

## Reflective Writing in a Third-year Biology Capstone Module: Student Perceptions and Considerations for Teaching and Employability

Camilla Laurén-Määttä\*, Department of Biosciences, Durham University, UK,  
[camilla.maatta@durham.ac.uk](mailto:camilla.maatta@durham.ac.uk)

Jen Gutridge, Science Faculty, Durham University, UK, [jennifer.gutridge@durham.ac.uk](mailto:jennifer.gutridge@durham.ac.uk)

**Abstract** Reflective writing is widely used in teacher training and other vocational programmes but has not been widely practised in STEM subjects. Biosciences undergraduates studying a module that included a short placement in a primary or secondary school were asked to use an online digital learning system for their reflective journal. The reflective journal provides a reference source for their assessed academic writing, the 'Executive summary', where students are asked to review their experiences in the context of pedagogical theory. In their journal, students reflect on both their learning experiences and personal development, including self-assessing their progress and development in both school-specific and transferable employability skills. Students were asked questions about their experience of writing the journal and we summarised their self-assessed skills levels at different points of the module. The aims were to find out what they thought about the reflective writing process, to pilot a digital template for the journal, and to review the development of transferable skills. Based on the results presented, we argue that reflective writing and portfolios could be used more widely in Biosciences undergraduate taught programmes to promote deeper learning, increased self-awareness and improved employability skills.

\* Corresponding Author  
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**Keywords:** Reflective writing, Reflective practice, Journal, Biology, Digital learning system, Employability skills, School placement

## Introduction

Dewey (1910, p. 6) first defined reflective thought as 'active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends'. Later, Rogers (2001) summarised reflection as a cognitive and affective process that requires active engagement, is triggered by an unusual experience, involves examining own beliefs, and leads to an integrated new understanding. Others have defined the reflective process in numerous ways. Across these definitions, common themes include enquiry and willingness to engage when faced with uncertainty (Marshall et al., 2021). Verbal or written reflections can develop learning and understanding in students or practitioners engaging in reflective practice (Marshall et al., 2021).

Reflective writing in higher education is commonly practised within vocational study programmes, including education, human health, veterinary medicine, and social care (Altalhab et al., 2021; Duret et al., 2022; Rajhans et al., 2021; Vinjamuri et al., 2017). Student teachers are often asked to write reflectively with the aim of integrating theory and practice (Halim et al., 2011; Loughran, 2002). Reflective writing has also been used to evaluate the development of wider employability skills, such as interpersonal communication and teamwork (Cathro et al., 2017).

Students studying STEM (Science, Technology, Engineering, and Mathematics) subjects, including biological sciences, are rarely asked to write reflectively. Instead, they are often taught to keep an objective approach to their topic and to structure their writing in a formal manner. There are, however, examples where reflective writing has been used effectively to help biology undergraduate students understand concepts in genetics (Tammu, 2024), assess teamwork (Mayne, 2012), or evaluate learning

placements (Halpin et al., 2020). Historically, writing reflectively has been an important tool, as both Darwin and Wallace made use of diaries to reflect on data and theory (Blair & Deacon, 2015).

Kolb (1984) introduced an experiential learning cycle, with the steps of concrete experience, reflective observation, abstract conceptualisation, and active experimentation. Gibbs (1988) adapted Kolb's model, proposing a reflective cycle as a practical method to approach reflection. Gibbs' model begins by describing an experience that evokes feelings, which are analysed and evaluated, followed by conclusions and an action plan. Writing reflectively can help students review what they have learned and to place everyday observations into a framework of more abstract concepts, using these cycles as a guide. Writing reflectively can also aid personal growth and development and enhance employability skills (Mayne, 2012). Possible frustrations, for both students and educators, could be the additional workload and lack of motivation if students cannot see the benefits of developing their reflective practice.

Reflective writing is part of the assessment of the third-year 'capstone' module Biology into Schools. This is a 20-credit optional module that develops students' science communication skills and introduces them to teaching in schools. Full-time UK students usually take 120 credits per academic year with each credit being equivalent to 10 hours of study. Students taking capstone modules are in their final or penultimate year of study and are expected to carry out an independent project with support of module leaders and supervisors. The module structure is similar to other Science into Schools modules taught at Durham University. One of the assessed components is a 2,000-word executive summary covering 3-4 key themes related to teaching and learning, as well as personal development. The executive summary is an example of academic reflective writing that draws on material from a personal reflective journal whilst also referring to relevant theory. Students keep a journal throughout the module during their tutorials and placement. Executive summary themes are selected by students from interesting experiences or issues emerging during their studies or placement. Examples of themes

could be ‘Student-directed learning’, ‘Misconceptions in biology’ and ‘Communication skills’.

**Table 1.** *A simple logic model for the reflective writing activity.*

Inputs	Outputs	Outcomes	
		Short-term	Long-term
Reflective writing training	Journal reflections	Increased self-awareness	Improved employability
Formative peer and tutor review of reflective writing	Self-audits		

In this study we wanted to investigate how reflective practice can be incorporated into STEM teaching and learning, as this is a neglected approach within the discipline. To this end, a cohort of final-year Biosciences students studying a Biology into Schools module were trained in reflective writing practices and asked to complete a reflective journal and self-audits of transferable skills. We then evaluated how the students used and appreciated reflective writing and how they self-assessed their own development of employability skills. The process is summarised as a simple logic model (Table 1). The main aims of the study were to 1) evaluate students’ perceptions of the benefits and hurdles to keeping a reflective journal based on a questionnaire, 2) pilot a digital template for the journal entries, and 3) examine changes in students’ self-audits of transferable skills across the module. Questionnaire comments indicated that most students found the exercise useful, although there were mixed responses about the level of scaffolding needed in the digital journal template. Students graded their skills set higher towards the end of the module compared to the start. The results are discussed in terms of implications for future practice, including whether reflective writing could be used more widely in undergraduate science teaching and learning.

## Methods.

We created an online journal template in PebblePad, a digital portfolio platform for professional and personal development that can be used by students to manage and reflect on their learning experience. Students were asked to make weekly diary entries after each tutorial and during their school placement. They were also asked to complete SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) goals and a Personal Development Plan (PDP) for their placement and to conduct skills-audits at the start, middle and end of the module.

Students' perceptions of reflective writing and their views on using an online tool for this purpose were investigated through a questionnaire in Microsoft Forms (Appendix A). Approval for the study was gained from the Department of Biosciences Ethics committee prior to the study. Ethical procedures were followed, including keeping questionnaire data anonymous. Students were informed about the purposes of the project and provided with a detailed university privacy notice and consent form, which explained how data would be used and about their rights to withdraw and express concerns. Students were asked to confirm that they had read the documents and that they consented to data being used for educational research. An invitation to undertake the survey was sent by email to minimise coercion. As responses were anonymous, it was also not possible for the authors to trace whether students had participated in the study.

