

ARTICLE

# Improved Behavioural Engagement of Students through Low-stakes Online Tests and Immediate Dialogic Feedback

Glen Currie\*, Tracii Ryan

Faculty of Engineering and Information Technology, The University of Melbourne, Australia

## ARTICLE INFO

### Article history

Received: 01 December 2022

Accepted: 10 February 2023

Published: 28 February 2023

### Keywords:

Behavioural engagement

Immediate dialogic feedback

Low-stakes tests

Mixed-methods

Online learning

Quantitative, Survey

## ABSTRACT

The engagement of students is a recognised challenge for teachers. Technology offers some practical student engagement tools, and this paper examines the use of low-stakes online tests and immediate dialogic feedback to improve behavioural engagement. The academic exploration of low-stakes tests and dialogic feedback has been extensive, and they are credible teaching tools. In this study, we explore the learning benefit of their combination. Postgraduate engineering students' self-reported and learning analytics data shows conclusive evidence of improved behavioural engagement. We measured a 500% increase in the Learning Management System (LMS) page views on the days when we ran the low-stakes tests (each worth 2% of the marks for the subject) and engaged in immediate dialogic feedback. To interpret these results, we draw on theories of behavioural engagement, low-stakes tests, and feedback. We conclude that the combination of low-stakes tests and immediate feedback improves student behavioural engagement.

### Implications for practice or policy:

- Course leaders may gain efficacy (as it relates to student engagement and experience) by aligning dialogic feedback with low-stakes online tests.
- For students, this mix of low-stakes online tests and dialogic feedback will act as an incentive to increase their behavioural engagement.

## 1. Introduction

Student engagement has seen increased focus since the introduction of emergency online teaching due to the COVID-19 pandemic in 2020 (Aguilera-Hermida, 2020).<sup>[1]</sup> Although researchers have been developing techniques for online engagement (Sinfield & Cochrane, 2020),<sup>[39]</sup> this remains a complex challenge. The student must feel supported, and teachers must provide authentic learning, promote problem-solving and link theory to real-life

scenarios (Sugden et al., 2021).<sup>[41]</sup> Therefore, student engagement cannot rely solely on technology tools but must also include mediation of that learning (Devlin & McKay, 2016).<sup>[13]</sup>

Engagement is key to student success in higher education, and learning design should aim for behavioural and cognitive engagement (Kahu, 2013).<sup>[21]</sup> The literature supports the learning value of low-stakes tests (Evans et al., 2021,<sup>[14]</sup> van Alten et al., 2019)<sup>[43]</sup> and online low-stakes tests (Van der Kleij et al., 2015).<sup>[44]</sup> Immediate

### \*Corresponding Author:

Glen Currie, Lecturer, Faculty of Engineering and Information Technology, The University of Melbourne, Australia; Email: [glen.currie@unimelb.edu.au](mailto:glen.currie@unimelb.edu.au) ORCID ID 0000-0003-1239-1443

dialogic feedback can foster productive student learning (Yang & Carless, 2013)<sup>[51]</sup> and encourages both behavioural (Thomas, 2012)<sup>[42]</sup> and cognitive engagement (Laurillard, 2013).<sup>[24]</sup>

This study assessed whether online low-stakes tests and immediate dialogic feedback developed behavioural engagement (Steen-Utheim & Wittek, 2017;<sup>[40]</sup> Willis et al., 2021;<sup>[49]</sup> Yang & Carless, 2013).<sup>[51]</sup>

## 2. Literature Review

The research consensus is that engagement can be encouraged with software that facilitates discussion with the teacher and other students (Devlin & McKay, 2016;<sup>[13]</sup> Williams et al., 2012)<sup>[48]</sup> and immediate feedback (Sugden et al., 2021;<sup>[41]</sup> Van der Kleij et al., 2015).<sup>[44]</sup> We, therefore, review the literature on behavioural engagement, low-stakes online tests and immediate dialogic feedback.

### Behavioural Engagement

Engagement can be viewed as a “meta” construct that includes an interplay of “behavioural, cognitive, and affective (emotional) dimensions” (Fredricks et al., 2004).<sup>[17]</sup> Behavioural engagement relates to what the student does actively, and cognitive engagement relates to the student’s investment in intellectual resources (Ryan et al., 2019).<sup>[35]</sup> Engagement is “strongly associated with high levels of learning and personal development” (Kuh, 2001).<sup>[22]</sup> It is challenging to engage students, and only some will engage, even with well-designed learning activities (Laurillard, 2013).<sup>[24]</sup>

Educational technology offers tools for engagement. It can help teacher-student engagement and enable learner-content engagement and peer-to-peer interaction (Bedenlier et al., 2020;<sup>[3]</sup> Vygotsky & Cole, 1978).<sup>[45]</sup> These three aspects of engagement should be considered when designing educational technology, including low-stakes online testing.

### Low-stakes Online Tests

Low-stakes online tests are online and have a low impact on the student grade. Student learning is improved by frequent practice (Roediger III, 2013),<sup>[34]</sup> and low-stakes online tests offer an efficient method of frequent practice. In addition, online tests can provide students with unique feedback for each answer and include illustrations and other digital innovations. Software can also help improve the test questions by calculating “difficulty index (DIF), discrimination index (DI), item-total score correlation coefficients (RPB), and Kuder–Richardson 20 (KR-20) reliability index” (Malau-Aduli et al., 2014, p.

