Students' use of online feedback in a first year tertiary biology course

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ABSTRACT

Students often report feedback experiences at university are insufficient to make progress. The size of many large courses means the provision of personalised and timely feedback to individual students is challenging. Online systems have been promoted as a way students can receive feedback for learning. This study explores the extent to which students use the feedback information when it is provided in a self-directed online homework system in a first year biology course and whether this supports learning and improves achievement levels in summative assessments. Structural equation modelling was used to test a hypothesised model. The study demonstrates that feedback is not necessarily accessed and used by students, but that students who use the online system information to help their learning for the entire course are helped academically by using hints.

Keywords: assessment, feedback, tertiary education, digital tools

One of the challenges facing students in university education is adjusting to and understanding assessment practices and standards (Carless, 2015a). A recurrent view reported across studies is the belief by many students that feedback information received at university is inadequate or not supportive of their learning (Beaumont, O'Doherty, & Shannon, 2011; Carless, 2006; Harvey, Drew, & Smith, 2006). This difference may arise because of the greater reliance in higher education on standardised testing and summative assessment within large classes with relatively little interaction time between instructors and students in 12-15 week courses that meet only 2-3 hours per week. This means that little constructive and formative information is generated and delivered by the teacher to the student (Beaumont et al., 2011). Rather, the results of summative assessments in the form of marks and grades are expected to provide feedback to students about their progress (Lipnevich, Berg, & Smith, 2016). Increased access to higher education in recent decades, has seen an increase in enrolments and student diversity along with increasing student-staff ratios and decreases in resourcing per student, threatening the sustainability of feedback practices (Hounsell, 2007). While teachers recognise the value of feedback in learning, they acknowledge it may not always be of benefit or be used by students in the large undergraduate class context and can lead to students viewing feedback as not useful in the long term (Price, Handley, Millar, & O'Donovan, 2010). Current directions in assessment for learning in higher education do not insist that instructors give personal feedback, but do point to the importance of dialogic feedback, even delivered by video or audio, as an effective approach to ensuring feedback is understood and implemented by students (Carless, 2016). Nonetheless, the extent to which these formative assessment strategies are being implemented by universities is quite restricted (Carless, 2017).

Success in university is more likely when students are autonomous learners taking individual responsibility for their outcomes (Brinkworth, McCann, Matthews, & Nordstrom, 2009). Key skills of autonomous learners include the ability to create internal feedback and self-regulation mechanisms that allow them to monitor their progress in learning (Zimmerman, 2008). Less effective learners depend much more on external factors for feedback, while successful learners are able to generate and use feedback (Brown, Peterson, & Yao, 2016). Given the often large size of learning groups in higher education settings, the use of technology is one way to address the challenge of providing adequate feedback. For example, automated tutoring systems can provide structured feedback and links to teaching materials in response to student answers to questions and tasks embedded in the system (Katz & Gorin, 2016). This study investigated how extensively tertiary level students used and benefited from an online feedback system.

Feedback

Assessment is an important and integral component of learning and teaching in university education and is predominantly a summative collation of evidence about achievement. Learning strategies adopted by students in higher education frequently tend to focus on maximising marks or grades at the expense of developing higher-order skills which are the intended outcomes for courses and programs and teachers (Carless, 2015a). Feedback to learners about their achievement in higher education frequently occurs only at the conclusion of a learning episode (Sadler, 2010). This situation occurs despite general acceptance that formative feedback before the end of courses enhances learner capacity to become independent, effective and responsible learners (Black, 2007; Sadler, 1989).

Feedback requires action by the learner in order to make learning gains. Ramaprasad (1983) stated: *"Feedback is information about the gap between the actual level and the reference level of a system which is used to alter the gap in some way"* (p.4) (Ramaprasad, 1983). Sadler (1989) emphasised that the effect of this feedback is realised when the student uses the information to improve their performance in some way. Although the distinction between information and feedback is not universally accepted, it can be argued (Carless, 2015b; Sadler, 1989), that it is the active self-regulating role of the learner that turns information into feedback. The learner needs to possess a concept of the learning intention or goal being aimed for, be able to compare this with the actual (or current) level of performance, and then, in some way, engage in appropriate action which leads to some closure of the gap.