The questionnaire comprised 31 questions and, as part of the study, students had the option to be entered anonymously in a random prize draw. For this purpose, students were asked to submit their departmental anonymous codes. Numbers were ordered from 1-15 and the winner was drawn using a random computer-generated digit. The anonymous code associated with the number was emailed to departmental office staff who contacted the winner without involvement of the authors. Questions were either multiple-choice, multiple answers, likert-scale, or free-text format. We checked the

reliability of likert-scale responses (1-5) by calculating the correlation between similar questions using Cronbach's alpha in SPSS v. 31. The results showed that alpha values were at least 0.7 for similar questions, indicating that responses were consistent to an acceptable level. Written comments were organised by means of data-driven coding (inductive thematic analysis), using any themes that emerged from the answers.

The questionnaire was open to responses from the final week of Term 2 (11/03/24) until the end of the second week of Term 3 (3/05/24). A total of 15 out of 20 students completed the questionnaire. There was only one male student in this module cohort, so to maintain anonymity we did not ask questions related to sex or gender. Students have been referred to by a letter code between A and O where comments are cited.

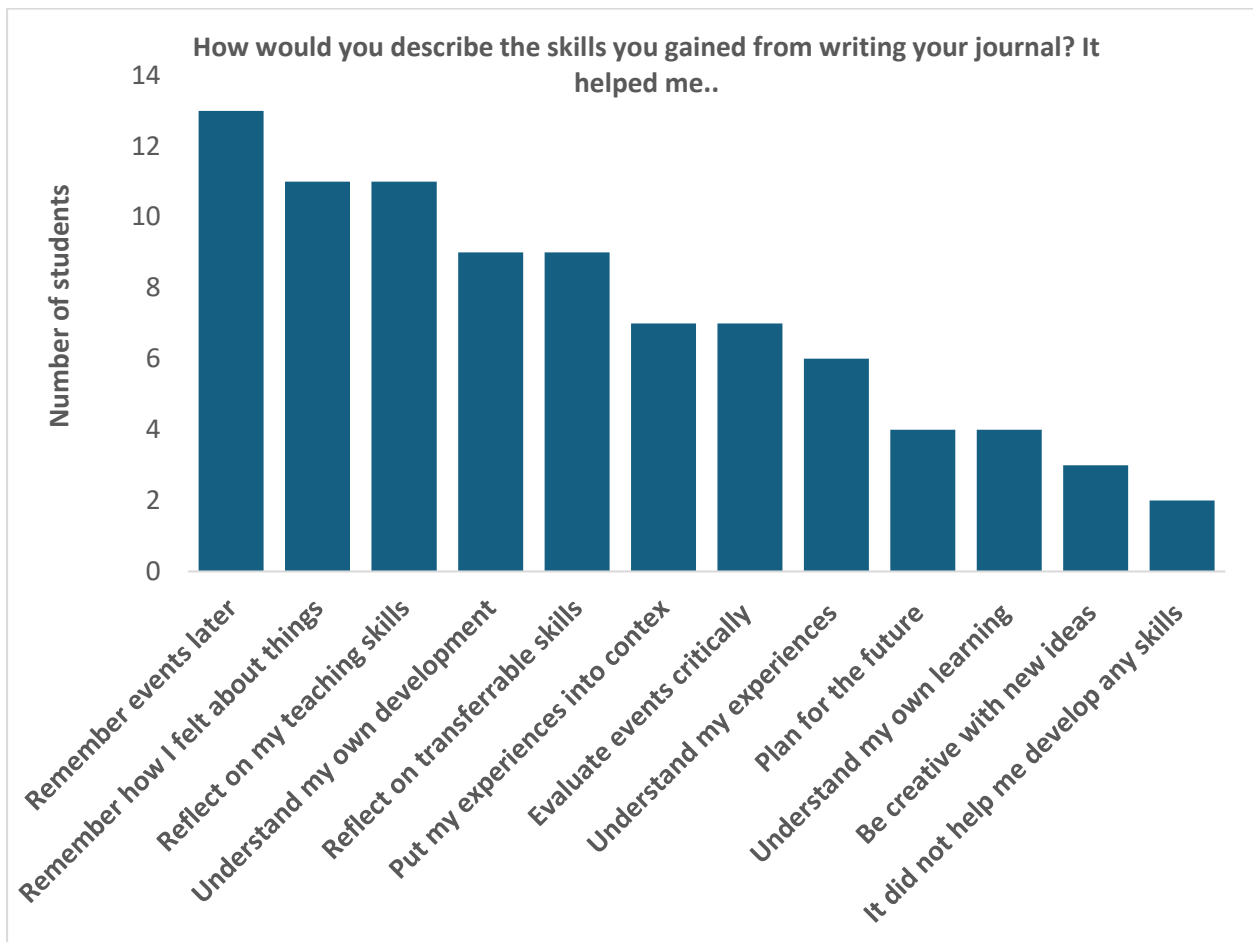
We also collated data from self-audits showing changes in student confidence levels on a scale from 1-9 at three different stages of the module for six different skills (community culture, working practices, IT skills, presentation skills, team building and leadership). Community culture and working practices refer to the school environment. It wasn't possible to anonymise the journals from the authors, as the use of references to reflective journals was assessed as part of the executive summary (see Introduction). Only numerical data from self-audits and no written extracts were used for this study. Partial responses were included, but individual responses were plotted separately on graphs for clarity.

## **Results**

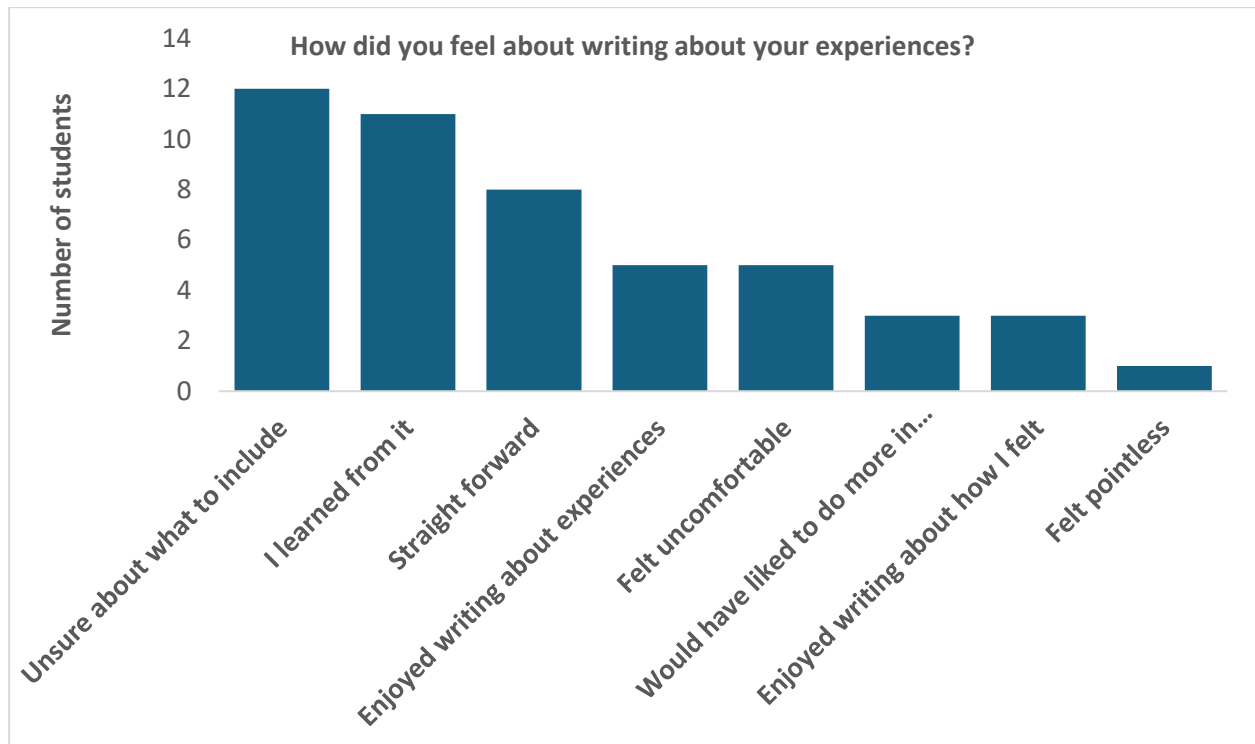
### ***How they felt about writing reflectively***