512).<sup>[26]</sup>

Universities have explored quality low-stakes online tests (Forbes, 2018)<sup>[16]</sup> and found that they may achieve formative feedback and high-order learning outcomes (Finley, 2019)<sup>[15]</sup> and motivate learning (Wise & DeMars, 2005).<sup>[50]</sup> Low-stakes online tests must be well-designed to engage students (Nicol, 2007).<sup>[30]</sup> Low-stakes tests can serve as formative assessments in that the student answers the question and then their understanding is

moderated, so they can help students know their level of learning and help staff know where students have problems (Shuhidan et al., 2010).<sup>[37]</sup> Immediate feedback makes this moderation the most effective (Kulik & Kulik, 1988;<sup>[23]</sup> Van der Kleij et al., 2015).<sup>[44]</sup> Students are not taking too much of a risk in taking the low-stakes test, and once they are engaged, there is an opportunity for immediate dialogic feedback, which we now explore.

### Immediate Dialogic Feedback

Dialogic feedback includes all dialogue to support learning (Askew & Lodge, 2004),<sup>[2]</sup> and we adopt a definition of “immediate” as being within the lecture period. Dialogic feedback can include automatic dialogic loops (Willis et al., 2021),<sup>[49]</sup> can benefit from the use of exemplars (Carless & Chan, 2017),<sup>[8]</sup> and can be seen as framed in terms of the content, interpersonal negotiation, and the organisation of feedback (Yang & Carless, 2013).<sup>[51]</sup> Most importantly, dialogic feedback can enhance students’ understanding (Carless et al., 2011)<sup>[9]</sup> and can overcome limitations of feedback, such as being too late for students to enhance their learning (Higgins et al., 2002).<sup>[19]</sup> Carless (2012, p. 90)<sup>[7]</sup> demonstrated the role of trust in dialogic feedback and reports that feedback messages can flourish if we show “empathy, tact and a genuine willingness to listen”.

Dialogic feedback has four dimensions: “emotional and relational support; maintenance of the feedback dialogue; opportunities for students to express themselves; and contribution to individual growth” (Steen-Utheim & Wittek, 2017, p. 18).<sup>[40]</sup> It is, at its essence, a conversation between the student and the teacher and can provide error correction, exemplars and explanation of responses’ relative consequences and appropriateness (Carless & Chan, 2017).<sup>[8]</sup>

Feedback improves learning (Carless & Winstone, 2020)<sup>[10]</sup> and is considered the most critical factor in learning design (Boud & Molloy, 2013,<sup>[4]</sup> Hattie & Timperley, 2007).<sup>[18]</sup> Feedback frequency is also important (Broadbent et al., 2018),<sup>[5]</sup> the test should be conducted during the course, and the feedback should include suggestions for improvement (Shute & Kim, 2014).<sup>[38]</sup>

It should also be noted that feedback is constrained by resources (Broadbent et al., 2018),<sup>[5]</sup> and a lack of feedback can limit student learning outcomes and even limit student engagement (Maringe & Sing, 2014).<sup>[27]</sup> Fortunately, learning technologies offer timely feedback and benefit learning outcomes if well-designed (Van der Kleij et al., 2015).<sup>[44]</sup>

Students prefer immediate feedback and spend far more time reading it than delayed feedback (Kulik & Kulik, 1988,<sup>[23]</sup> Van der Kleij et al., 2015)<sup>[44]</sup>. Kulik and Kulik found that students prefer immediate feedback for lower-order learning. They also found that immediate feedback improved student learning in tasks with higher cognitive demands.

The literature concludes that dialogic feedback immediately after the low-stakes online tests will encourage engagement. There is little research on the nexus of online low-stakes testing and immediate dialogic feedback, and our study focused on this nexus. The dialogic feedback was expected to be effective because it helps students relate concepts to everyday experiences, relate evidence to conclusions, and connect new ideas to previous knowledge (Ramsden, 2003).<sup>[32]</sup> The following questions guided this research:

1. Is there a measurable effect of a low-stakes test and immediate dialogic feedback on behavioural engagement?
2. Do students reflect that low-stakes tests and immediate dialogic feedback contributed to their learning?

## Context of the Present Study

We conducted this research over three subsequent postgraduate Engineering classes at a large (over 50,000 students) research-intensive university in a metropolitan Australian city. The university community includes over 20,000 international students from 130 nations, and 69% of Engineering students are international, many of whom are students with English as an additional language.

The 2020 teaching year started on 2nd March 2020 with face-to-face teaching, which then switched to online learning on 24th March, when the COVID-19 lockdown started and remained online for our entire study period (March 2020 to October 2021).

One change we made at that time was to set up tutorials to suit the different time zones of our students. Half of our students needed to return to, or remain in, their home country because of the COVID-19 pandemic. Another critical contextual issue was changes brought about by the COVID-19 isolation, which had a measurable psychological impact on staff and students (Brooks et al., 2020)<sup>[6]</sup> and created a concern about whether students

were learning well. The teaching team felt empathy for students experiencing financial and emotional strain, and staff communications took on a tone of reassuring and supporting students. It was notable that the messages shifted from an authoritarian tone to an empathetic tone as soon as the COVID-19 pandemic struck. COVID-19 has hugely affected enthusiasm. There has been insufficient security which means teachers and students are unsure of the future, and in many cases, some students face financial and emotional pressure (Brooks et al., 2020).<sup>[6]</sup>

Our study kept the teaching content and people in the teaching team the same as in previous years. We only changed from face-to-face delivery to delivering lectures and tutorials online. We introduced low-stakes online tests students completed during class and followed these with immediate dialogic feedback. We used Zoom software, and the online test used our LMS software Canvas (Whitmer & Daley, 2020)<sup>[47]</sup> and included four questions each, with a ten-minute time limit. Then there was an intensive discussion between the lecturers and students about the questions. This included industry experts supporting the lecturer and offering professional context for the discussion. We also increased students' pre-reading and preparation for the lectures using Perusall software (Perusall, 2021),<sup>[31]</sup> which also played a role in the student preparation for the low-stakes tests. The dialogic feedback took about 30 to 40 minutes after the test and developed a high level of engagement. In previous years in face-to-face classes in the subject, 30% of students were present. However, with this new online format, we normally had 75% of the students in the cohort students present and remain engaged for the one hour online.

