Limited Choices, Greater Engagement: Involving Cyber Security Students in Inclusive Assessment Design

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Abstract

Designing inclusive assessments in higher education is particularly important for large and diverse student cohorts. This paper reports on a practice implemented in a postgraduate computing science course with approximately 300 students from varied academic backgrounds, assessed through an examination, continuous assessments, and a group coursework project. To promote inclusivity, students were offered limited design choices within the coursework components. For the group project, they selected the elements their written reports would address, while for the continuous assessments, they chose how their final quiz grade would be calculated. These choices did not alter the overall assessment formats but were intended to foster a sense of ownership and ensure that the assessment better reflected diverse strengths and preferences. Although the analysis revealed no significant differences in performance outcomes, student feedback indicated greater positivity toward the assessments and appreciation for being involved in their design. The findings suggest that even small, structured opportunities for student choice can enhance inclusivity and engagement in assessment design.

CCS Concepts

• **Social and professional topics → Student assessment**; **Computer science education**.

Keywords

cyber security, assessment design, inclusive assessment

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1 What is it?

The present practice is constructed to support students in participating in the design of coursework assessment on a postgraduate course in cyber security, delivered in a School of Computing Science at a research-led institution.

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The assessment structure for the students enrolled in the course was presented on the first day of the course. The course's assessment structure for the students enrolled in the course was presented on the first day of the course. The assessment has three elements: continuous assessments in the form of individual quizzes completed regularly throughout the course and together weighted at 10% of the overall grade, one group assignment to produce a written report weighted at 20%, and an individual examination in an invigilated, controlled environment weighted at 70%. The continuous assessment and group assignment represents the coursework for the course.

The practice reported here centres on these coursework assessments. The bare structures of the coursework assessments were presented to students. For continuous assessments, this was the structure of each quiz: in that each quiz always contained the same number of questions, each question was always multiple-choice, always had four options, and that one option was always optimal and all other options were distractors. For the group assignment, teams had to generate a cyber security policy for a given context, the policy had to be informed by an appropriate risk assessment and teams had to identify and document appropriate metrics to evaluate the effectiveness of their proposed policy.

The students were involved in the design of some aspects of the assessments. For the continuous assessment, it was how individual quizzes contributed to the final grade. For the group assignment, it focused on the structure and problem space for the assignment. The important point to note, is that the course coordinator was still responsible for the core aspects of the assessments and how these aligned with the learning outcomes for the course. Furthermore, for those aspects the students did influence, they ultimately only influenced them from the perspective of opting for design choices devised and presented by the course coordinator.

A series of design options were presented to students for both coursework assessments. For each option, the underlying rationale was explained alongside the course coordinator's preferred design. Students were invited to indicate their preferred options and provide a brief justification for their selections via an online form. This process took place on the first day of the course during an interactive design session, with students given until the end of the first teaching week to finalise their responses. This extended period allowed time for reflection and peer discussion before submitting a final decision.

The design session was delivered as a lecture outlining the assessment structures, learning outcomes, and the rationale underpinning the proposed designs. Students were encouraged to ask questions either directly or anonymously through an audience engagement system. Preferences were submitted via an online form and then the form closed at the end of the week, the majority preferences were adopted as the final assessment design choices. The updated assessment specifications were subsequently published through the virtual learning environment (VLE) for the course.

This participatory approach positioned students as active contributors to the assessment design process, promoting transparency and a sense of shared ownership. While the extent of influence was bounded by the available design options, the process was designed to foster engagement, enhance students' understanding of assessment criteria, and align with emerging principles of inclusive and co-created assessment design.

The design choices depended on the assessment. For the continuous assessment, there were 16 quizzes in total throughout the course duration. Eight of the quizzes probed reading of research material, the other eight probed review of lecture material. Students were presented with four design choices as to how the 16 quizzes would be used to produce their final grade. The first choice was the eight highest scoring quizzes of the 16 would be used to generate the grade. The second option was the four highest scoring quizzes of each group of eight quizzes would be used, i.e. research versus lecture. The third choice was that students could select their own eight quizzes and the last choice was the course coordinator could decide.