Students felt that writing the journal helped them remember events later (87 %) and how they felt about them (73 %) (Figure 1). Most students said that it was useful for reflecting on their teaching skills (73 %), own development (60 %), and transferrable skills (60 %). Just under half (47 %) felt that it helped put their experiences into context and evaluate events critically.

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**Figure 1.** Number of students (out of 15) agreeing that they gained each skill described from writing the journal. Students were asked to select all options that applied to them.



**Figure 2.** Number of students (out of 15) stating that they could relate to each description of the writing experience. Students were asked to select all options that applied to them.

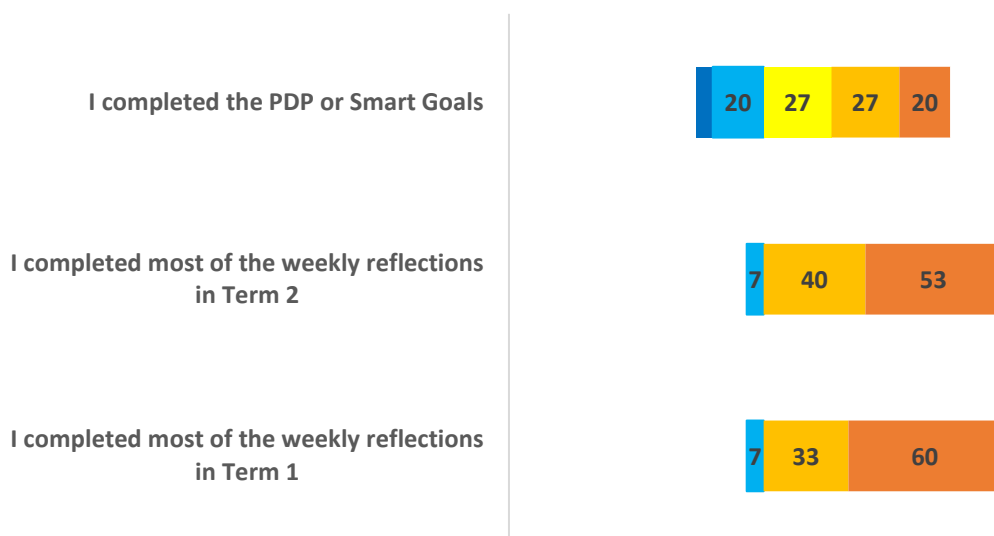
Most students felt unsure about what to include (80 %) but had learned from the reflective writing experience (73 %) (Figure 2). 53 % felt that the writing was straightforward. 33 % said that they enjoyed writing about their experiences and a similar number felt uncomfortable about it. 20 % would have liked to do more in other modules.

Comments on reflective writing were positive overall, but students described some difficulties and acknowledged that this was a new experience (Appendix B, Writing reflectively – overall experience). Student O explained that ‘I found it difficult to know exactly how to write about the experiences, and what to include in order to be able to develop themes from the writing.’ On the other hand, it was useful for the purpose; ‘At the time it was hard to know what to include but it was useful for the executive summary’ (Student A). Student M acknowledged that the experience helped them understand their own progress and think about this more deeply: ‘I felt it quite

overwhelming at points but when it came to writing the assessments I knew how much writing it had benefited my understanding of my own progress. I think overall I am glad that this was part of the module, I don't think I would have thought as deeply about my experiences without it.'

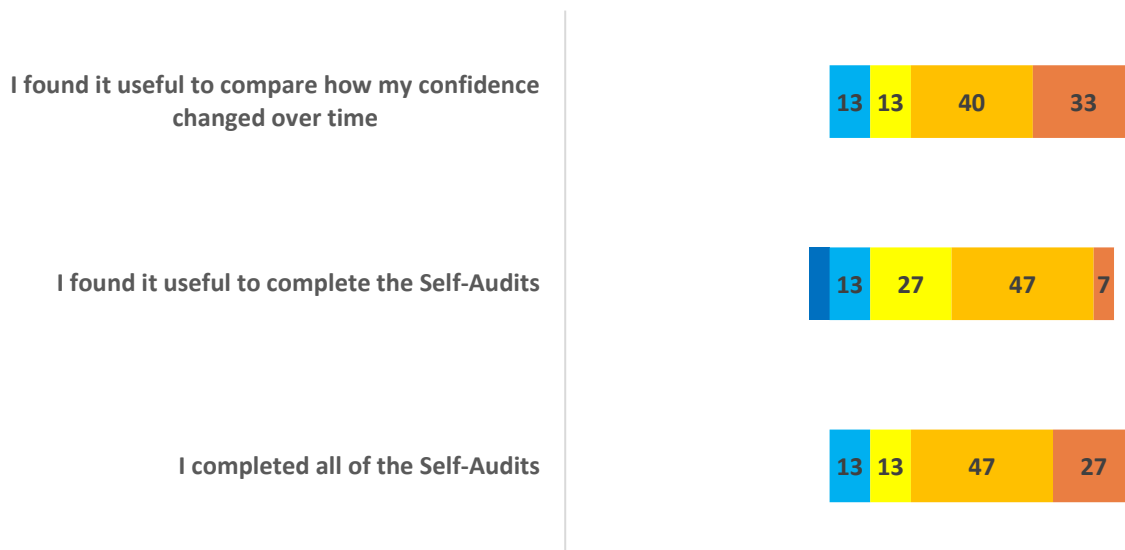
### ***Engagement and self-audits***

Most students completed the majority of the weekly reflections (93 %) and self-audits (74 %) during both terms, but the uptake was poorer for the Personal Development Plan and Smart Goals (47 %) (Figures 3 and 4). Student comments indicated reasons for why they had not completed these, such as lack of time or not feeling that the Smart Goals were necessary (Appendix B, Own engagement with tasks), e.g., 'I didn't feel the Smart Goals were necessary as I knew what I wanted to work on throughout placement from the reflection' (Student D)