This dialogic feedback allowed students to communicate with the teacher to help clarify concepts and co-construct meaning (Steen-Utheim & Wittek, 2017).<sup>[40]</sup> We did not discuss questions that most students answered correctly, as we assumed most students understood the concept. The teachers would discuss questions where students had trouble, and then students were encouraged to query their scores, which led to further discussion of the low-stakes online tests and the answers (Ingram & Nelson, 2006).<sup>[20]</sup>

We used dialogic feedback in the classes in this study. The dialogic feedback occurred immediately after the low-stakes online test. We showed the test answers and discussed the associated theory. For example, Figure 1 shows the type of data we used for the dialogic feedback and shows that 42 respondents answered the question correctly, which would guide our conversation.

Dialogic feedback included conversations between the lecturers and students and student-to-student interaction.



**Figure 1:** Example of test results for discussion with the class, n=54

We encouraged debate, which was enabled with the Chat function in the Zoom software, with two tutors helping the professor manage the discussion. Few students spoke, but their preference was to use the chat.

### 3. Methods

Our general approach to this research design was to use action research (Crawford & Jenkins, 2017; <sup>[11]</sup> Lewin, 1946) <sup>[25]</sup> as the study required a focus on our local issues, such that our conclusions could be applied to a broader context. We evaluated the use of low-stakes tests combined with immediate dialogic feedback using analysis of the mean number of “page views” each day per student. We also designed and surveyed one cohort to collect student reflections.

#### Participants

This research was conducted in three masters by coursework classes in an engineering faculty in 2020 and 2021 (N=361). On average, these student cohorts were 34% female, and 39% international students, and all classes were online. It was the first time these subjects ran online in 2020, and the change was due to COVID-19 restrictions.

#### Materials

The Learning Management System (LMS) was a

source for grades and learning analytics. The page views data were from the LMS. The LMS data included over one thousand records showing the categories of LMS page views (not individual student activity). A “page view” measure is a measure for each different page in the LMS that students opened.

We also used an online survey to measure student perceptions of learning with Cohort A, a class of 55 students.

#### Procedure

We measured students’ behavioural engagement by evaluating LMS page views in the LMS for the three classes in our study.

We also developed an online student survey to measure student experience with online learning. The questions for that survey arose out of the discussions with teaching peers and were designed to measure student experience with the LMS and online learning. The survey was conducted as an anonymous quiz in the student LMS and had not been pilot tested or based on a previous survey. We invited all 55 students to participate in the survey, and 46 students responded, which meant 84% of the students in the study group filled out the survey. The student names were never collected. The survey includes six two-part questions, which invited students to rate with a 5-point scale and then elaborate their response with a text answer.

**Table 1 Students Participating in the Study**

Group	Number of students	Reflections recorded
Cohort A (Semester 1, 2020)	54	46
Cohort B (Semester 2, 2020)	246	
Cohort C (Semester 1, 2021)	61	
<b>Total</b>	<b>361</b>	<b>46</b>



The survey questions were carefully worded, but there was a risk of measurement error due to varying degrees of language fluency. The analysis used descriptive statistics.

We ran the survey late in the teaching semester. Survey results were anonymised by never showing the student names in the file, and there was great care in supporting confidentiality. The lead researcher was involved in teaching the class, so we were careful not to pressure the students. Also, no incentives were offered.

## 4. Results

This section presents results for low-stakes online tests and immediate dialogic feedback.

Some chat comments said the peer pressure to speak up, and chat comments would sometimes answer questions from other students. Student feedback was a mix of caution about the chaotic “noisy” class, and comments such as “I love the debate and look forward to next week”. Active dialogue rose from about 5% of students in comparable lectures to about 40% in these three cohorts.

### Effect of Low-stakes Tests on Behavioural Engagement

Figures 2, 3 and 4 show the daily LMS page views per student for the three cohorts (N=361). We noticed approximately a 500% increase in LMS page views for each test, worth 2% of the mark in all three cohorts.

Figures 2, 3 and 4 show LMS page views rising 500% on the day of a low-stakes online test worth 2% of the students’ marks. The other peaks in these tables show for the final exam, primary assignment, and the first weeks of the semester, but none reach more than 300% of the underlying trend.

## Student Reflections

We collected student reflections from students in Cohort 1 (n=54). All students were asked to complete the survey, and forty-six students replied. There were two questions regarding online learning, with results shown in Figure 5. Our results showed that students were confident learning online and could collaborate with other students.

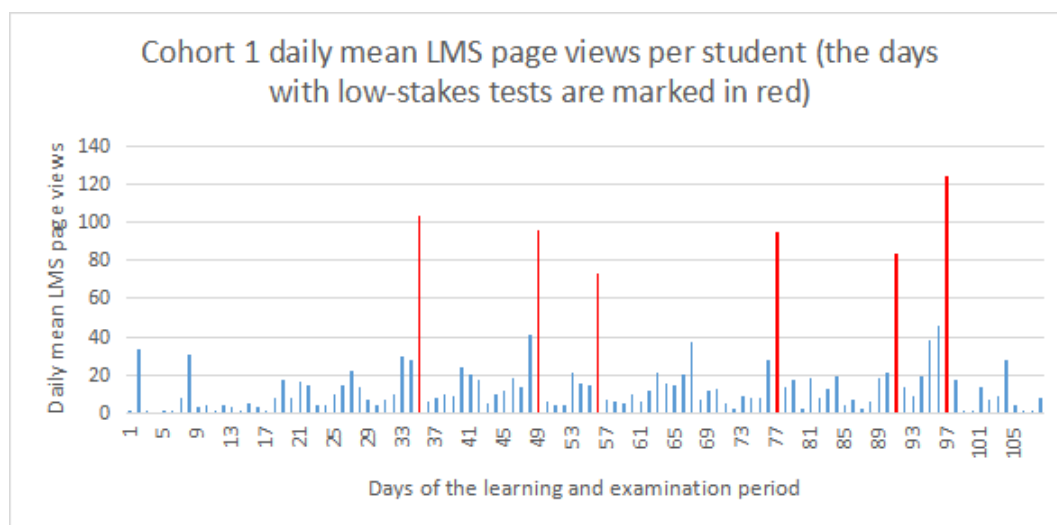
Students commented on the support from the teachers online and in tutorials. Also, three students commented on the speed of responses from teachers. Three students said they preferred Zoom meetings as they believed they met more often with group members and did not waste their transportation time. Eight students commented that online learning was challenging initially but became more manageable after a few weeks. Fifteen students commented about internet connection problems and difficulties with motivation to study at home. However, one student commented, “these challenges taught me some valuable lessons to study hard and increased my self-confidence.”

