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**Article:**

**Introducing Patchwork Assessment into Natural Science curricula**

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## **Abstract**

Patchwork Assessment (or Patchwork Text Assessment) is an alternative to exams or traditional coursework, and may be particularly appropriate for introduction as part of a module being redesigned for flexible digital delivery. It involves students creating or curating numerous “patches” of content or activity as they progress through the module, and using them in combination as the basis of a final summative assessment (the Patchwork) that adds up to more than the sum of its component patches. It is not merely a portfolio, as the components themselves are not summatively assessed. Advantages include opportunities for improvements in inclusivity, student engagement, and the deployment of strategies for generative learning. Disadvantages include unfamiliarity to both students and staff, and potentially significant workload in developing the new assessments and inducting students into the process. We introduced patchwork Assessments into two undergraduate modules, one in Geography, one in Geology, as part of a redevelopment of teaching and assessment during the 2020 Covid lockdowns. Patchwork Assessments were found to encourage student engagement with both course content and related materials. They stimulated dialog and conversations between staff and students. Some of the work submitted was of such high quality that it could be included as sample class materials for future cohorts.

## **Introduction**

This article explores the experiences of the authors and our students in the development and use of Patchwork Assessments in undergraduate modules for students in Geography, Environmental Science and Geology. We begin by outlining what Patchwork Assessment is and how it works, and then we move on to sharing staff and student perceptions of our experience of introducing Patchwork Assessments into two of our modules. In an attempt to distance this work from the typical style of academic writing where we would be “disinterested specialists” (Hyland and Jiang, 2017), we have adopted a more flexible style for part of this paper, hopefully creating a more accessible and engaging read by presenting some of our ideas in the Question-and-Answer format that we used when first explaining to colleagues how Patchwork Assessments work. Patchwork Assessments are a mode of assessment that involves students completing and collecting small items of work (patches) across a period of time. These patches are then ‘stitched’ or curated into a piece of work (the patchwork) that is submitted for summative assessment. This assessment type is student centred and owned, flexible in content and delivery style, inclusive, and provides the opportunity for continuous feedback (Winter, 2013; Jones-Devitt *et al.*, 2016). Patchworks fit well with generative/active learning. Completing patches step by step through a module encourages continuous engagement and deeper learning, compared with assessments that are based more on end-of-module recall or reproduction of previously learnt material (Trevelyan and Wilson, 2011; Winter, 2003). The use of Patchwork Assessments is known from clinical-, humanities- and arts-based educational environments (e.g. Surridge *et al.*, 2010; Hagar *et al.*, 2016; Horn and Van Niekert, 2020), but not from physical and natural sciences. The shift to hybrid delivery due to the COVID-19 lockdowns in 2020, required a change in assessments to allow students (and staff) to work remotely when required; Patchwork Assessment offered physical and natural science students autonomy of subject matter, assessment style and learning structure. This article documents and reflects on the embedding of Patchwork Assessments across two modules from the school of Geography, Geology and the Environment, Keele University, UK (ESC-10039 Fundamentals of Physical Geography and ESC-10045 Introductory Geology for the Environmental Sciences). We introduced the new assessment in the academic year 2020/21 and ran it for a second time with the same modules in 2021/22. Here, we share staff perceptions from the authors, who were leaders of the two modules, and student perceptions based on the responses to a survey sent out to cohorts on ESC-10039 Fundamentals of Physical Geography and ESC-10045 Introductory Geology for the Environmental Sciences in 20/21 and 21/22. We were particularly interested in the students’ transition into what was for them a completely new assessment type, and in how students can be helped to understand the

assessment. The overall aims of this piece are to outline what Patchwork Assessment is (in an accessible manner), to describe our experience of introducing it to modules (and students) where traditional assessment styles had previously been dominant (i.e. an exam), and to give some brief analysis of how well it worked.

