undergraduate Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Consultation skills
Clinical decision making
Patient centered care
Communication skills
Managing medical complexity
Managing polypharmacy

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Question 6: At which stage(s) in your professional development do you think this type of programme could be useful, or not? Tick all that apply.

Early undergraduate
Late undergraduate
First 4 years post-graduation
5-10 years post-graduation
11+ years post-graduation

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical scenarios following your use of the virtual patient programme?

Highly unlikely
Unlikely
Likely
Highly likely

Question 7b: If you think there will be any changes, what do you think these will be?

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Question 9: How would you rate the format of the feedback given to you at the end of the simulation? (1 = very poor, 5 = very good)

Question 10: How much feedback did the virtual patient provide?

No useful feedback
Too little
Right amount
Too much

Question 11: Do you have any comments on the feedback given?

Question 12: What did you like about the virtual patient experience?

Question 13: What did you dislike about the virtual patient experience?

Question 14: Do you have any other comments about the virtual patient?

Appendix 20 – Medical Undergraduate Demographic Data

Gender	
Male	Female
6	16

Year of Study					
1st	2nd	3rd	4th	5th	6th
1	5	0	8	7	1

Appendix 21 – GPR Information Sheet

Information Sheet

Study Title: **The use of virtual patients for developing the evidence informed, shared decision making of clinicians**

My name is Simon Jacklin and I am a pharmacist and PhD student. I am conducting research into using virtual patient animations to develop the consultation skills of clinicians. The clinician can communicate with the virtual patient to diagnose and explain/offer treatment options, allowing them to practice whenever and wherever using a smartphone, tablet or computer. I am looking to see how useful these types of software can be in helping develop patient centred, evidence informed decision-making skills in health professionals and I am inviting you to participate in this research. My work is being supervised by Professors Stephen Chapman and Neal Maskrey.

Before you decide whether or not you wish to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information.

Why have I been chosen?

You have previously participated in this study by using the virtual patient at a half day training workshop.

Do I have to take part?

You are free to decide whether you wish to take part or not. If you do decide to take part you will be asked to complete an online consent form. You are free to withdraw from this study up until you a week after the interview. You do not have to provide reasons for withdrawal.

If I take part, what do I have to do?

You will be interviewed over the phone about your experience of the virtual patient software used in the workshop. All the questions will pertain to the educational usefulness of the virtual patient.

What are the benefits of taking part?

You will be contributing to a research project that will hopefully improve the quality of educational tools such as virtual patients.

What are the risks of taking part?

There are no tangible risks associated with your participation in this project. The interview will only focus on the educational points of the virtual patient.

How will information about me be used?

Your data will form part of the research looking at how effective virtual patient programmes are at developing your decision making, evidence use and patient centred consulting. It will not be passed on to third parties but will be published in an anonymised form in the scientific literature. Quotes may be used in publication but these will be anonymised.

Who will have access to information about me?

The interview will be recorded and stored on a password protected University computer and shared (using Google Drive) between Simon Jacklin and Stephen Chapman. Only the principal investigator and supervisor (Stephen Chapman) will have direct access to this via password protection. The data will be treated confidentially. Quotes may be used in publication but these will be anonymous.

Who is funding and organising the research?

The funding is derived from the National Institute for Clinical and Healthcare Excellence. The principal researcher is Simon Jacklin who is being supported by Stephen Chapman and Neal Maskrey, both professors at Keele University and registered health professionals.

What if there is a problem?

If you have a concern about any aspect of this study or wish to withdraw, you can contact either;
Simon Jacklin, principal researcher, s.jacklin@keele.ac.uk, 0759793501
Professor Stephen Chapman, supervisor, s.r.chapman@keele.ac.uk

Please note, you cannot withdraw after one week after your interview; you can do so at any time before this. If you remain unhappy about the research and/or wish to raise a complaint about any aspect of the way that you have been approached or treated during the course of the study please write to:-

Research Governance Officer
Research & Enterprise Services
Dorothy Hodgkin Building
Keele University
ST5 5BG
E-mail: research.governance@keele.ac.uk
Tel: 01782 733306

Appendix 22 – GPR Consent Form

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw up until one week after I have completed the final evaluation.
3. I agree to take part in this study.
4. I understand that data collected about me during this study will be anonymised before it is submitted for publication.
5. I agree to be contacted about possible participation in an interview for this project; this future participation is entirely optional and voluntary.
6. I agree to the use of quotes from responses which will be anonymised in publication.

To agree to the above terms, please tick the box:

Appendix 23 – GPR Pre-Questionnaire

To which gender do you identify?

Male / Female / Prefer not to say / Other

Question 1: How would you define a 'digital virtual patient'?

Question 2: How useful do you think virtual patient technology could be in the development of your professional knowledge and skills?

1 = not at all useful, 5 = very useful

Question 3: Which statement would you say best suits yourself?

I tend to adopt new technology very early, I am often the first person to acquire a new product when it comes on the market
I enjoy new technology but am rarely the first to invest in a new product
I am indifferent towards technology but will use a product when it has been on the market for a while and many others have the product
I have no desire for new technology, I tend to only adopt it after the majority of other people
I dislike change in technology and will only use a product when it has become mainstream

Question 4: Which of the following methods have you used or experienced in your education? Tick all that apply

Simulated Patients (actors)
Videos of others consultations
Video recordings (your own consultations)
Role plays
Digital virtual patients

Question 5: How useful do you think new technology, such as a digital virtual patient, can be when used to teach the following (1 = not useful at all, 5 = very useful)

Healthcare education
Clinical decision making
Consultation skills
Patient centered care

Question 6a: Which of the following do you currently use to aid your professional learning/development and how many times per month do you use them?