Students were asked two questions about their view of low-stakes testing, and the results are shown in Figure 6.

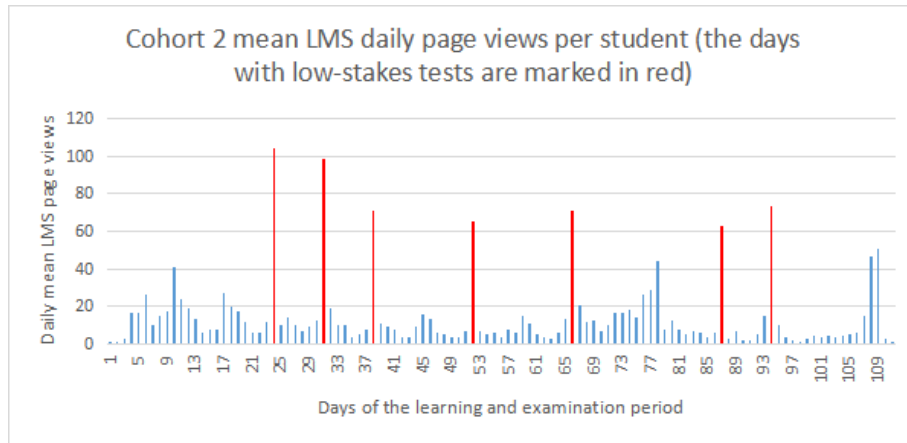
Students felt the low-stakes tests were fair and increased their preparedness for the exam. Student comments were that the teaching staff had supplied detailed feedback during the dialogic feedback after the low-stakes tests.

The two survey questions shown in Figure 7 tested the student relationship with the lecturer, which relates to the dialogic feedback process.

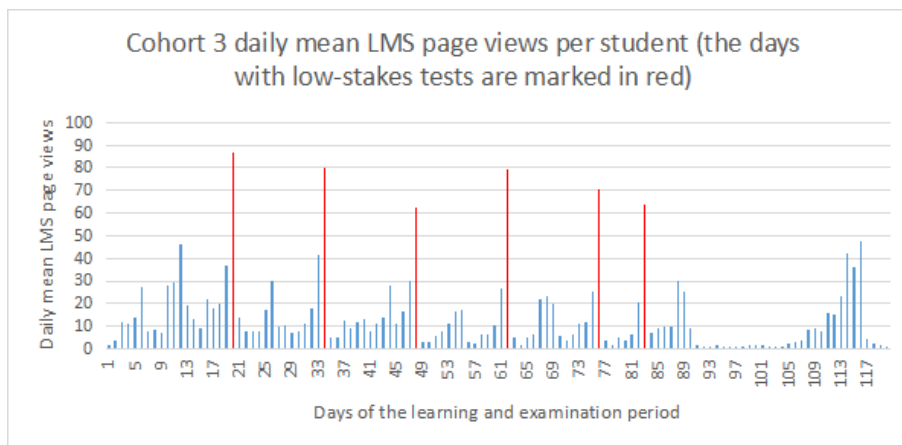
The students perceived the availability of teachers as good. Students felt their teachers were successful in their transition into e-learning, as shown by the student’s



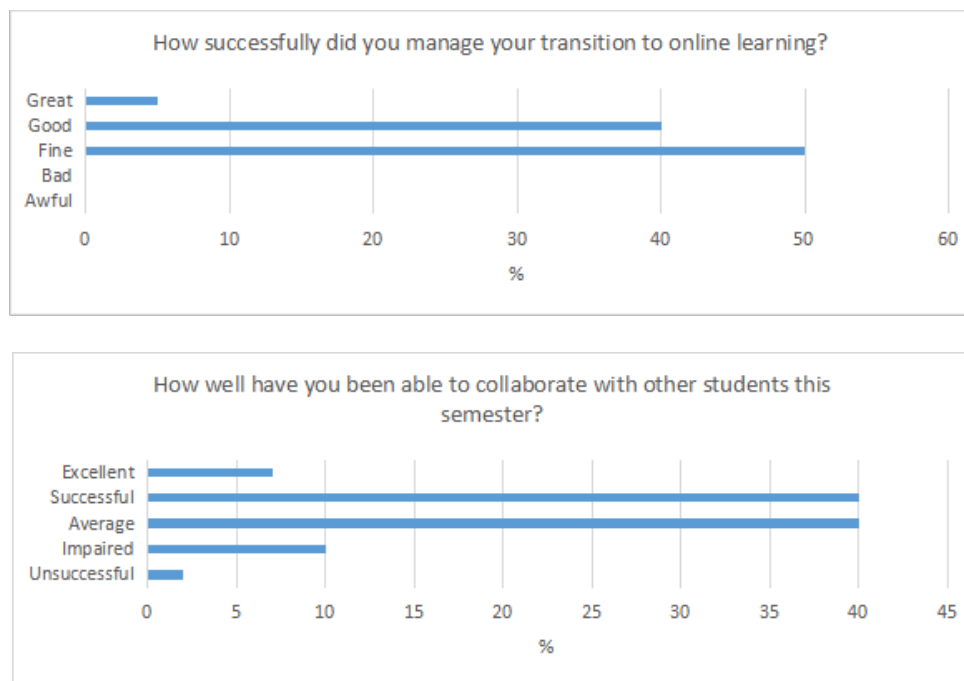
**Figure 2:** Daily mean LMS page views per student each day for Cohort 1 (Semester 1, 2021), n=54.