Effective feedback answers a series of questions including *"Where am I going?"* (What are the goals?); *"How am I going?"* (What progress is being made toward the goal? Which may manifest as self- assessment and self-evaluation) and *"Where to next?"* (What activities need to be undertaken to make better progress?)" (Hattie & Timperley, 2007). Such feedback is generally powerful in its effects (Black & Wiliam, 1998; Hattie, 2009; Kluger & DeNisi, 1996). One way to structure feedback about 'what next' is to give students 'hints' about where task-related information might be found in a course text-book or what the correct series of steps is to solve a problem, or even provide additional opportunities to review teaching resources about a topic. However, some kinds of feedback (e.g., self-oriented praise or blame) have been shown to be counter-productive (Hattie & Timperley, 2007; Kluger & DeNisi, 1996). Thus, the key seems to be ensuring feedback is informative, can be understood, and is acted upon by students.

Learning is effective when students seek answers or information in relation to each of the feedback questions identified by Hattie and Timperley (2007) so as to reduce discrepancies between their current understanding and the desired goal or performance level. The three feedback questions are not necessarily addressed in a linear fashion and students may not always engage with all three questions to work to increase their achievement. Learning may not always start with clarifying goals, just as checking progress may be overlooked, and students may be unaware of a gap in their understanding. Seeking out more information and challenges to deepen understanding might not occur if students do not engage with "Where to next?" Thus, the effectiveness of these three questions is dependent on the self-regulating learning abilities of students.

Feedback through online systems

The use of computers to generate feedback may resolve some of the difficulties encountered in providing effective information in higher education. Hattie (2009) reported *"the most effective forms of feedback that provide cues or reinforcement to the learner, are in the form of video, audio or computer-assisted instruction feedback, or relate feedback to learning goals."* (p. 174). Individualised feedback to students is now possible via computer-assisted online systems and has potential to improve student performance and learning experience (Henly, 2003; Sly, 1999; Wang, 2007).

Combining 76 meta-analyses on computer-assisted instruction in, mainly American, compulsory schooling, Hattie (2009) found that the average effect size for improving achievement was $d = 0.37$ (se = 0.02) (Hattie, 2009). He reported a reasonable degree of variability across the meta-analyses which may highlight a number of issues such as the complexity of the learning contexts and inconsistency of practice by teachers and students.

The range of technology used in the studies included in the meta-analyses was wide, and the studies were mainly about teachers using computers for instruction and fewer studies were about students' use in learning. Hattie (2009) identified some contexts where computers were used effectively, including situations when the student, not the teacher, was in "control" of learning and when feedback was optimised. Although end-users (students) are probably not becoming more skilled in using technology for learning nor is the effect of computer-assisted learning increasing with the sophistication of technology advances (Hattie, 2009), the use of online activities is a suggested solution for managing feedback practices in large classes (Carless, 2015a).

In essence, computers can respond to all student interactions in a timely manner, something normally difficult to achieve in classes of hundreds of students with one lecturer, even with many tutors. Nonetheless, a limitation of computer responses being pre-programmed is that their fit to the specific needs of a particular individual may not be sufficient to enable task completion. A further constraint arises when a learner's understanding is already well-established; feedback on successful performance may have a trivial impact, since students are already competent. Generally, challenging tasks have positive effects (Lou, Abrami, & d'Apollonia, 2001).