For the group assignment, students could decide whether peer-review would be part of the assessment or not, in that groups would review drafts produced by other groups part way through the course before submitting their final version for grading by the course coordinator. Students could also select the domain of the problem context, be it health, finance or manufacturing. Students could also choose what the policy should focus on, whether that be employees' use within an organisation of (1) messaging services, such as Telegram, (2) personal use of cloud services, such as Dropbox or (3) personal use of Generative Artificial Intelligence services, such as ChatGPT.

2 Why are we doing it?

From the perspective of the course coordinator, the existing assessments were pedagogically sound and had typically received positive feedback from previous cohorts. Yet, when first introduced to a new class, they were often accompanied by friction. While the rationale for design decisions could be explained, there was no guarantee that students would accept or value these explanations; many placed greater trust in their own judgement about how they should learn and what motivated them. This risked assessment being seen as something imposed rather than shared, creating tension instead of alignment. The introduction of limited but collective choice was therefore an intentional design move, expected to ease such tensions by allowing students to shape aspects of assessment while the core framework remained intact. The expectation was that this approach would strengthen inclusivity, engagement, and transparency, each of which has growing recognition in computing education research.

For inclusivity, the expectation was that students would feel their different strengths and interests were recognised, even within a common written-report format. All groups were required to produce written work, but the class could collectively decide the domain in which their work was situated, for example, health, finance, or manufacturing, and the type of solution they explored, such as secure messaging systems or the implications of generative AI. This flexibility was intended to ensure that students could connect the assignment to areas they found meaningful, aligning the work with their interests and career aspirations. Prior research highlights that rigid assessment designs can exacerbate inequities, while opportunities to choose contexts increase inclusivity by validating diverse perspectives [4]. In cyber security education specifically, out-of-class projects and contextually varied problem spaces have been shown to enhance student learning and perceived relevance [10]. By allowing choice over the domain and focus, inclusivity was expected not just to mitigate disadvantage but to foster genuine recognition of students' varied motivations.

For engagement, the expectation was that limited choice would promote 'buy-in' or ownership by shifting students from passive compliance toward active involvement. Nicol argues that assessment should be rethought as a process in which learners actively construct meaning and evaluative judgement, rather than passively receive marks [12]. Computing education research has noted that students often approach assignments instrumentally, focusing narrowly on "getting it to work" at the expense of conceptual understanding [19]. In cyber security, student motivation is particularly sensitive to perceptions of real-world relevance [10]. By giving students bounded influence over the problem space or lens through which they tackled an assignment, the design was expected to cultivate ownership and investment. Engagement would not need to be engineered solely by the course coordinator, but could emerge from students' sense that the assessment reflected choices they had made.

For transparency, the expectation was that collective decision-making would provide a forum for clarifying contested design elements, particularly peer-review. Student scepticism of peer processes is well-documented in computing education: they are often perceived as unfair or unproductive unless the rationale and processes are clearly explained [17, 18]. More recent reviews emphasise that transparency around criteria, roles, and ethics is essential to the credibility of peer review in computing science in general [13]. By situating peer-review within a design conversation, the approach aimed to transform a point of resistance into a pedagogical opportunity, making explicit why such practices mattered for learning and professional preparation. Transparency in this sense was expected not to eliminate disagreement, but to shift perceptions from arbitrariness to purposefulness, building trust in the fairness of assessment.

3 Where does it fit?

The present practice was deployed in a postgraduate cyber security course focused on the enterprise delivered at a research-led UK higher education institution. The institutional teaching strategy emphasises courses being research-led and that they embed active engagement with students.

The cyber security course, given that it is focused on the enterprise, addresses areas such as enterprise architecture, risk assessment, adversarial behaviours, security policy, and security metrics. It is a 10-week course delivered in the first semester of the academic year with a typical enrollment of 300 to 400 students. The course is compulsory for some postgraduate programmes, such as cyber security, while for other postgraudate programmes it is available as an elective.