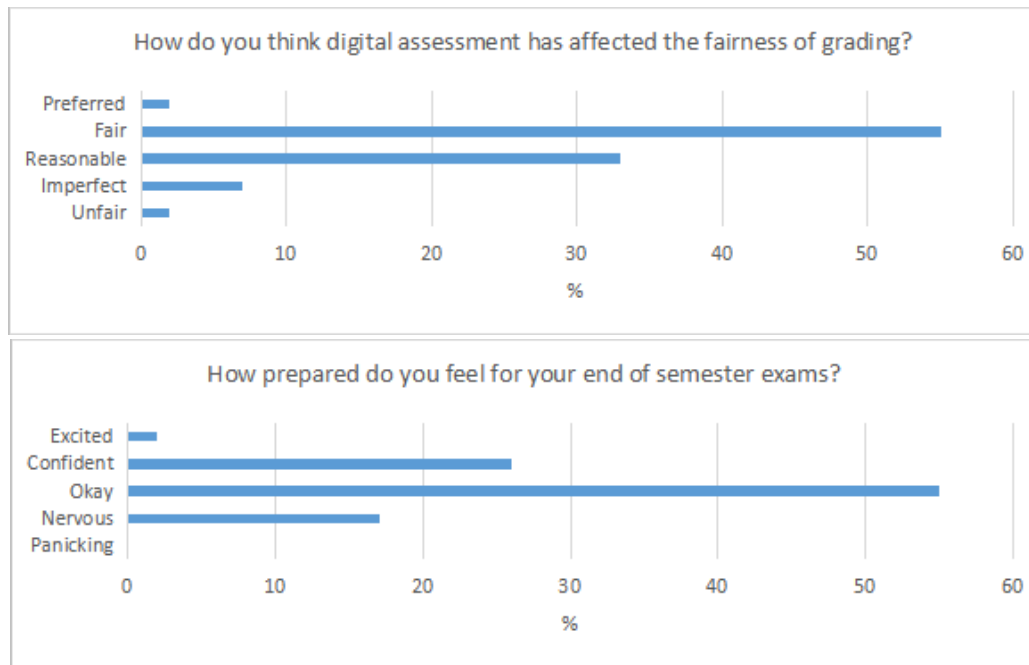
**Figure 3:** Daily mean LMS page views per student for Cohort 2 (Semester 2, 2020), n=246.



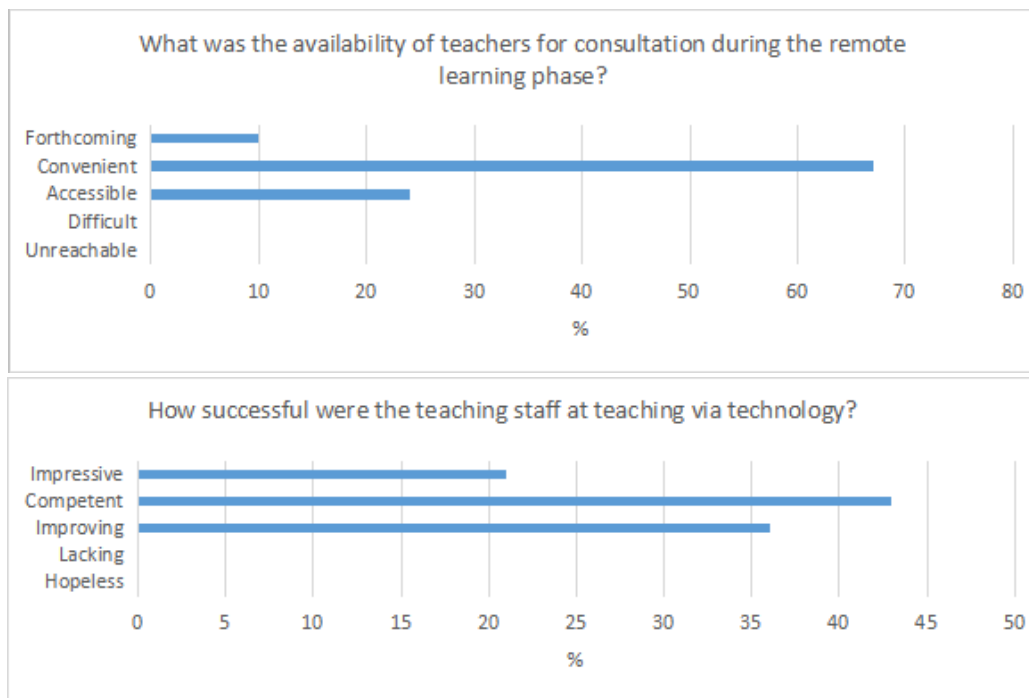
**Figure 4:** Daily mean LMS page views per student for Cohort 3 (Semester 1, 2021), n=61



**Figure 5:** Student's transition to online learning (N=46) (As a percentage of all survey answers)



**Figure 6:** Digital assessment with online learning (N=46) (As a percentage of all survey answers)



**Figure 7:** Teacher access (N=46) (As a percentage of all survey answers)

comment about “the vastness of materials distributed to students throughout the semester.” Students particularly commented on the speed of responses to emails to teachers, which led them to perceive the teachers as “consistent in their efforts to convey relevant information regarding the tests and assignments and commented that their “emails in other subjects received responses more

slowly”.