### **Introducing Patchwork Assessment to colleagues: a Q&A**

Towards the beginning of the COVID pandemic the School of Geography, Geology and the Environment (Keele University, UK) held an Education and Scholarship “away week”. This involved remote events spread across the week covering a wide variety of topics, ranging from using Microsoft Teams for teaching, virtual fieldwork, Decolonising the Curriculum and more. One of the sessions focussed on alternative assessment types (particularly assessments which might replace a ‘traditional’ exam). Patchworks were covered in this session, and to provide a resource for colleagues who were unfamiliar with this type of assessment, PGK produced the following introductory Q&A.

#### **Q: Before we start, are these just your own ideas or is there a framework of pedagogic research and experience behind this?**

A: There is an extensive framework of published research and experience around Patchwork Assessment, but my answers here are personal opinions based partly on that framework and partly on my own experience. Two key sources to begin with would be Winter (2003) and Jones-Devitt *et al.* (2016).

#### **Q: So, is Patchwork Assessment just a fancy term for “Portfolio”?**

A: No. Some of the literature is quite adamant that thinking about Patchwork Assessment as simply a portfolio assessment is unhelpful, because we are not assessing a collection of material but assessing something *developed from* that collection, the collection being an extended student activity that precedes the assessment item. However, I confess that when I first started to think about Patchworks, the idea felt at-least somewhat related to the idea of a portfolio. Now, I find it helpful to differentiate between the patchwork collection (the patches or items that you might think of as a non-assessed portfolio) and the final Patchwork Assessment (the assessed item that emerges from, or uses, the patchwork collection). We are not assessing the collection, but assessing something that the student creates after they complete the collection. Some sources do refer to the final assessment as a stitching together of the patches, but I think of it as needing to be more than just that: more than just the sum of its parts.

#### **Q: If it’s not a portfolio, how does a Patchwork Assessment work, then?**

A: There are two stages to the activity.

(1) Throughout a module, students create and assemble short items of work (patches) that are not themselves summatively assessed, (but may be *formatively* assessed to provide constructive feedback, or may be shared and discussed in peer groups). These patches can and should be quite varied, ideally with students having a choice of which ones to engage with. They might include personal notes on a set reading, a short reinforcement exercise, an online group discussion, a reflective commentary on a lecture, a topic summary, or a student choosing their own local case study or application of a theme from a taught session and producing a development, commentary or illustration of that in their own preferred format. Blog or vlog entries might work well, or some type of course-long workbook. A lot of these activities could be things that we like to image students might be doing anyway as part of their independent work, but we are giving them a bit of a steer and a push. Tutors might “prompt” activities alongside each lecture or online session. These items are not themselves summatively assessed and it is up to the module leader how closely they want to “enforce” engagement. Having students share and discuss their activities with their peers in a shared module space can be helpful.

(2) At the end of the module, when students (should) have assembled (at least a partial) collection of different items from those that have been recommended through the module, the summative assessment requires

them to *do something* with their collection. This might be an applied or practice-based task where the collection is used as the basis of something such as a planning application or a grant application or a professional report or a job application, or at its simplest it could be that they are asked to produce a written reflection on their collection, with items from the collection being presented as illustration or evidence within that summative report but not themselves being assessed.

If it is set up properly, the quality of the final summative piece will depend partly on students having effectively engaged with the collection of formative patchwork items along the way, without the collection itself actually being assessed.

**Q: Does the tutor have to mark all these little pieces of work!??**

A: No. The patchwork items are not themselves assessed. They are materials that the students are compiling for themselves, to use when they do the final component. It is up to module leaders whether the students have chances for interim submissions, peer-group discussions, etc. in order to get formative feedback as they work up their patchwork, but certainly there is no formal assessment of this stage of the activity. Most staff will need to manage this process carefully to keep their workloads appropriate, and there is no requirement that staff will be heavily engaged in this stage of the students' work once the framework of instructions to students is set up.

**Q: What if a student simply doesn't do the in-course formative items? Can they just write the report at the end and somehow get away with it?**

A: If they haven't collected their items, they can (and must) still do the summative assessment, but if it has been set correctly their work will be severely limited by the lack of evidence or illustration from their patchwork items. The final piece has to be designed to build on (rely on) the collected items, so the quality of the overall assessment will depend on the quality of the collection even though the collection was not in itself assessed.