MasteringBiology®

A software application that provides a range of feedback systems is MasteringBiology®, an online learning product developed by Pearson Publishing Company (Pearson 2008). MasteringBiology® provides an assignment area where teachers are able to specify resources and activities that align with lecture content and can be used to practice tasks that facilitate understanding and retention. The system provides tutorial activities with

animations and relevant content in combination with objectively-scored tasks that students can use for either practice or review. The system automatically scores the student response to the task and provides feedback about correctness and statements that reinforce the knowledge required for correct answers. The system provides optional help or "hints" which students can use prior to the task or afterwards, if the system scores their answer as incorrect. If students answer incorrectly, they can revisit the task with the option of seeking further help before re-attempting the task. Hints are in the form of further information or clues, and in some cases, simpler questions.

The flow of student use of MasteringBiology® is illustrated in Figure 1. The system provides tutorials which lead to homework tasks which are scored as correct or incorrect. Once the student finishes the task credit is awarded in the course system provided the task was completed on time and with at least 50% of the tasks answered correctly.

Insert Figure 1

Figure 1: Pathway in MasteringBiology® for task completion, indicating options for help seeking.

Thus, MasteringBiology® allows students to engage in "deliberative practice" under conditions of learner control, receive immediate feedback about correctness, and options for assistive feedback. MasteringBiology® provides feedback about 'where am I?' by confirming the correctness of responses as tasks are completed. It allows the student to return to wrongly answered tasks, as well as opportunities to obtain more information about the topic, thus giving opportunity to know 'what do I do next?". When uncertain or wrong, students can seek help by clicking on "hints" which provide new information (e.g., further questions, diagrams or animated tutorials) that can scaffold further learning of the

target knowledge structures (Figure 2). Panel A of Figure 2 shows a task on photosynthesis which students complete by dragging correct chemical structures onto the fields in the diagram of the Calvin cycle. Panel B shows three incrementally complete hints with prompt questions that require students to use hint information to formulate a new response.

Insert Figure 2

Figure 2. Example of MasteringBiology question presented to students as task on Photosynthesis and hint information and question available to help seekers (Pearson Publishing Company).

"Seeking help is a learner proficiency, and many types of help-seeking behaviour can be considered aspects of self-regulation" (Hattie & Timperley, 2007, p.96). Seeking out and making use of feedback as a means of improvement is associated with higher achievement (Brown, Peterson, & Yao, 2016). Thus, the formative feedback resources built into MasteringBiology® (i.e., hints) require students to actively monitor and direct their own actions toward a learning goal, in light of the scores and hints delivered by the system. Students' willingness to invest effort into seeking and dealing with the hint feedback information may be characteristic of effective learners, but is likely to be carried out by less proficient learners who make more mistakes. This means that MasteringBiology® aligns with several powerful learning forces in that it allows and requires self-determined action of the individual learner without oversight by the instructor and is structured so that students can potentially receive or seek feedback that explains error, points to helpful resources, provides explanations, and offers multimedia tutoring. Nonetheless, if students are getting the test questions correct, their use of hints is likely to be minimal, suggesting that weaker students may refer to the hint feedback more than academically proficient students.

For research and teaching purposes, MasteringBiology® stores data about student accuracy in answering tasks and the frequency of student repetition of items, use of hints, and other activities within the system. All data are stored on Pearson Education servers located in Waltham, MA, USA.

Research Goals

In this study, the automated tutoring system provides a hint system associated with machine-scored tasks. Given the workloads and demands of students in the programme, it is anticipated that the additional hint system would be used primarily by students who are struggling to meet the target of 50% tasks answered correctly. Thus, making use of the hints is not necessary for academically proficient students who can get more than 50% of the tasks correct. However, the academic benefit of using hints by less-proficient students is not well understood and this is the major goal and contribution of the current study.

This study examined the degree that hint usage contributed to performance on formal assessments in the course for which MasteringBiology® was used. Since potential hint usage took place prior to two different assessment events, a temporal causal structural equation model was developed to explore the linear effect of prior achievement and hint usage on subsequent academic performance.