**Figure 3.** Student self-assessment, on a likert-scale, about completion of reflections and PDP/Smart Goals. Numbers indicate percentages. Dark blue = strongly disagree,

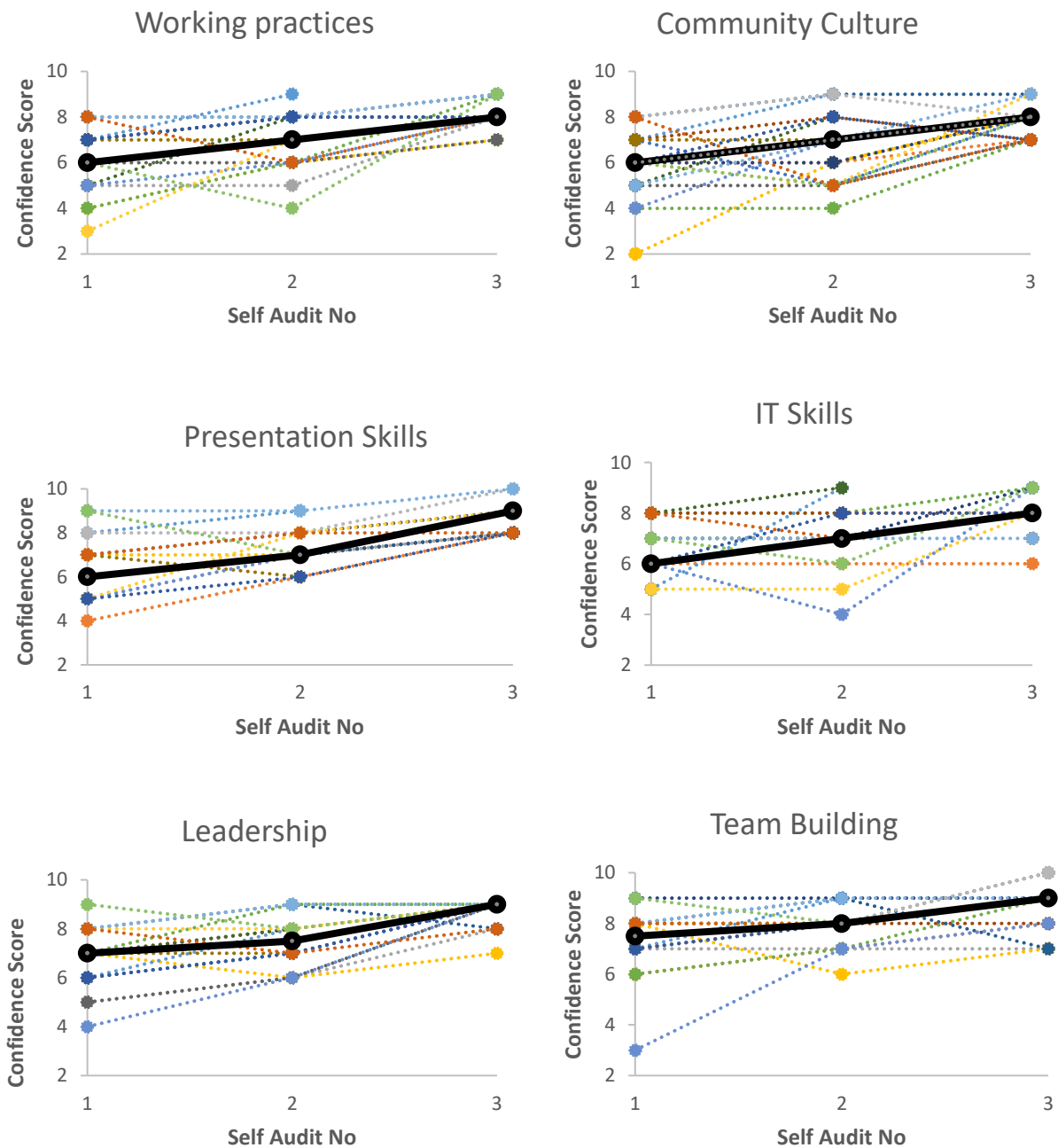
*light blue = disagree, yellow = neither agree nor disagree, light orange = agree, dark orange = strongly agree.*



**Figure 4.** Student self-assessment, on a likert-scale, about completion and usefulness of self-audits. Numbers indicate percentages. Dark blue = strongly disagree, light blue = disagree, yellow = neither agree nor disagree, light orange = agree, dark orange = strongly agree.

Most students completed all self-audits (74 %) and found this useful (54 %) (Figure 4), especially comparing how their confidence changed over time (73 %). Summary data of self-audits indicated that median confidence scores for all skills listed in the journal template from the beginning to the end of the module; from 6 to 8 for community culture, working practices, and IT skills, from 6 to 9 for presentation skills, and from 7 to 9 for team building and leadership (Figure 5).

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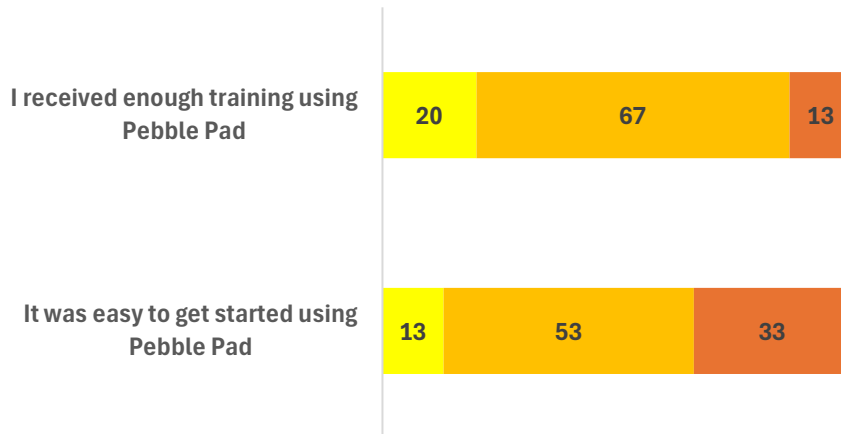


**Figure 5.** Student self-audits showing median (bold line) and individual (dashed line) increase in confidence in key skills over time (1 = beginning of Term1, 2 = end of Term 1, 3 = end of Term 2) for working practices, community culture, presentation and IT skills, leadership and team building.

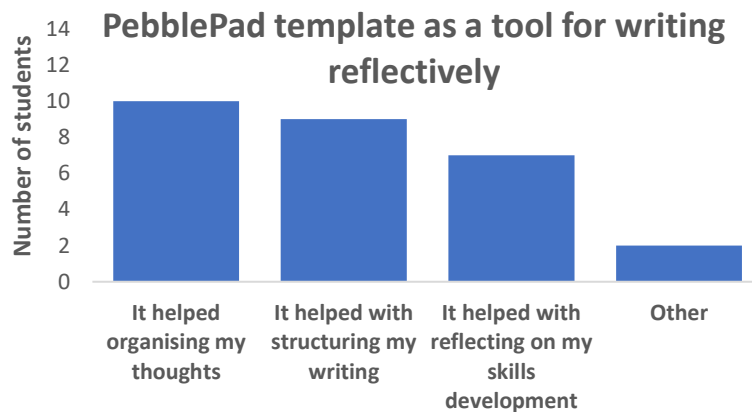
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**How useful was the PebblePad template as an online tool for reflective writing?**

Students felt that PebblePad was easy to use (86 %) and that they had received sufficient training (80 %) (Figure 6). They thought that it was particularly useful for organising their thoughts (67 %) and structuring the writing (60 %) (Figure 7).