The students reported that they adapted to online technology with minimal issues in the survey. A response from one student highlighted the importance of interaction to keep them accountable in lectures and keep them engaged. We used Zoom Breakout rooms to allow small group discussions.

Three students stated they liked variability in online interaction to encourage participation. Options we used included: Padlet; the annotate function in Zoom (being invited to write on slides); Poll Everywhere; polls within Zoom; calling directly on students; and using chat. The variability in online interaction led to the following student comments: “It’s good because I can participate, but it’s more in the background. I’m not being called on to answer in front of everyone,” and “Mixing things up keeps me on my toes”.

## 5 Discussion

This study aimed to investigate low-stakes online tests followed by immediate dialogic feedback that affected students’ behavioural engagement and learning. We used two measures. One measure examined students’ behavioural engagement in the LMS, and the other measure analysed student survey responses.

### (RQ1) Discussing Whether We Achieved a Measurable Effect on Behavioural Engagement

The measure of behavioural engagement used in this research was the daily average student LMS page views which increased 500% for each low-stakes test and immediate dialogic feedback. This extraordinary focus on student online activity on the days of the low-stakes tests shown in Figures 2, 3 and 4 suggests that although the individual tests were worth only 2% of the marks, they could significantly affect student learning. This phenomenon was consistent across the three cohorts in this research. This increase in behavioural engagement links to student learning (Dawson et al., 2018, p. 19,<sup>[12]</sup> Sancho-Vinuesa et al., 2013).<sup>[36]</sup> Our students’ engagement in debating the answers to the tests suggested that the immediate dialogic feedback contributed to student learning and underscored the importance of feedback speed (Miller, 2009).<sup>[29]</sup>

We built student engagement through regular dialogue about the low-stakes tests. Interestingly, even sending an email offering to help students who did poorly on the tests generated a response from more than 30% of these students each time. In past years, students would ignore those invitations. Each time we invited students to extra tutorials, the 30-40% response rate suggested the students felt safe in taking up the added tutorial.

### (RQ2) Do Students Reflect that Low-stakes Tests and Immediate Dialogic Feedback Contributed to Their Learning?

We conclude that low-stakes tests followed by

immediate dialogic feedback can effectively engage students and result in student learning. The survey results suggested that the low-stakes tests contributed to student learning and were considered fair. Students were confident with their online learning transition, although they initially found the change troubling. Student reflections in the survey showed evidence that they thought the low-stakes tests contributed to their learning, reinforcing Nicol’s (2007)<sup>[30]</sup> argument that low-stakes tests can contribute to learning. While the evidence in our results was not conclusive about the role of immediate dialogic feedback, when we consider the strength of the literature supporting dialogic feedback, we are confident of its contribution to learning (Carless & Chan, 2017;<sup>[8]</sup> Steen-Utheim & Wittek, 2017;<sup>[40]</sup> Willis et al., 2021;<sup>[49]</sup> Yang & Carless, 2013).<sup>[51]</sup>

## Further Research and Limitations

Limitations of the research design include testing only three cohorts of postgraduate engineering students. A broader sample of classes would allow us to generalise the results. Further research using design-based research (Reeves, 2015)<sup>[33]</sup> could also explore ways to achieve higher-order learning with low-stakes online tests and empirically measure the student learning related to the low-stakes tests and immediate dialogic feedback. The four stages of design-based research are: analyse and explore; design; evaluate; develop a matured intervention (McKenney & Reeves, 2018, p. 16).<sup>[28]</sup> This approach would gradually increase the staff involved and develop a community of practice (Wenger, 2009)<sup>[46]</sup> to investigate ways of achieving higher-order learning with low-stakes tests and the role of dialogic feedback. Another suggested research focus would be the role of low-stakes tests as gamification of learning.

## 6 Conclusion

This research posed two research questions to help develop methods for student engagement. The two questions were: “Is there a measurable effect of the low-stakes test and immediate dialogic feedback on behavioural engagement?” and “Do students reflect that low-stakes tests and immediate dialogic feedback contribute to their learning?”

We conclude that a low-stakes test and immediate dialogic feedback had a measurable effect on behavioural engagement, as shown by the high student engagement with the low-stakes tests in Figures 2, 3 and 4. Students responded to a minor assessment task with extensive use of the LMS for 2-3 days, even when the task was worth as



little as 2% of the subject mark. Therefore, the low-stakes test was shown to be of far more value in behavioural engagement than might be expected.

Our second conclusion is that student reflections showed that students believed low-stakes tests contributed to their learning. While we were not able to definitively demonstrate the role of immediate dialogic feedback in learning, the existing literature does strongly support the contribution of dialogic feedback to higher cognitive engagement and therefore improved student learning outcomes (Carless & Chan, 2017;<sup>[8]</sup> Steen-Utheim & Wittek, 2017;<sup>[40]</sup> Willis et al., 2021;<sup>[49]</sup> Yang & Carless, 2013).<sup>[51]</sup> Future research could use design-based research with a community of practice drawn from the engineering faculty and tertiary teaching and learning experts.

Students might use these findings to understand the role of low-stakes online tests, and the results are valuable to course designers. The authors have started implementing these lessons in other subjects, and we believe this has wide application and is of international significance. Hence, we recommend future research to test our conclusions in different contexts.

## Data Availability

Datasets and appendices related to this article can be requested from the Author.

## Statements and Declaration

This research did not receive any specific grant from funding agencies in public, commercial or not-for-profit sectors. The authors did not have any financial interests of relevance to this research.