	Webinars	Social Media	Blogging sites	Online Simulation	MOOCS
Don't use					
1-2 or less					
3-5					
6-8					
9+					

Question 6b: If you do use any of the above for your professional learning/development, what area of the curriculum or skills do you use them to help develop? Tick all that apply

Basic Science
Clinical decision making
Communication skills
Ethical issues
Other:

Question 7: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Appendix 24 – GPR Post-Questionnaire

Question 1: How did you find the virtual patient programme to use? (1 = not at all enjoyable, 5 = very enjoyable)

Question 2: In terms of accessibility and usability, what was the virtual patient programme like to use? (1 = very difficult, 5 = very easy)

Question 3a: How would you rate the format for giving your reply to the patient? (1 = very poor, 5 = very good)

Question 3b: Any comments on the format for providing a response to the virtual patient?

Question 4: How useful was the virtual patient in teaching the following? (1 = not useful at all, 5 = very useful)

Consultation skills
Clinical decision making
Patient centered care
Communication skills
Managing medical complexity
Managing polypharmacy

Question 5a: Would you like to use the virtual patient programme again to help your development and learning in future?

Question 5b: If you selected 'Yes, but with improvements', what improvements would you suggest?

Question 6: At which stage(s) in your professional development do you think this type of programme could be useful, or not? Tick all that apply.

Early undergraduate
Late undergraduate
First 4 years post-graduation
5-10 years post-graduation
11+ years post-graduation

Question 7a: How likely do you think it is that there will be any changes in your approach to clinical scenarios following your use of the virtual patient programme?

Highly unlikely
Unlikely
Likely
Highly likely

Question 7b: If you think there will be any changes, what do you think these will be?

Question 8: Rank the following in terms of the priority they hold within a clinical consultation when selecting treatment options, in your personal opinion (1 being highest priority, 4 being lowest)

Maximising effectiveness
Minimising risks
Minimising costs
Respecting patient choices

Question 9: How would you rate the format of the feedback given to you at the end of the simulation? (1 = very poor, 5 = very good)

Question 10: How much feedback did the virtual patient provide?

No useful feedback
Too little
Right amount
Too much

Question 11: Do you have any comments on the feedback given?

Question 12: What did you like about the virtual patient experience?

Question 13: What did you dislike about the virtual patient experience?

Question 14: Do you have any other comments about the virtual patient?

Appendix 25 – GPR Demographic Data

Demographics	
Male	Female
10	16

Appendix 26 – Pilot Study Ethical Approval

Keele University

Ref: ERP394

4th May 2017

Simon Jacklin
Institute of Applied Clinical Sciences
Keele University

Dear Simon,

Re: Pilot Study: The use of virtual patients for developing the evidence informed, shared decision making of clinicians

Thank you for submitting your revised application for review. I am pleased to inform you that your application has been approved by the Ethics Review Panel.

The following documents have been reviewed and approved by the panel as follows:

Document(s)	Version Number	Date
Email Correspondence	1	14-02-2017
Participant Information Sheet	2	18-04-2017
Consent Form	1	13-02-2017
Print Screen of Consent Form (Online)	1	13-02-2017
Pre-Questionnaire and screenshot of online version	1	14-02-2017
Post Questionnaire and screen shot of online eversion	1	14-02-2017

If the fieldwork goes beyond the date stated in your application, **1st December 2017**, or there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator at research.governance@keele.ac.uk stating **ERP3** in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me via the ERP administrator on research.governance@keele.ac.uk, stating **ERP3** in the subject line of the e-mail.

Yours sincerely

pp C H Bannerman

Mrs Val Ball
Chair – Ethical Review Panel

CC RI Manager

Appendix 27 – Medical Student Evaluation Ethical Approval

Keele UNIVERSITY

21/12/2017

Dear Simon

PI: Simon Jacklin
Title: The use of virtual patients for developing the evidence informed, shared decision making of clinicians
Ref: ERP3102

Thank you for your request to amend your study.

I am pleased to inform you that your request has been approved by the Ethical Review Panel.

If the fieldwork goes beyond the date stated or there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator at research.governance@keele.ac.uk stating **ERP3102** in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me.

Yours sincerely
PP.

Dr Valerie Ball
Chair – Ethical Review Panel

Appendix 28 – General Practice Registrar Evaluation Ethical Approval

Keele UNIVERSITY

09/07/2018

Dear Simon

PI: Simon Jacklin
Title: The use of virtual patients for developing the evidence informed, shared decision making of clinicians
Ref: ERP3102

Thank you for your request to amend your study.

I am pleased to inform you that your request, received on 2nd July 2018 has been approved by the Ethical Review Panel.

If the fieldwork goes beyond the date stated or there are any other amendments to your study you must submit an 'application to amend study' form to the ERP administrator at research.governance@keele.ac.uk stating **ERP3102** in the subject line of the e-mail. This form is available via http://www.keele.ac.uk/researchsupport/researchethics/

If you have any queries, please do not hesitate to contact me.

Yours sincerely
PP.

Dr Valerie Ball
Chair – Ethical Review Panel