Thus, the model was based on four hypotheses about the effect of prior achievement and hint usage. It was presumed that prior achievement would positively predict subsequent performance on the course (H_1) and that weaker, rather than stronger students would use hints (H_2). It was also presumed that more frequent hint usage would predict continued usage of hints (H_3) and would positively contribute to course achievement (H_4).

Insert Figure 3

Figure 3. Proposed Hypotheses Concerning Hint Usage and Academic Performance

Method

Context

This study took place in a large ($N \approx 40{,}000$), publicly-funded, research intensive university, situated in New Zealand's largest metropolitan region (approximately one-third of national population). Entry to the university is selective in that students are required to have a minimum of 150 points from the best 80 credits earned in the New Zealand National Certificate of Educational Achievement Level 3 compared to the minimum entry score of 120 points used at all other universities. The course is a prerequisite for students majoring in biological science and intending to apply for programmes such as health and medicine.

The key concepts in the course included cell and molecular biology, microbiology and genetics before the mid-semester test. The second half of the course focused on evolution and biochemistry, which were assessed in the course final examination.

The course is a single semester 12-week course having four 50 minute lectures each week with two sessions per day to accommodate students in groups of 600. Fortnightly laboratory classes involved 64 students in each session. There were no formal tutorial classes. However, a blended model of tutorial support provided opportunities for students to access learning materials and practice activities and a discussion board to facilitate peer to peer communication. MasteringBiology® was a separate online resource that provided assignments customised by the teacher and presented as regular homework activities (i.e., formative assessment for learning).

Previous students in this course had reported dissatisfaction with insufficient feedback and were frustrated by limited opportunities to learn actively during a predominantly lecture-driven course. Given the constraints of providing feedback in large university classes outlined above, the study reported in this article investigated how first year biology students used an online homework system and what effect this system had upon their tested course learning. To address these concerns, the course designers incorporated MasteringBiology® into the coursework schedule as sets of online homework activities available alongside the relevant lecture material each week. The activities were due for completion at the end of each week. As an incentive, there was a small contribution (4%) to the final graded course mark if the students completed by the due date provided they scored a minimum of 50% correct for each activity. There was no penalty for using hints, although such use would increase time taken to complete the assignment.

The course had two summative assessments (i.e., a mid-semester test and final examination) contributing 74% of the final grade. The balance of the grade was made up of in-course work including laboratory assessments (22% of grade) and 30 MasteringBiology® assignments (4% of grade). All assessments were summative in that they contributed to the final course grade.

Participants

Of the 1252 undergraduate first year biology students in the course, 918 volunteered to participate. Of these volunteers, 65.3% were female and 34.7% male. The majority were in their late teenage years (M_{age} = 19.1 years, age range: 16-49 years) with modal age (43%) of the participants being 18 years old, followed by 36% age 19. A third were majoring in Biomedical Science, the prerequisite for selection into medicine. Biology majors were 14% of the volunteers. Other applied majors making up 12 % of the volunteers included Food

Science and Medicinal Chemistry. Participants identified their ethnicity as about one-third New Zealand European (Pākeha); 4% as N.Z Māori; 16.9% as Chinese; 9% as Korean; 10% as Indian; 12.3% other Asian; 3.7% as from the Pacific Island region; with smaller numbers from Australia, Britain, Europe, Africa and South America.

Procedures

After gaining ethical approval, students were approached by an independent person, seeking their interest in participation in this project. Students gave signed consent for their data from completing MasteringBiology® online activities for homework to be gathered and analysed. The data for the participating students' use of MasteringBiology® was extracted from the online system and merged with course summative achievement, demographic and university entrance qualification information.