The cohort is diverse, attracting students from a range of academic and professional backgrounds. While some students have prior computing science knowledge, some are graduates from other disciplines. A commonality across the cohort is limited prior knowledge of enterprise-focused cyber security. As the course is delivered in the first semester, it must also accommodate students transitioning into the institution, whether from other UK universities or from overseas. Consequently, an important consideration in delivery is assessment literacy, including supporting students in understanding institutional expectations and, for international students, helping them adjust to studying in the UK.

4 Does it work?

The assessment design survey was completed by 132 students. For the continuous assessment, the majority of students (85.6%) favoured the design choice where the grade was automatically calculated from the eight highest of the sixteen quizzes. The remaining options were all comparatively unpopular, with only 10.6% of students preferring to choose the quizzes themselves, 2.3% opting to let the course coordinator decide, and 1.5% selecting the option that balanced between the two types of quizzes. In considering the open-text responses students provided to rationalise their design choice, three themes emerged. Many students emphasised fairness and reduced stress, as participant P12 explained, *"Maybe some students will get low scores at the beginning because they are not familiar with the approach, or they may have some issue. Therefore, it is scientific to take the 8 highest scores in all tests as the score, which can effectively avoid some accidental loss of points."* Others valued efficiency and simplicity, with P3 summing up the majority by writing simply *"fair."* A further theme compared the relative strength of the options, with P19 arguing, *"Because it's the optimal choice. Actually, choice A has included choice C (students will always choose the highest 8 scores once they choose option C, which is the strategy of choice A), and choice A is better than choice B."*

Students demonstrated less agreement when it came to peer-review. 49.2% were opposed, 37.9% supported the inclusion of peer review, and 12.9% preferred to let the course coordinator decide. Many students that favoured excluding peer-review cited concerns over time and fairness, with P27 noting, *"It would waste my time and be biased,"* and a preference for the course coordinator to mark, with P15 stating, *"The coordinator will grade more fairly and consistently."* In contrast, those students that favoured peer review highlighted accountability and professional practice. P44 remarked, *"Peer review is an essential part of publishing and our careers, so it is fair to include it,"* while others saw value in the feedback it could generate. The undecided participants typically expressed trust in the course coordinator to make the right judgement.

In terms of the domain of the problem context, finance was the most popular choice (50%), followed by health (34.8%) and then manufacturing (15.2%). Many students suggested the choice was motivated by relevance and personal interest. Finance was perceived as both challenging and important, with P88 writing, *"Finance is closely related to security and data breaches, so it is more realistic."* For health, the sensitivity of personal records was frequently cited, as P71 explained, *"Health records are very sensitive, so protecting them is ethically important."* Manufacturing appealed to a smaller group of students who valued its technical relevance, such as P94 who commented, *"It's more suitable for computer science students."*

The choice of policy problem showed a near-even split between messaging services (40.2%) and generative Artificial Intelligence (39.4%), with cloud storage less popular at 20.5%. Students selecting messaging services often emphasised prevalence and risk, with P63 commenting, *"Everyone uses these apps and they are the biggest security issue today."* Those who selected generative Artificial Intelligence highlighted its novelty and ethical complexity, such as P118 who wrote, *"It's a new field and very important for the future."* A smaller group focused on cloud storage, usually citing data privacy, for example P102 explained, *"Cloud services are close to us and easy to misuse."*

The design decisions made by students were accepted and implemented, but there was no noticeable impact on student performance. There was a positive impact on course feedback from students with more positive responses from students than previous years.

The last question students were asked in the design session was if they had any other comments or thoughts. The response was overwhelmingly positive. P89 stated "*I love that we are engaged in the assessment format as students.*" If nothing else, relative to the time and energy in conducting the design session, it would suggest involving students in assessment design may foster a more positive culture even in large classes, and delivers dividends relative to its cost.