## References

- [1] Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open*, 1, 100011. <https://doi.org/10.1016/j.ijedro.2020.100011>
- [2] Askew, S., & Lodge, C. (2004). Gifts, ping-pong and loops—linking feedback and learning. In *Feedback for learning* (pp. 13-30). Routledge. <https://doi.org/10.4324/9780203017678>
- [3] Bedenlier, S., Bond, M., Buntins, K., Zawacki-Richter, O., & Kerres, M. (2020). Facilitating student engagement through educational technology in higher education: A systematic review in the field of arts and humanities. *Australasian Journal of Educational Technology*, 36(4), 126-150. <https://doi.org/10.14742/ajet.5477>
- [4] Boud, D., & Molloy, E. (2013). *Feedback in higher and professional education: understanding it and doing it well*. Routledge. <https://doi.org/10.4324/9780203074336>
- [5] Broadbent, J., Panadero, E., & Boud, D. (2018). Implementing summative assessment with a formative flavour: a case study in a large class. *Assessment & Evaluation in Higher Education*, 43(2), 307-322. <https://doi.org/10.1080/02602938.2017.1343455>
- [6] Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet*. [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8)
- [7] Carless, D. (2012). Trust and its role in facilitating dialogic feedback. In *Feedback in higher and professional education* (pp. 100-113). Routledge. <https://doi.org/10.4324/9780203074336>
- [8] Carless, D., & Chan, K. K. H. (2017). Managing dialogic use of exemplars. *Assessment & Evaluation in Higher Education*, 42(6), 930-941. <https://doi.org/10.1080/02602938.2016.1211246>
- [9] Carless, D., Salter, D., Yang, M., & Lam, J. (2011). Developing sustainable feedback practices. *Studies in Higher Education*, 36(4), 395-407. <https://doi.org/10.1080/03075071003642449>
- [10] Carless, D., & Winstone, N. (2020). Teacher feedback literacy and its interplay with student feedback literacy. *Teaching in Higher Education*, 1-14. <https://doi.org/10.1080/13562517.2020.1782372>
- [11] Crawford, R., & Jenkins, L. (2017). Blended learning and team teaching: Adapting pedagogy in response to the changing digital tertiary environment. *Australasian Journal of Educational Technology*, 33(2). <https://doi.org/10.14742/ajet.2924>
- [12] Dawson, P., Henderson, M., Ryan, T., Mahoney, P., Boud, D., Phillips, M., & Molloy, E. (2018). Technology and feedback design. *Learning, Design, and Technology*, Michael J Spector, Barbara B Lockee, and Marcus D. Childress (Eds.). Springer International Publishing, Cham, 1-45. [https://doi.org/10.1007/978-3-319-17727-4\\_124-1](https://doi.org/10.1007/978-3-319-17727-4_124-1)
- [13] Devlin, M., & McKay, J. (2016). Teaching students using technology: Facilitating success for students from low socioeconomic status backgrounds in Australian universities. *Australasian Journal of Educational Technology*, 32(1). <https://doi.org/10.14742/ajet.2053>
- [14] Evans, T., Kensington-Miller, B., & Novak, J. (2021). Effectiveness, efficiency, engagement: Mapping the

- impact of pre-lecture quizzes on educational exchange. *Australasian Journal of Educational Technology*, 37(1), 163-177. <https://doi.org/10.14742/ajet.6258>
- [15] Finley, S. (2019). Writing effective multiple choice questions. In *Learning and Teaching in Higher Education*. Edward Elgar Publishing. <https://doi.org/10.4337/9781788975087.00046>
- [16] Forbes, H. a. M., Suzie. (2018). *Professional development: Enhancing the MCQ item writing capability of academic staff*. [https://blogs.deakin.edu.au/deakin-learning-and-teaching-conference/wp-content/uploads/sites/319/2018/11/E1-S2-sp3-Forbes-Macfarlane\\_ProfessionalDevelopmentMCQs\\_East1\\_1.40pm.pdf](https://blogs.deakin.edu.au/deakin-learning-and-teaching-conference/wp-content/uploads/sites/319/2018/11/E1-S2-sp3-Forbes-Macfarlane_ProfessionalDevelopmentMCQs_East1_1.40pm.pdf)
- [17] Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research*, 74(1), 59-109. <https://doi.org/10.3102/00346543074001059>
- [18] Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of educational research*, 77(1), 81-112. <https://doi.org/10.3102/003465430298487>
- [19] Higgins, R., Hartley, P., & Skelton, A. (2002). The conscientious consumer: Reconsidering the role of assessment feedback in student learning. *Studies in Higher Education*, 27(1), 53-64. <https://doi.org/10.1080/03075070120099368>
- [20] Ingram, E. L., & Nelson, C. E. (2006). Using discussions of multiple choice questions to help students identify misconceptions & reconstruct their understanding. *The American Biology Teacher*, 68(5), 275-279. <https://doi.org/10.2307/4451988>
- [21] Kahu, E. R. (2013). Framing student engagement in higher education. *Studies in Higher Education*, 38(5), 758-773. <https://doi.org/10.1080/03075079.2011.598505>
- [22] Kuh, G. D. (2001). *The National Survey of Student Engagement: Conceptual framework and overview of psychometric properties*. <https://nsse.indiana.edu/nsse/about-nsse/conceptual-framework/index.html>
- [23] Kulik, J. A., & Kulik, C.-L. C. (1988). Timing of feedback and verbal learning. *Review of educational research*, 58(1), 79-97. <https://doi.org/10.3102/00346543058001079>
- [24] Laurillard, D. (2013). *Rethinking university teaching: A conversational framework for the effective use of learning technologies*. Routledge. <https://doi.org/10.4324/9780203160329>
- [25] Lewin, K. (1946). Action research and minority problems. *Journal of social issues*, 2(4), 34-46. <https://doi.org/10.1111/j.1540-4560.1946.tb02295.x>
- [26] Malau-Aduli, B. S., Assenheimer, D., Choi-Lundberg, D., & Zimitat, C. (2014). Using computer-based technology to improve feedback to staff and students on MCQ assessments. *Innovations in Education and Teaching International*, 51(5), 510-522. <https://doi.org/10.1080/14703297.2013.796711>
- [27] Maringe, F., & Sing, N. (2014). Teaching large classes in an increasingly internationalising higher education environment: Pedagogical, quality and equity issues. *Higher Education*, 67(6), 761-782. <https://doi.org/10.1007/s10734-013-9710-0>
- [28] McKenney, S., & Reeves, T. C. (2018). *Conducting educational design research*. Routledge.
- [29] Miller, T. (2009). Formative computer-based assessment in higher education: The effectiveness of feedback in supporting student learning. *Assessment & Evaluation in Higher Education*, 34(2), 181-192. <https://doi.org/10.1080/02602930801956075>
- [30] Nicol, D. (2007). E-assessment by design: using multiple-choice tests to good effect. *Journal of Further and higher Education*, 31(1), 53-64. <https://doi.org/10.1080/03098770601167922>
- [31] Perusall. (2021). Perusall. Retrieved 2 June 2021 from [www.perusall.com](http://www.perusall.com).
- [32] Ramsden, P. (2003). *Learning to teach in higher education*. Routledge. <https://doi.org/10.4324/9780203507711>
- [33] Reeves, T. C. (2015). Educational design research: Signs of progress. *Australasian Journal of Educational Technology*, 31(5). <https://doi.org/10.14742/ajet.2902>
- [34] Roediger III, H. L. (2013). Applying cognitive psychology to education: Translational educational science. *Psychological Science in the Public Interest*, 14(1), 1-3. <https://doi.org/10.1177/1529100612454415>
- [35] Ryan, T., French, S., & Kennedy, G. (2019). Beyond the Iron Triangle: improving the quality of teaching and learning at scale. *Studies in Higher Education*, 1-12. <https://doi.org/10.1080/03075079.2019.1679763>
- [36] Sancho-Vinuesa, T., Escudero-Viladoms, N., & Masià, R. (2013). Continuous activity with immediate feedback: A good strategy to guarantee student engagement with the course. *Open Learning: The Journal of Open, Distance and e-Learning*, 28(1), 51-66. <https://doi.org/10.1080/02680513.2013.776479>
- [37] Shuhidan, S., Hamilton, M., & D'Souza, D. (2010). Instructor perspectives of multiple-choice questions in summative assessment for novice programmers. *Computer Science Education*, 20(3), 229-259. <https://doi.org/10.1080/08993408.2010.509097>