**Figure 6.** Student self-assessment, on a likert-scale, about completion and usefulness of self-audits. Numbers indicate percentages. Yellow = neither agree nor disagree, light orange = agree, dark orange = strongly agree.



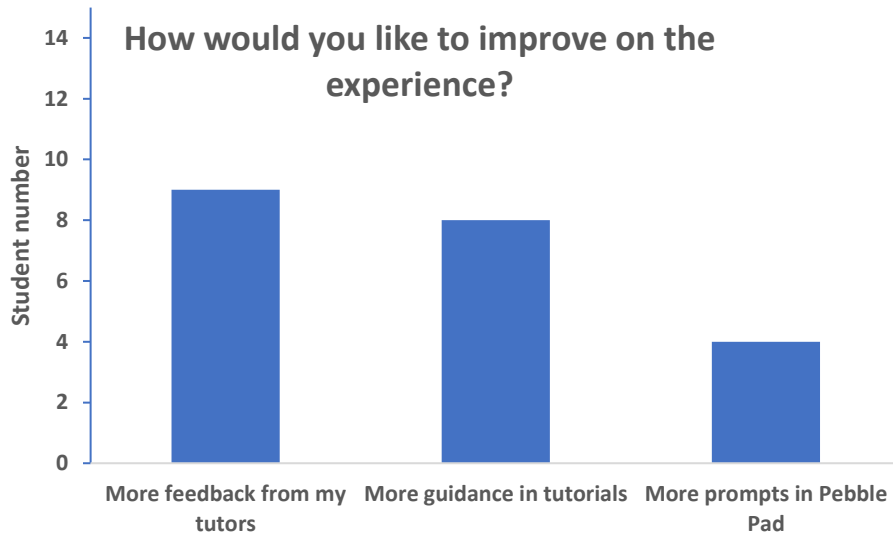
**Figure 7.** How students felt that the template helped them when writing reflectively. Students were asked to select all options that applied to them from a list.

There was no strong preference for either PebblePad or Word as a reflective software, with 67 % stating that they would like to use PebblePad and 60 % selecting Word. Most students (87 %) said that they had uploaded additional supporting material onto PebblePad.

Comments indicated some mixed feelings about the online template with a few people expressing a preference for an offline template (Appendix B, Using the PebblePad template for reflective writing), although most of the comments were positive, *e.g.*, Student C said 'I liked having it on PebblePad. I think it was good to have something external to record my experiences on as otherwise I may not have kept up with it.' Student L was more ambivalent; 'It was okay, it's likely more functional than Word due to the organisation but having more features such as the highlight tool would have been helpful'. Other comments indicated that students wanted more examples of writing.

### ***Suggestions for improvement***

When asked how they would like to improve on the experience of writing a journal, 60 % wanted more feedback and 53 % would have liked more guidance on what to include (Figure 8).



**Figure 8.** How students would like to improve on the reflective writing experience.

Students were asked to select all options that applied to them from a list.

Comments on improvements often related to the use of prompts, with students having very mixed views of them (Appendix B; Use of prompts in journal);

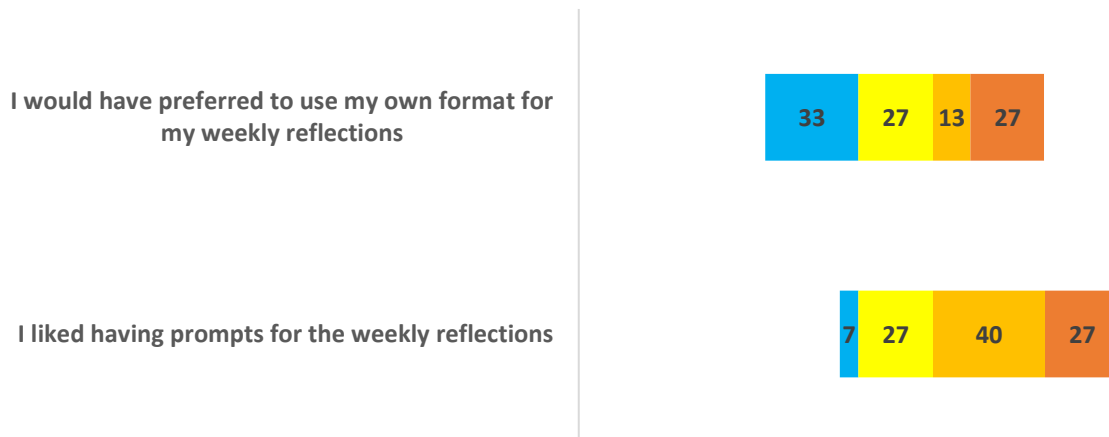
'I think the prompts were appropriate but sometimes a little too vague for me to know which box I should write certain thoughts in' (Student M)

'Less prompts and more flexibility in reflections' (Student I)

'I think it was good to have the prompts, but often I didn't write something for all of them if I didn't feel they were relevant to that week. Sometimes it was just easier to write all of my thoughts in one paragraph in one box rather than breaking them down.' (Student D)

'I think I would have liked the opportunity to personalise my questions more. For example, having an extra section at the bottom.' (Student C)

When asked more specifically, 67 % of students still liked to have prompts, 27 % were neutral and only 7 % disagreed. Students were rather divided about whether they would have preferred to use their own format; 40 % agreed, 27 % were neutral and 33 % disagreed (Figure 9).

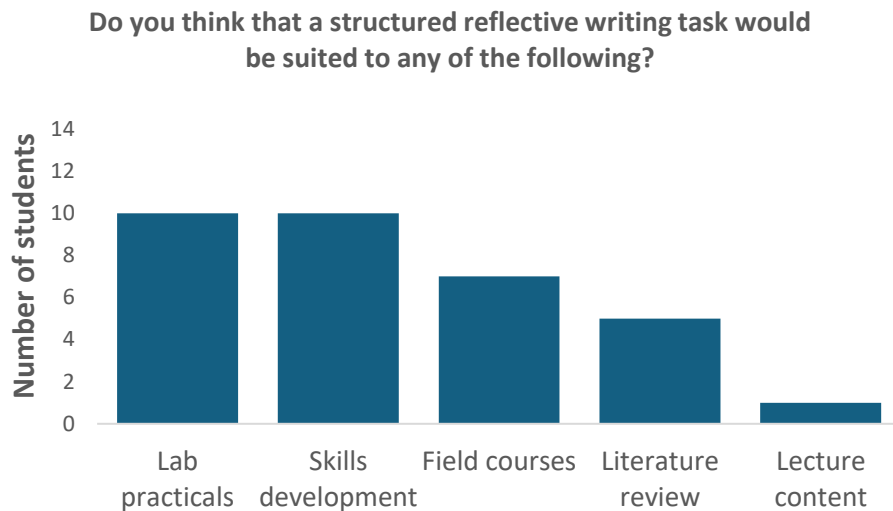


**Figure 9.** How students felt about having prompts in the online reflective journal template. Answers were given on a likert-scale. Numbers indicate percentages. Light blue = disagree, yellow = neither agree nor disagree, light orange = agree, dark orange = strongly agree.