**Q: What if a student does excellent work on the (formative) patchwork items but does a poor job on the summative write-up: do they get credit for the component items?**

A: The assessment is based entirely on the summative item. This will include reference to the patchwork components as examples, illustrations or evidence, but the mark is assigned for the summative piece, not the patchwork parts. Theoretically, a student could do good work creating their component items but then get a poor result if they do not use them effectively in the actual assessment.

**Q: Do the students present the patchwork items within the final report?**

A: This will depend on the exact nature of the final report that you have set. It could be set up so that the patchwork items are "behind the scenes", or so that they have to be incorporated in some way within the report, or as an appendix. If students are to be asked to submit their collection there is a danger that the exercise reverts to the level of a portfolio. Alternatively, they could just insert items (or parts of items) from their portfolio as bits of evidence or examples for things they are doing in the summative assessment. The tutor does not need to read and mark all the collected items... the final report should be free-standing (albeit with those references back to patchwork items or activities).

**Q: So what is the final report... is it "about" the patchwork items?**

A: This is up to the tutor to decide and will depend on the nature of the module. A simple approach would be to have students write a final report that basically describes their patchwork collection, but I don't think this really makes much of a step up from basic portfolio-plus-reflection. A more sophisticated approach could be, say, to have students complete a new task or solve a problem using their patchwork items. They could build from their patchwork to develop a new textbook outline, or create a public-facing or industry-facing document about the module, the topic, or their experience... Or based on a patchwork of local case studies a student might compile a national-scale proposal. It is really up to the imagination of the module designer to find

activities or missions that will enable students to create something new and freestanding that somehow draws on their experience of assembling the patchwork and somehow uses their patchwork items towards some greater outcome. In some contexts, there could be a specific “question” for students to write in response to: “Making specific reference to items from your patchwork and/or to the patchwork as a whole, demonstrate how x, y, z, and propose how A and B in the next ten years.” This is for individual tutors to decide in their own module contexts, and provides a huge amount of flexibility.

**Q: Do you announce the final assessment up front, or at the end?**

A: Again, either way could work depending on how you organise the module. If you want students to knowingly build a patchwork for a particular purpose, and if you want them to make decisions for themselves about what to collect en-route, then giving them the final assessment “question” at the very start of the module would make sense. On the other hand if you set the exact components of the patchwork yourself (for example as a basic year-long workbook of exercises) then it might make sense to reveal the exact assignment at the end, a bit more like an unseen exam. At the moment I think that announcing everything up front gives the students a greater degree of responsibility and autonomy.

**Q: How does the student know what to do and when to do it... is there a roadmap?**

A: Some modules might build the patchwork creation into a weekly “task list”, basically telling students what to do and when to do it. (e.g. Week 1: complete Online exercise 1, read reference items 1 & 2, and write a 200-word reflection on your existing knowledge...). Other modules could leave it much more to students to decide what to do when, but in that case very clear suggestions, examples, etc. would be needed. Certainly, for students who have not done this before, I think that really very clear guidance will be necessary, even if the guidance is based on sets of choices. For example, there might be pathways leading towards different optional final assessments, so students collect items relevant to their particular target. In my own context, I can imagine having suggestions such as “At this point in the course for your patchwork collection *either* identify the most intensively researched examples of a soft-bed and a rigid-bed surging glacier (if you are working towards patchwork-text assessment option A) *or* identify a research programme that has used numerical modelling to simulate surge behaviour (if you are working towards patchwork-text assessment B)”.