- [38] Shute, V. J., & Kim, Y. J. (2014). Formative and stealth assessment. In *Handbook of research on educational communications and technology* (pp. 311-321). Springer. [https://doi.org/10.1007/978-1-4614-3185-5\\_25](https://doi.org/10.1007/978-1-4614-3185-5_25)
- [39] Sinfield, D., & Cochrane, T. (2020). A framework for rethinking the pedagogy of studio-based design classrooms. *Pacific Journal of Technology Enhanced Learning*, 2(2), 31-44. <https://doi.org/10.24135/pjtel.v2i2.77>
- [40] Steen-Utheim, A., & Wittek, A. L. (2017). Dialogic feedback and potentialities for student learning. *Learning, Culture and Social Interaction*, 15, 18-30. <https://doi.org/10.1016/j.lcsi.2017.06.002>
- [41] Sugden, N., Brunton, R., MacDonald, J., Yeo, M., & Hicks, B. (2021). Evaluating student engagement and deep learning in interactive online psychology learning activities. *Australasian Journal of Educational Technology*, 37(2), 45-65. <https://doi.org/10.14742/ajet.6632>
- [42] Thomas, L. (2012). *Building student engagement and belonging in Higher Education at a time of change*. [https://www.heacademy.ac.uk/system/files/what\\_works\\_final\\_report\\_0.pdf](https://www.heacademy.ac.uk/system/files/what_works_final_report_0.pdf)
- [43] van Alten, D. C., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review*, 28, 100281. <https://doi.org/10.1016/j.edurev.2019.05.003>
- [44] Van der Kleij, F. M., Feskens, R. C., & Eggen, T. J. (2015). Effects of feedback in a computer-based learning environment on students' learning outcomes: A meta-analysis. *Review of educational research*, 85(4), 475-511. <https://doi.org/10.3102/0034654314564881>
- [45] Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard university press.
- [46] Wenger, E. (2009). Communities of practice. *Communities*, 22(5), 57-80. <https://doi.org/10.1017/CBO9780511803932>
- [47] Whitmer, B., & Daley, D. (2020). *Canvas LMS*. In Infrastructure.
- [48] Williams, B., Brown, T., & Benson, R. (2012). Feedback in the digital environment. In *Feedback in higher and professional education* (pp. 135-149). Routledge. <https://doi.org/10.4324/9780203074336-13>
- [49] Willis, J., Gibson, A., Kelly, N., Spina, N., Azordegan, J., & Crosswell, L. (2021). Towards faster feedback in higher education through digitally mediated dialogic loops. *Australasian Journal of Educational Technology*, 22-37. <https://doi.org/10.14742/ajet.5977>
- [50] Wise, S. L., & DeMars, C. E. (2005). Low examinee effort in low-stakes assessment: Problems and potential solutions. *Educational assessment*, 10(1), 1-17. [https://doi.org/10.1207/s15326977ea1001\\_1](https://doi.org/10.1207/s15326977ea1001_1)
- [51] Yang, M., & Carless, D. (2013). The feedback triangle and the enhancement of dialogic feedback processes. *Teaching in Higher Education*, 18(3), 285-297. <https://doi.org/10.1080/13562517.2012.719154>