Instruments

Hint Usage. Data were obtained from MasteringBiology® concerning Hint Usage for eight assignments. The first assignment (Topic Cell and Molecular biology) did not elicit any hint usage, nor did the final assignment for Biochemistry, due one week before the exam. Hence, a maximum of six assignments had hint use data. The distribution of usage showed high kurtosis, meaning that most students had zero usage and a few had extremely low usage. Therefore all cases which had used one or more hints were recorded as 1, while all participants who had no use of hints were recorded as 0. Table 1 shows that as the mid-term test approached almost half of the research volunteers had used hints, with an average of about one-third in the first half-semester. In the second half-semester, only 15% of volunteers made any use of the hints.

Table 1. MasteringBiology® Frequency of Hint Users

Insert Table 1

Academic performance. Student academic performance on the course mid-semester and final examination was obtained from university records. Both the test (M=62.19, SD=16.10) and exam (M=63.21, SD=20.00) were scored out of 100 using multiple-choice and short written questions. Student prior achievement was derived from entrance qualifications recorded in the university database as a grade point equivalent (GPE). The GPE was converted to a numeric scale, where 0 represents an average of fail grades (D-, D and D+); 1 is C-, increasing by 1 for each increment through to 9 =A+.

Data Analysis

The data available in this study represents traces (Webb, Campbell, Schwartz, & Sechrest, 1966) left by system users as they interacted with MasteringBiology® within the constraints of a high-stakes introductory course in Biology. Thus, the data are uncontaminated by researcher effects since they are naturally occurring phenomena left behind by the learners' autonomous efforts to master biology. Since the use of hints was hypothesised to be a contributing factor to higher academic performance, causal analysis of data is appropriate (Wegener & Fabrigar, 2000). Causal modeling uses the statistical power of regression analysis to examine the strength of linear associations between constructs to determine the proportion of variance explained in a dependent variable by a set of predictor variables (Hoyle, 1995). Since the data occur chronologically, the structural modeling reflects the role time plays by linking the data in the same time order. The quality of fit of the model to the data is used to determine whether the model is a satisfactory representation and simplification of the complex data relationships.

Confirmatory factor analysis (CFA) was used to determine whether the frequency of hint usage could be legitimately aggregated into a latent tendency to use hints within the

two time periods (i.e., pre-mid-semester test and pre-final exam). Understandably, topics

for which there was no usage were excluded from analysis. CFA allows determination of (a)

whether the grouping of items into a latent factor has good fit to the data, (b) whether the

path values from the latent trait to the contributing indicators are statistically significant,

and (c) the scale of variance explained by the retained paths (Bandalos & Finney, 2010).

Structural equation modelling (SEM) extends CFA by testing the strength and nature

of relationships among factors and manifest variables (Klem, 2000). The structural model

was a longitudinal, autoregressive model (Figure 3) making use of a bivariate (i.e., hint usage

and academic proficiency) simplex model. Each measure (i.e., hint usage and academic

proficiency) is a function of the conceptually identical measure immediately preceding it. To

account for the possibility that hint usage and academic proficiency influenced each other

cross-lagging between constructs was introduced (Curran & Bollen, 2001).

Given that hint usage and academic proficiency scores were continuous scales,

maximum likelihood estimation in Amos version 23 (IBM, 2013) was conducted. For both

CFA and SEM modelling, consistent with current practice (Fan & Sivo, 2007; Marsh, Hau, &

Wen, 2004), models with statistically non-significant χ^2 per *df*, comparative fit index (CFI)

and gamma hat > .90, and root mean square errors of approximation (RMSEA) and

standardised root mean residuals (SRMR) < .08 were considered sufficiently close to the

data so as to not be rejected.

Results

Hint Usage CFA

In the first half semester data was collected for five tasks. Of these, only three tasks

either had tasks with hints or actual hint usage. These were Cell and Molecular Biology task

7, Microbiology Task 3, and Genetics Task 1 only. Genetics Task 2 was not kept in the model because the material, as advised to students, was not assessed in the mid-semester test. This meant it would not be a valid predictor of the relevant hint usage in that time period. In the second half of the semester only two tasks had actual hint usage (i.e., Biochemistry Task 4 and Biochemistry Task 6). This two-factor model of hint usage in the first and second halves of the semester had good fit to the data (χ^2=11.95; df=4; χ^2/df=2.99, p=.08; CFI=.93; gamma hat = .98; RMSEA=.064; SRMR=.024).