When asked more generally about what they would change or what functionality they would add to the journal writing, some suggested improvements such as reverting to the old system, receiving reminder emails, getting comments from lecturers and having a highlighter function (Appendix B; Other suggestions for improvement).

### ***Applying reflective writing to other types of learning***

67 % of students thought that reflective writing would be suitable for laboratory practical work and skills development, whereas 47 % felt that it would be suitable for field courses (Figure 10).



**Figure 10.** *Number of students (out of 15) stating that they thought reflective writing would be suited to the skill listed. Students were asked to select all options that applied to them.*

### **Discussion and Conclusions.**

The questionnaire and self-audits indicated that our STEM students benefitted from the reflective practice and that incorporating more of this into the degree programme would help develop self-awareness and ultimately employability. Most students acknowledged the benefits of reflective writing for the purpose of remembering events (87 %) and how they felt about them (73 %). The majority recognised that writing reflectively made them understand their own development and reflect on transferable skills (60 %). Although they felt unsure about what to include (80 %) they did feel that they learned from the experience (73 %). Most students felt that reflective writing would be suitable to practical work and skills development (67 %). Overall, students also acknowledged the benefit of using an online digital tool for organising their thoughts and structuring their writing.

The purpose of reflective writing can be to help students revise and understand a specific topic in more depth (Tammu, 2024), it can be used as an assessment tool

(Ezezika & Johnston, 2022), or to give feedback on teaching practice or placement experiences (Ahmed, 2019; Findlay et al., 2010; Pack, 2014; Vinjamuri et al., 2017). The goal is often to improve students' reflective skills and self-awareness. Our students' academic reflective writing integrated their personal journal reflections with additional reading and was an essential part of the module assessment. However, we also wanted students to develop self-awareness and critical thinking; attributes that can enhance employability. Employers frequently highlight that in addition to well-articulated evidence relating to the necessary skills and attributes for a role, some additional self-reflection can really put candidates at an advantage, as this demonstrates introspection and self-awareness (Peter Fox, Durham University Careers Adviser, personal communication).

Training students to write reflectively is crucial (Halpin et al., 2020; Hume, 2009; Trimasse, 2025), especially for STEM students who are trained to write concisely and objectively. Analysing the structure of example text passages or own writing and guiding students to use language appropriate for the purpose can be the key to improving on reflections (Ryan, 2011). Our students received training in academic reflective writing from Professor Steve Kirk and his colleagues at the Durham Centre for Academic Development. During this training, students were introduced to reflective practice and to the concept of writing as a process of making connections, referred to as "waving", between three levels: (1) experience, (2) interpretation/generalisation, and (3) theory/hypothesis. This approach develops the concept of semantic gravity waves from Legitimation Code Theory or LCT (Maton, 2014) for a pedagogic context (Kirk, 2017, 2024). In the session, students were shown examples of reflective writing and were asked to analyse the texts for these different levels of understanding. Students also peer-reviewed formative executive summaries and received feedback from staff on their formative work. Many students would still have liked further guidance on the style and type of journal entries to include. We addressed this the following year by inviting students to ask for feedback on the journal itself. We also included further training in reflective writing at the beginning of the module.

Reflective practice requires a willingness and open-mindedness of the learner which only is possible when they make a conscious decision to be reflective and mindful. There is an element of challenge and movement beyond the comfort zone when it comes to writing reflectively that needs to be overcome (Rogers, 2001). Several students approached the task somewhat reluctantly and admitted to feeling uncomfortable about it, although questionnaire comments indicated that they had gained from the experience, and most could see the value of it afterwards. More specifically, some students felt unhappy about sharing their personal thoughts; this feeling was also expressed by some veterinary students (Duret et al., 2022). We addressed this by highlighting that we only would be reading their final journal in detail and by making sure that only key module staff had access to their writing.

We made use of guiding questions for the journal template, which some students felt was helpful and others perceived as restrictive. To address this, we have now included guiding questions for the first two tutorial weeks only and then move onto a more freeform template from the third tutorial week and for all placement weeks. Most studies have made use of detailed guiding questions asking students to describe the event, feelings, reactions, learning and future action (Ahmed, 2019; Mayne, 2012). Findlay et al. (2010) used a freeform journal to provide confidential feedback from clinical placement students, although they found that the freeform approach resulted in more descriptive entries with fewer personal reflections. While we now mostly use freeform entries, we have included guidance and examples of what to include, to encourage more personal reflective writing.

Reflective journals are usually Word documents although online journals have been used for example in social fieldwork (Pack, 2014). Using an online personal learning system made the reflective writing process easier to manage for both staff and students, as students could refer directly to their online journal when drawing on reflections in the assessed Executive summary. We could also monitor whether students had completed their journal entries and prompt them when necessary. Comparing self-audits across the module meant that students and staff could evaluate how student confidence in a range

of employability skills developed over time. The journal can also be used as an e-portfolio after graduation.

Students reported an increase in confidence throughout the module, not only in placement-specific skills such as (school) working practices and community culture, but also in other more generic skills such as presentation and IT skills, teamworking and leadership. Transferable employability skills are needed alongside subject-specific knowledge and skills for biosciences students to be competitive in a rapidly evolving job market (Mayne, 2012). The benefits of writing reflectively can extend not only to academic studies but also to future professional practice. Students will develop transferable skills such as resilience and problem solving, which are key skills in a range of careers. Our students produced academic reflections on a few themes of their choice. Students were free to select a theme, and they often selected employability skills, such as teamwork, resilience, and communication. Having reflected on these as part of the assessment will give them an advantage when applying for future studies and employment. Students' online rating of their confidence in a range of employability skills at different points of the course can further increase their own, educators' and employers' understanding of specific skills gained during their studies.

The overall goal of the activity was to develop self-awareness, maturity, and critical thinking, and to prepare students for their personal and professional life after university. The written comments indicated that this goal was achieved for students that had engaged in the activity. Although students felt that writing reflectively could be uncomfortable at times, writing reflectively made them think more deeply about their experiences, and for some this was a habit they wanted to continue. Most students were open to using reflective writing for other purposes, such as practical classes and skills development.