**Q: What’s the advantage of this over a more traditional assessment?**

A: There are several advantages: for example – inclusivity and motivation to engage. Students may be better motivated to engage with their module throughout, as they can collect, create and compile their patchwork components based on activities week by week as the module progresses. Also, it is usually up to the student to identify the pivotal moments in learning that they want to include as patches in their collection. It will be hard for students to leave everything till the end and rely on last-minute revision as they might do for an exam, as opportunities such as group activities, lecture-connected exercises, etc. roll by throughout the course. Another advantage (especially if the module offers lots of choice or flexibility in what a student can include in their patchwork) is inclusivity, as students will have a variety of different activities underpinning the assessment, and should have the opportunity to select what items to work on or what media, methods or platforms to use. Patchworks promote assessment *for* learning rather than just assessment *of* learning, and encourage the use of student-centred teaching methods.

**Q: And what are the disadvantages?**

A: Having just embarked on introducing this type of assessment into my own modules I would say the initial disadvantage is the set-up cost in the tutor’s time. It would be very quick and easy to replace a traditional exam with, say, a take-home exam or yet another essay, whereas inserting a Patchwork Assessment into an existing module feels a bit like taking the sugar out of a hot cup of tea, or threading the veins into a raspberry ripple ice cream. Patchwork Assessment doesn’t feel like a bolt-on; it is something that needs to be integrated into the fabric of a module in a fairly complex way. Students will require a significant amount of direction at the start of the module to understand the importance on continuous engagement and the value of developing

and assembling worthwhile patches that will eventually stitch together as a component of the final assessment. This will involve a more substantial fraction of the module's total hours than would be needed to explain a simple essay-plus-exam assessment structure.

The HEA practice guide (Jones-Devitt *et al.*, 2016) identifies one particular issue that is worth thinking about at the outset: resistance! Both students and colleagues may find this novel and initially disconcerting, and may need to unlearn some of their preconceptions about how learning and assessment are aligned.

**Q: Your introduction said Patchworks could help with “generative learning”. What’s that?**

A: Generative learning is a term often used alongside “active learning” to differentiate between “passive” learning activities such as listening or reading that involve memorisation for inserting knowledge into the brain, and activities such as organising, applying, summarising or re-teaching that involve learners using the material that they are trying to learn, which leads to a deeper level of learning and retention (e.g. Fiorella and Mayer, 2015). In our context, that might be achieved by setting patchwork activities that include these types of activity and will lead students away from over-reliance on time sitting in front of a lecturer or reading pages of text over and over again. Inviting students to summarise and re-teach something from their reading would be an example of a generative learning activity. Enser (2020) provides a short discussion of the value of summaries (summarising a lecture, summarising set readings) as a way of engaging students with generative learning. Patchwork Assessments can give tutors good opportunities to embed these sorts of activities in a distributed manner throughout the module, also enabling the implementation of strategies such as spacing, interleaving and dual coding in such a way that students do those things as part of their own generative learning rather than simply “receiving” them from the tutor standing and delivering.

**What did students think of the patchworks?**

Both of the modules that our patchworks were developed for are broad in nature, covering a variety of topics and introducing students to an array of experiences and examples. We introduced the patchworks early in the courses, explaining to the students that these assessments were probably nothing like assessments they had worked on before. The broad idea of the assessment was outlined, along with some suggestions of the themes the students might want to focus on for their patches. Students were provided with a document outlining what Patchwork Assessment is, and how it works. In the second year of deployment exemplars were also provided. Students were encouraged to be creative and to attempt making their patches, or the final patchwork, in a medium (poster, essay, report, Sway, website etc.) they had previously experienced but would like to experience, with support and feedback opportunities across the module.

We deployed a questionnaire to the cohorts that had a Patchwork Assessment. The questionnaire was a mix of open text and Likert style questions. From the first cohorts (20/21 year), 16 students out of a total of 90, completed the survey. Only 4 students out of 64 responded from the second cohort (21/22 year). We attribute the low response rate to survey fatigue; with low response rates being observed for other surveys released at a similar time (e.g. de Koning *et al.*, 2021). Of the 16 students in the first cohort, 7 experienced patchworks in ESC-10039 (Fundamentals of Physical Geography), 1 student was from ESC-10045 (Introductory Geology for the Environmental Sciences) and 8 students sat both modules (therefore completing two patchworks). For the second cohort, 2 students were from ESC-10045 and 2 had attended both modules.