5 Who else has done this?

There is a surprisingly long, although slender, tradition of arguing that teachers should stay out of telling learners what to do, and get them to decide for themselves on how, and even more on what the real goal for learning is. Hebb in 1955 created motivation by refusing to teach anything until pupils produced reasons why they should learn the material [7]. He describes the effect of removing all compulsion on school children to learn (see p.246) where he refused to teach them at all until they asked them to. A colleague of ours some years ago repeated a version of this approach in a class where, due to a colleague's illness, he had suddenly to teach a subject he did not like nor know well. He began the "lecture" class by asking them: why should you bother to learn about electric motors? Surely that is not important? In this way he had them produce reasons for teaching them, while also defusing his own grumpiness and acting in a throroughly constructivist manner, i.e. by getting them to construct their own reasons for learning the material.

Illich in 1970 argued that countries that have limited resources almost have a culture where citizens must teach themselves [8]. Ironically, this is now much more possible, even in very wealthy countries, due to the web. But this also applies to subjects which only a few widely scattered people are interested in: classes may be convened regardless of whether the learners live near each other or not.

More recently, work on *connectivism* advocates creating groups by recruiting learners, who then begin by agreeing the topic to learn next [7, 8, 16]. A slightly different angle is that of Mitra [11], much of whose work is to bar teachers from the classroom as always reducing the motivation and achievement of the learners compared to when they learn in small self-organising groups. Such groups invent their own learning goals, as well as creating their own motivation. Mitra has been a professor at the University of Newcastle in the UK, and gave a keynote at the ALT-C 2010 conference.

6 What will we do next?

There is existing research on involving learners in the co-creation of assessments, and several of these approaches could be adapted for future iterations of this course. For example, Russell employed multiple-choice question (MCQ) tests and made a particularly insightful observation regarding their use [14]. He used three "isomorphic" questions, which to someone who understands the concepts, ask the same thing but, he observed, students who did not understand it could not even recognise that the three questions were asking the same thing. So we could detect the *non-comprehenders*, and it would be appropriate to give an A grade for getting all 3 right, and a C for getting only 1 or 2 right. Confidence Based Marking [5, 6, 9] is a well developed, but arguably under-used, method of testing with MCQs which has these properties, where the student must not only select what they think the right answer is, but also select a degree of confidence. This modifies the MCQ format, but goes with a modified scheme of test scores where high confidence and the right answer get higher marks; but high confidence and the wrong answer incurs extra penalties. So maximum scores are earned only if you are right and confident.

Beyond these approaches, there are many reports and examples of educators involving students in the design of MCQs and questions in general [1, 2, 15]. Similarly, there are also examples of educators in the design of group assessment work. Another tested innovation was Baxter's [3], and it might be applied to the group reports described in this paper. It was a learning design using peer interaction, but not tutor marking.

Baxter divided a huge first year class into groups from the start, and get all their work to be in those groups who had to submit an essay roughly every 2 weeks [3]. But the only feedback they got, once per assignment, was that he, the course coordinator, picked out one of the essays and recommended it to the whole of the class. He did not in fact have to read all the essays necessarily – just enough to pick a good example for that week. So the class, unusually, had no social experience other than in their little groups, but it seemed to work well both in terms of the student experience and in the sense of being part of a large class and getting some feedback.

A growing body of work illustrates how educators have successfully involved learners in the design of their assessments. Such interventions are frequently less disruptive or resource-intensive than might initially be assumed. Although clear evidence of measurable performance gains is often limited, there is little indication of any adverse impact on achievement. More consistently, these initiatives are associated with enhanced student experience, engagement, and ownership of learning. While robust empirical evidence remains emergent, the prevailing trend suggests that inclusive, co-designed assessment practices merit further systematic exploration within educational research and practice.

7 Why are we telling you this?

We found it interesting to involve a large class in assessment design, this was inexpensive and while it delivered no noticeable difference in student performance, there was an impact on student experience, compared to feedback from previous years. This paper afforded us an opportunity to reflect how this practice related to education literature and others practice. We hope it will inspire others to experiment with assessment design, even with large classes, to possibly improve student experience, if nothing else.

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