The study was based on self-assessment by students both in terms of answers to the questionnaire and the self-audits. This means that the results should be interpreted with some caution due to potential self-report bias. Both authors did have access to the

journals as they were a key part of the summative assessment, but the content of the journals were not used in this study. The survey timing was before the grading, as it would have been difficult to get a response from final year students after the end of the academic year. The main concern would be that students might exaggerate their skills development in their self-audits. However, they were not graded based on this aspect, only on the reflective qualities of their writing. It is also possible that students had limited insight into their own learning processes; the answers did indicate a range in maturity and struggles with making sense of the task. This was interesting, and the detailed written answers to the questionnaire highlighted the range in responses.

The limited sample size meant that we could not carry out equity-related analysis such as comparisons between students of different sex and gender. The response rate (15/20) was good for the cohort size, but it is likely that students not responding were either neutral or not very engaged with the reflective writing process. It would be interesting to do comparisons of reflective writing across departments and institutions, although care would be needed to mitigate for differences between module teaching and institutional practices.

The rise of Artificial Intelligence means that novel teaching and assessment approaches are needed in higher education; using reflective writing in a wider range of contexts could be one solution. When writing reflectively about their experiences, students practise higher order cognitive skills rather than merely reproducing what they have been taught. Cognitive challenge and evaluative judgement are integral parts of authentic assessment (Villarroel et al., 2020) and reflective writing therefore has the potential to contribute to a more genuine approach to assessment. AI can be used for critical and creative prompting (Miserandino, 2025), and engaging AI in a discussion about learning experiences could be a useful tool to help students think more deeply about their experiences.

Higher Education institutions are only starting to address the challenges that AI poses to science teaching and learning. Apart from the Biology into Schools module, the Biosciences Department at Durham University also incorporates assessed reflective writing as part of the Masters in Biology programme. We are not aware of many other

recent attempts to use reflective practice in lab-based subjects, but University of Portsmouth reported a trial where second year Biology students practised reflective writing as part of their assessment (Williams et al., 2025). Although this study is set within a UK context, reflective writing is relevant to higher education on an international level. A recent review summarising scholarship studies from across the world, where reflective writing was part of summative assessment in higher education, did include studies within more applied STEM disciplines such as Medicine, Nursing, and Pharmacy, but did not list lab-based or theoretical disciplines within Biology, Chemistry, Physics, or Earth Sciences (Ross et al., 2024). Including further reflective writing would be beneficial to foster critical thinking, although practices may need to be sensitive to cultural and educational traditions as well as professional expectations regarding reflection.

In our study, all students were highly proficient in written and spoken English, as they were selected for the module through interviews and were expected to teach smaller groups of students during a school placement. Other cohorts of students may need multilingual support such as translation tools or glossaries. Reliable internet access can also be an issue when using digital platforms for online journals. Because internet access was not always available in placement schools, students occasionally took digital notes and later transferred them to the online journal. Students typically spent one day per week at the placement school but did have access to the internet on all other days. Depending on the educational context and resource settings, more inclusive approaches such as offline templates or paper-based options may be more suitable than online journals to mitigate any accessibility barriers.

Asking students to write reflectively throughout their course, and teaching them how to do this, should be considered more widely in STEM subjects to help students grow in resilience and critical thinking. This should aid them in their further studies and employment. Although we did not apply AI to help students writing reflectively, using AI such as CoPilot or ChatGPT to prompt in-depth thinking could help them approach their experiences in a more thoughtful manner. Using reflective writing for assessment can

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also help educators create fair but challenging tasks for the AI era. Actively reflecting on their experiences and skills development also gives students an advantage when applying for employment, with the reflective practice providing valuable evidence of self-awareness and potential to develop and learn as an employee.

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## **Ethics**

Research was approved through Durham University's ethical review processes. Please see the Methods section for further details.

## **Disclosure**

Generative AI was not used for data analysis or for writing up this paper.

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## Appendix A.

### *Questionnaire about reflective writing and use of online journal.*

Q1. Please read the Information Sheet and Privacy Notes attached to the email before completing the survey. (Students asked to confirm this and to give consent to answers being used anonymously).

Q2. How would you describe the skills you gained from writing your journal? Please tick all options that apply. Options: It helped me remember events later. It helped me remember how I felt about things happening. It helped me understand my experiences. It helped with putting my experiences into context. It helped me understand my own learning. It helped me understand my own development. It helped me reflect on transferrable skills. It helped me plan for the future. It helped me evaluate events critically. It helped me be creative with new ideas. It did not help me develop any skills. Other.

Q3. If other, please explain.

Q4. Select whether you agree or disagree with the following statements: It was easy to get started using PebblePad. I received enough training using PebblePad. (Likert-scale options).

Q5. If you would like more training, how would you prefer to receive it? Tick all that apply. (In person, video, other).

Q6. If other, please specify.

Q7. Did you use the Help option in PebblePad?

Q8. If you used the Help option, what did you ask?

Q9. What did you think about the PebblePad template as a tool for writing reflectively? Please tick all options that apply. Options: It helped with organising my thoughts. It helped with structuring my writing. Other.

Q10. If other, please specify.

Q11. How did you feel about writing about your experiences? Tick all options that apply. Options: It was straightforward. I enjoyed writing about my experiences. I enjoyed writing about how I felt about things. I learned from writing about my experiences. I would have liked to do more reflective writing in other modules to help reflect on my learning. I was unsure about what to include. I felt uncomfortable about sharing my personal experiences and/or thoughts. It felt pointless. Other.

Q12. If other, please specify.

Q13. How would you like to improve on the experience of writing a journal. Tick all that apply. Options: More guidance in the tutorial about what to include. More prompts in PebblePad about what to write about. More feedback from my tutors on my writing. More feedback from other students on my writing. No further improvement needed. Other.

Q14. If other, please specify.

Q15. Do you think that a structured reflective writing task would be suited to any of the following activities? Tick all that apply. Options: Lecture content, laboratory practicals, field courses, literature review, skills development, none of the above, other.

Q16. If other, please specify.

Q17. Select whether you agree or disagree with the following statements about the Self-Audits: I completed all of the Self-Audits, I found it useful to complete the Self-Audits. I found it useful to compare how my confidence changed over time. (Likert-scale options).

Q18. Any other comments about how you felt about or used the Self-Audit?

Q19. Select whether you agree or disagree with the following statements about completing the tasks: I completed most of the weekly reflections in Term 1. I completed most of the weekly reflections in Term 2. I completed the PDP or Smart Goals. (Likert-scale options).

Q20. If you didn't complete one or some of the sections, explain why.

Q21. Select whether you agree or disagree with the following statements about the format of the reflections: I liked having prompts for the weekly reflections. I would have preferred to use my own format for my weekly reflections. (Likert-scale options).

Q22. If you think the layout of the weekly reflection could be improved please comment further on this.

Q23. Did you upload additional supporting material onto PebblePad? (Yes/No/Can't remember).

Q24. If Yes, how did you upload the additional material? Tick all options that apply. (Directly using PebblePad/Using PebblePocket/Can't remember).

Q25. The Pebble Pocket mobile app allows you to upload photos and videos from your phone to PebblePad. Once in your asset library you can add them to your weekly reflections. Please, tick all statements that apply to you. Options: I used PebblePocket to upload photos or videos. I did not know about PebblePocket. I would have liked to know more about PebblePocket. I would have used PebblePocket if I had known about it. I am not interested in using PebblePocket.