Table 1 shows the themes and specific questions that we asked the students. Our first question asked students to describe the assessment in their own words and outline how they approached patches. We asked this to gauge how well the concept of the assessment had been communicated/understood, and to identify if students developed a different understanding of the concept through the act of completing the assessment. Every response highlighted as a central idea the collection, creation or curation of patches throughout the module based on a guiding theme. Further comments included that the patches informed a final piece of work: several responses highlighted essays or reports as the final product, but several highlighted the flexibility

and opportunity offered. One student referred to “...an assessment that can take on any form that the student wishes, therefore allowing complete flexibility with both the structure of the assessment and any associated patches.” Pleasingly there were no responses which conflated the assessment with a portfolio - indeed several responses highlighted that the patches were to be used as evidence or that patches can be considered information. Some of the responses also highlighted the student-owned and student-driven aspect of Patchwork Assessments. Our respondents reported that they had made videos, taken photos, used digital mapping platforms, made diagrams and notes, reviewed films, annotated academic literature, and completed a wide range of other activities to make their patches. Several responses highlighted that the students had made a variety of different types of patches through the module, making for highly variegated patchworks, whilst others reported that they had stuck to the same medium throughout the different patches, contributing a less varied range of patches into the patchwork. One response commented that the breadth of choice that was available to them had left them wondering if what they had done for each week was “...right...”.

In relation to how students thought of the assessment in comparison to other assessment types we asked them about the advantages and disadvantages of Patchwork Assessments (Table 1). We should point out that these students undertook much of their A-levels (or equivalent) in lockdown conditions, therefore their experience of some assessment types might be different from other cohorts. Respondents highlighted creativity, freedom, and engagement as the advantages of the assessment in comparison to more ‘traditional’ assessment types. The ability to focus on material that might normally be considered to be “...going down a rabbit hole...” was seen as a fun and enjoyable aspect of the assessment and promoted engagement with a wider set of materials. The assessment was also praised for being across the whole module, rather than just focusing on one topic, as this cross-module breadth was seen as scaffolding different aspects of the modules to one another. The most common disadvantage that students reported was the uncertainty around the assessment, and whether a patch that was created early in the module would still be relevant by the time the final patchwork was made. One respondent commented “Flexibility can make students feel “lost””. This was an anticipated aspect of patchwork, and formative feedback of patches was offered to help alleviate this. A lack of inspiration for patches relating to a particular theme for topics that didn’t obviously fit was also given as a cause for confusion. Several responses highlighted that collecting or making patches was more time consuming than doing the wider reading that might normally be associated with a module. These responses appear to hint that the assessment was a worry /confusing to some respondents whilst they were undertaking it, but that once they had completed it they could appreciate how it might have been an opportunity to be creative and offered freedom to explore around topics. Only a single response indicated that the student didn’t enjoy this assessment. Several indicated that whilst starting the assessment was difficult it became more enjoyable. One response highlighted how enjoyable it was to create the final patchwork using the patches collected along the way, and how they had a moment of realisation of the work completed and how their subject understanding had progressed.

In response to how the assessment could be improved (Table 1) many students from the first cohort to complete the task (students from the 20/21 cohort) commented that examples or exemplars would have been useful – the students had access to the marking criteria (in lots of detail) and instructions on what to do, but not necessarily how to do it. For the second cohort exemplars were available, and their responses reflect this, with less emphasis on examples being available, but with some suggestions that informal online workshops could be set-up to help out with patch creation early in the module.

Open text response question themes	Question wording
What are patchworks and how did you approach it?	Can you describe, in your own words, what a Patchwork Assessment is and how it is completed?
	How did you collect your "patches"?

Positives and negatives of completing the assessment	If you compare Patchwork Assessments to a more traditional report or essay, what would you say are the main advantages?
	Conversely, if you compare Patchwork Assessments to a more traditional report or essay, what would you say are the main disadvantages?
	Did you enjoy completing this assessment?
Further developing the assessment	How could this assessment type be improved for future students?