Structural Model: Hint Usage and Achievement

The results (Figure 4) had good fit to the data (χ^2=76.34; df=16; χ^2/df=4.77, p=.03; CFI=.98; gamma hat = .99; RMSEA=.064; SRMR=.028). The path values indicated strong support for H_1 (i.e., prior achievement predicts subsequent achievement); GPE strongly predicted mid-semester test performance (β=.64), mid-semester test strongly predicted exam performance (β=.80). Partial support was found for H_2 (i.e., weaker students use hints) in that the path from GPE to Hints 1 was moderately negative (β= -.34), but was zero from mid-semester test to Hints 2. Reasonably strong support was found for H_3 (i.e., initial use of hints predicts continued use) since the path from Hints 1 to Hints 2 was β=.65.

Finally, partial but weak support for H_4 (i.e., hint usage would positively contribute to course achievement) was found in positive path from Hint 2 to Exam score (β=.12), but contradicted by the negative path from Hint 1 to mid-semester test score (β= -.17). The additional cross-lagged path from Hint 1 to final exam was also negative (β= -.10), further contradicting H_4. The total indirect effect of Hint 1 to final exam score was small and negative ((β= -.06). The negative direct and indirect effect of Hint 1 on the final exam score may be a reflection that the material studied in the first half of the course is not tested

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directly in the final exam. Nonetheless, use of hints in the first half predicted hint use in the second half of the course and such usage did contribute, albeit in a small way, to final exam score.

Sex and ethnicity were introduced into the model as predictors of hint usage. However, neither was statistically significant and so differences according to these demographic factors were not pursued further.

The total variance explained in the exam performance was R^2=.665. The mid-semester test score was the strongest contributor (β=.80, R^2=.64). Thus, the combined effect of hint usage at time 1 and time 2 was no more than 2.50%. The direct effect of Hint 2 usage to academic achievement was very small (β=.12, R^2=.014). Nonetheless, its contribution indicates that prolonged hint usage can help weaker students.

Insert Figure 4

Note. All values are standardised regression weights.

Figure 4. Schematic representation of relationships between Hint Usage and Academic Performance

To summarise the results, academically weaker students at the start of the course tended to use Hints more and this usage gave a small pay-off for achievement only if students persisted in usage across the course. Usage fell considerably after the mid-semester test, but persistence did eventually contribute a small positive amount to better performance.

Discussion:

The purpose of this study was to investigate students' use of online feedback in a low-stakes, self-directed context. The feedback was delivered via the MasteringBiology®

computer system in accordance with good feedback principles. Student's use of hints was entirely self-directed and without penalty for course performance. The somewhat greater initial usage by weaker students (i.e., $\beta=-.34$ from entry GPE) suggested there was a tendency for participants to have some valid self-awareness of their need for additional help. It is disappointing that hint usage did not pay off quickly in improved test performance and this may have contributed to the reduced usage in the second half-semester. It may be that time taken in making use of hints prevented greater attention to all topics covered by the mid-term test or it may be that, when students have weaker starting proficiency, they simply require more time before visible effects can be seen in their tested performance. Nonetheless, students who persisted with getting hints did eventually have a small increase in performance. This suggests that in addition to recognising one's need for help, students must persist in this adaptive process and reinforces that learning is not an instant process.