Q26. If you were to complete a reflective journal in PebblePad again, what would you change or what functionality would you want to be added?

Q27. What were your overall feelings about writing a journal?

Q28. What were your overall feelings about using PebblePad for recording your experiences?

Q29. If you were to complete another reflective piece of work, which software would you prefer to use? (Word/PebblePad/Evernote/Other)

Q30. If other, please specify.

Q31. Many thanks for completing this questionnaire - your help is much appreciated! Please include your anonymous student code here if you would like to take part in the random draw of the Amazon voucher.

## Appendix B.

*Students' comments on aspects related to reflective writing and using the online template. Themes induced from comments are shown in bold font.*

Own engagement with tasks	<p><b>Redundancy of smart goals</b></p> <p>'I didn't feel the smart goals were necessary as I knew what I wanted to work on throughout placement from the reflection' (Student D)</p> <p>'I wasn't sure at what point to do the smart goals or what the benefit of doing so would be' (Student J)</p> <p><b>Time constraints</b></p> <p>'It's been really busy at the end of term finishing my placement, literature review, and preparing for the presentation so I've made notes to add later but will do so during the Easter break instead' (Student E)</p>
Using the PebblePad template for	<p><b>Preference for off-line template</b></p> <p>'I was neutral to positive about writing reflectively - I didn't like PebblePad. Occasionally it glitched and I used a Word document</p>

<p>reflective writing</p>	<p>to document my experiences and liked that more. I would have felt more confident in using PebblePad if other Science into Schools students were doing the same.’ (Student J)</p> <p><b>Mixed feelings about online template</b></p> <p>‘It did allow my journal entries to be tracked but I’m unsure how much this differs compared to word. Perhaps it’s because I know the module leaders can see my entries throughout the year which made me more inclined to write them’ (Student A)</p> <p><b>Positive to online template</b></p> <p>‘Positive- though sometimes I do forget to fill it in!’ (Student B)</p> <p>‘I liked having it on PebblePad. I think it was good to have something external to record my experiences on as otherwise I may not have kept up with it.’ (Student C)</p> <p>‘I liked PebblePad overall, I thought it was a good way to do it. I liked the fact that you could write the activities and then talk about your feelings and positives and challenges separately.’ (Student D)</p> <p>‘I think it will be useful to remember every experience coupled with what feeling we had about said experience.’ (Student G)</p> <p>‘It was very helpful, it meant that I didn't forget experience but also when writing and reading back through it, it prompted me to remember more events throughout the placement.’ (Student M)</p> <p><b>Mostly positive but more examples or tools needed</b></p> <p>‘I liked the structure and questions to get me started but sometimes I didn't know what to write and I felt like I was doing it wrong, examples would be useful.’ (Student E)</p> <p>‘It was okay, it's likely more functional than Word due to the organisation but having more features such as the highlight tool would have been helpful.’ (Student L)</p> <p>‘I thought PebblePad was good as it meant all the reflective pieces were organised in one centralised place rather than having to</p>
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	<p>organise it myself. I also appreciated the prompts, despite thinking they could be more detailed.’ (Student O)</p>
<p>Use of prompts in journal template and how this could be improved</p>	<p><b>More specific prompts needed</b></p> <p>‘I think the prompts were appropriate but sometimes a little too vague for me to know which box I should write certain thoughts in. I know I found the prompts on PebblePad most helpful when they gave examples of what to include, so maybe going through an example of a good journal entry in tutorials would be helpful for others in the future when knowing both what to include and where to include it.’ (Student M)</p> <p>‘More prompts on what each section could entail.’ (Student B)</p> <p>‘I would want there to be more prompts with more detailed explanations of what to include in your reflective writing, maybe including an example/more training in order to fully get to grips with what to write about. However this could also be improved by having more detailed explanations of what to include and easier to understand marking criteria for the executive summary.’ (Student O)</p> <p>‘More prompts because sometimes I was unsure what to say, or I felt like my observations didn't fit into any of the boxes, or sometimes I would repeat myself in several boxes’ (Student E)</p> <p><b>More flexibility preferred</b></p> <p>‘I think it was good to have the prompts, but often I didn't write something for all of them if I didn't feel they were relevant to that week. Sometimes it was just easier to write all of my thoughts in one paragraph in one box rather than breaking them down.’ (Student D)</p> <p>‘I feel like there were too many prompts that didn't apply every week so it made it quite difficult or made me feel like I wasn't</p>

	<p>writing enough or made me feel like I was filling in the form wrong.’ (Student H)</p> <p>‘I think I would have liked the opportunity to personalise my questions more. For example, having an extra section at the bottom.’ (Student C)</p> <p>‘Ability to look at weekly reflections side by side’ (Student D)</p> <p>‘Less prompts and more flexibility in reflections’ (Student I)</p> <p>‘The prompts were useful but the lack of flexibility was a little frustrating.’ (Student N)</p>
<p>Other suggestions for improvement</p>	<p><b>Old system</b></p> <p>‘Would have preferred to use the old system’ (Student K)</p> <p><b>Reminders</b></p> <p>‘Maybe a reminder email at the end of each week so I remember to complete it’ (Student A)</p> <p><b>Comments from lecturers</b></p> <p>‘It would be nice to get some comments from lecturers to back up some of our learning - this could help us with future plans.’ (Student G)</p> <p><b>Highlighter function</b></p> <p>‘Having a highlighter function so we could practise reflective writing would have been incredibly useful’ (Student L)</p>
<p>Writing reflectively – overall experience</p>	<p><b>New but useful experience</b></p> <p>‘At the time it was hard to know what to include but it was useful for the executive summary’ (Student A)</p> <p>‘Useful, especially for the project report and executive summary.’ (Student B)</p> <p>‘Overall I think it was helpful to remember what I had done and allowed me to think about how I felt about what had happened.’ (Student D)</p>

	<p>'I haven't done much reflective writing so this was really useful, I learnt a lot from it and I'll continue to use it after the module has ended too.' (Student E)</p> <p>'I quite enjoyed writing the journal and i think it will be useful to come back to when writing our report and summary.' (Student G)</p> <p>'I enjoyed it, while it did add extra work it was interesting to look back on and different assignment than what were used to' (Student L)</p> <p>'I felt it quite overwhelming at points but when it came to writing the assessments I knew how much writing it had benefited my understanding of my own progress. I think overall I am glad that this was part of the module, I don't think I would have thought as deeply about my experiences without it.' (Student M)</p> <p><b>New experience</b></p> <p>'I think it was a very new experience. The one difficulty I found is knowing if I was recording my experiences in the right style and if it was detailed enough.' (Student C)</p> <p><b>Uncomfortable experience</b></p> <p>'Didn't enjoy felt slight uncomfortable with some of the personal questions' (Student K)</p> <p><b>Difficult to complete</b></p> <p>'I personally found it difficult to know what to include, and to remember to complete the journal immediately after the session. I also found myself forgetting things that happened due to how long the sessions were.' (Student O)</p>
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