Table 1. A summary of the open text response questions used in the survey deployed for this study. The questions are grouped under broad themes.

Students were also asked to answer questions on a Likert scale, these questions, and the responses can be seen in Figure 1. The results here suggest that participants felt the assessment helped structure the course, gave flexibility in learning, and was engaging. These students also felt that the assessment was time consuming, not easy to complete or understand what was being asked of them. These latter points are most likely linked to the final question asked, where nearly all participants agreed (or strongly agreed) that the assessment was different to assessments they had experienced previously. The second cohort gave more positive feedback, suggesting some of the issues associated with the first year of embedding the assessments had been resolved. These students found the assessment easy to complete, but still found it hard to understand.



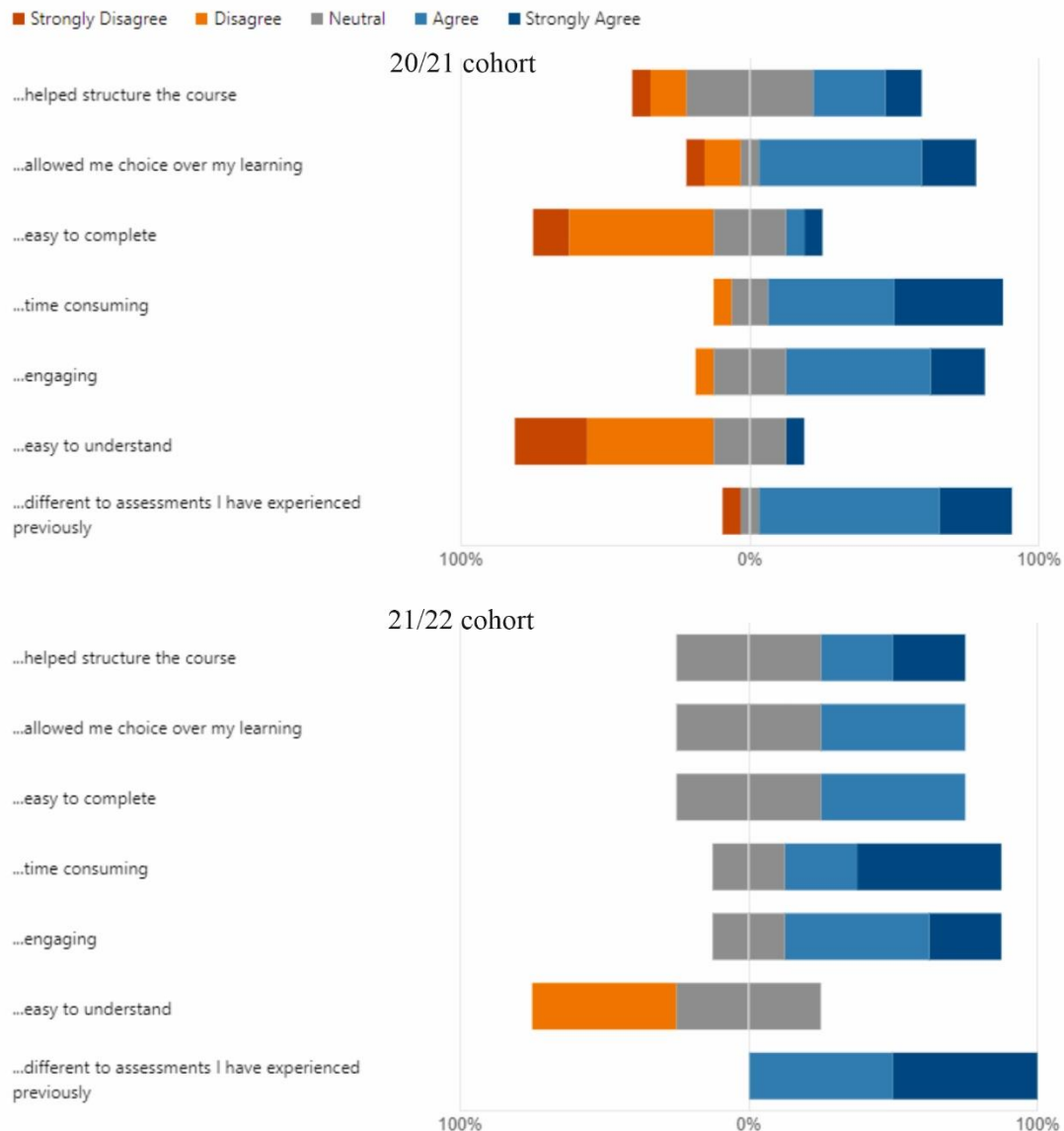


Figure 1. Likert scales associated with responses given to a range of questions. The top set relates to the responses of the 20/21 cohort, the bottom set is from the 21/22 cohort.

**What did staff think of the patchworks?**

This form of assessment was new to staff, as well as to students. We were learning as we went. There was no “sample work” from previous years to help us predict student performance or to use as a basis for giving students example of previous patchworks. In the first year, we had never seen what students might produce, so we had to use our imagination when setting our own expectations of how the work would proceed.

**For us, advantages...**

- Additional option in our armoury of assessments, avoiding some constraints and accessibility/inclusion problems posed by other types e.g. exams.
- Engages student's week-by-week through the module, building up their collection rather than just revising for a last-minute essay or exam. This experience of continuous learning matches the experience of previous authors including Trevelyan and Wilson (2012).

- Assessment as part of the learning process, driving and steering their research through the module, not just testing what they remember at the end.
- Includes assessment flexibility, promoting inclusivity by nature; students can play to their strengths whilst experimenting with new concepts, topics, designs, and processes.
- Patches and themes that students choose to work with can open up dialog and discussions, allow the course staff to suggest materials individual student might find engaging, and allow module sessions to be tailored to a certain extent (e.g. introducing different case studies).
- Excellent submissions (with a student's permission) can potentially become material for future years.