Perhaps disappointing to the developers and funders of MasteringBiology®, usage of hints was relatively low, despite the ability of the hints to help students understand the course material better. As required, students made use of the self-testing function within MasteringBiology®, and weaker students, as expected, sought out hints. Because help-seeking resulted in only a very small gain in achievement, it may be that students evaluated the cost-benefit for investing time in seeking and using help and concluded that there was little to gain. For competent students, the need to seek help is probably negligible in any event. Alternatively the large workload associated with this course (i.e., 40 lectures in 12 weeks) and associated courses in the students' programs, may have necessitated a strongly strategic approach to learning, in which seeking learning-oriented feedback would be seen as a counter-productive learning practice. It may also be that in an environment in which feedback is presented and understood as grades and marks, students may not realise the

value of the homework assignments and hint systems for improving learning. A recent model of feedback explores the complexity of student responses to feedback, whereby students either take some action on feedback or not with the consequence being that feedback is not effective in the same way for all students. (Lipnevich et al., 2016). With a multiplicity of feedback design factors influencing students' responses, it is still pleasing that hint-usage was ultimately a small adaptive behaviour.

This study relies on traces of student use of the MasteringBiology® system. Future research could obtain data directly from students during the process of using the system, for example talk aloud protocols (Mayring, 2000) to gain a deeper understanding of how and why students choose to use the hints or not. Additionally, retrospective reflections on the experience of using the system could be obtained, without interrupting course performance, in focus groups designed to cover high vs. low usage and high vs. low performance. Such studies could identify other factors (e.g., emotions, motivations, etc.) that contribute to the impact of the hint system in a more nuanced way than the current frequency of use index. Given that the value of the MasteringBiology® tasks to overall grade was relatively small, future research could examine the impact of such a system when its contribution to grades was much higher (e.g., 20% of course grade instead of 4%). It may be that when the consequence is higher that more able students would be inclined to use the hint system because of the potential greater pay-off in getting the tasks right.

Thus, effective formative assessment opportunities can be ignored by students in the context of high pressure and summative assessments (Yorke, 2003). In this study many students engaged in online activities for marking purposes only and did not use the hints help at all. In the current context, despite efforts to support formative use of feedback, the curriculum focus of students was narrowed and focused on achievement (Au, 2007). These

summative assessments become the focus for learning and encourage strategic behaviour by students to ensure passes and grade levels appropriate to their various goals. Consequently, the assessment design, being in the main summative, may have led to marginalisation of formative feedback that could support learning.

These results are in line with studies of school students' behaviour (Black & Wiliam, 2005; Carless, 2011; Harlen, 2005) where ensuring formative outcomes within a summative assessment framework is difficult. Often, because students focus on achieving high grades, they focus on practising for the test instead of learning for understanding. Thus, dominant summative assessment practices can limit the attention students pay to feedback information. Instead of viewing assessment as an integral part of learning, students come to view assessment as a competition with and external to teaching (Heritage, 2007).

Although studies indicate students find the culture of feedback different as they transition to higher education (Beaumont et al., 2011), they arrive with a multiplicity of experiences reflecting the diversity within a large student body (Harvey et al., 2006). For many students, this period of time at university is important for the development of learning behaviours such as monitoring their own learning by themselves. This resonates with this study's findings. The online system was built into the course to encourage self-monitoring and help-seeking behaviour. However, the findings suggest that due to the powerful messages built into the tests and exam-based systems and extensive workloads, many of the students ignored the online system or used it only to secure a few extra marks by completing the assignments provided. Effective use of the system was predicated on students having self-regulation skills so they would evaluate and monitor their learning. To some extent, this is seen to be the case with weaker students who used the hints and persisted in such use throughout the course.

Understanding whether students engage with opportunities to receive feedback is an important factor in designing learning tools and assessment practices in higher education. As a first step in this process, the study reported here investigated whether students engage with formative assessments and feedback when opportunities are available to them in a self-managing online system. The findings suggest that weaker students tended to make some use and that considerable effort was needed before a positive contribution to performance could be seen. These findings raise questions about why so few students used the feedback in the system and why it took so much usage to see a beneficial contribution to results. It would be helpful to know why those that fully used the system did so and how, in the students' opinions, such a system might better serve their learning needs.

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