#### **And the Disadvantages...**

- Set-up time, as it was all new. Also marking time, as this was first experience. But those are short-term problems only.
- Introducing students to this assessment type will always take more explanation/resources than a 'standard' report or exam – though this is not necessarily a disadvantage. Allowing students flexibility/autonomy when prior/current experience forbids this, can be difficult for some students.
- Students who do not engage with the assessment throughout the module can end up with a large workload at the end.

#### **What would we change for the future?...**

- Need to map the assessment against course-long assessment strategy
- Develop induction resources to increase confidence of (some) students, but without providing too strict a template that would limit the freedom of expression of other students. The flexibility is really important, but for some students the lack of certainty in how we “direct them” to complete their patches can, especially at 1<sup>st</sup> year, be challenging. Would patchworks actually work best at higher levels rather than 1<sup>st</sup> year? Perhaps we should develop a base-level Patchwork Assessment for 1<sup>st</sup> year, then develop a more sophisticated version for final year?

#### **Recommendations/conclusions**

Our ultimate recommendation is simple –Patchwork Assessments can work well in Natural Science curricula; give them a go! The modules we have embedded patchworks into are both broad and foundational in nature, which likely fits well with the assessment type, there will undoubtedly be other modules that it wouldn't work as well for. Don't underestimate how nervous many students will be about the freedom they have, and don't underestimate the amount of induction time/resources you might need to put in to help students get started – but once they are underway students enjoy the breadth of the content, process, and methods they can collect/curate/undertake. In the current climate of speculation about the use of Generative AI to complete some assessment types, Patchwork Assessments may prove to be, at least partially, “safe” from being generated remotely. Indeed, students might even be encouraged to use Generative AI to produce some of their patches. For example, they might use AI to produce a piece of material and then conduct their own review and assessment of the strengths and weaknesses of the AI product. Therefore, Patchwork Assessments might offer an opportunity to embed some Generative AI literacy within courses.

Overall, both we and our students have found this to be a sometimes challenging but always exciting experiment in assessment design. We recommend the approach, but recognise that we still have a lot of work to do in fine tuning and embedding this mode of assessment effectively in our programmes.

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