Understanding student perceptions and engagement for formative assessment: A study of interactive online quizzes

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Introduction

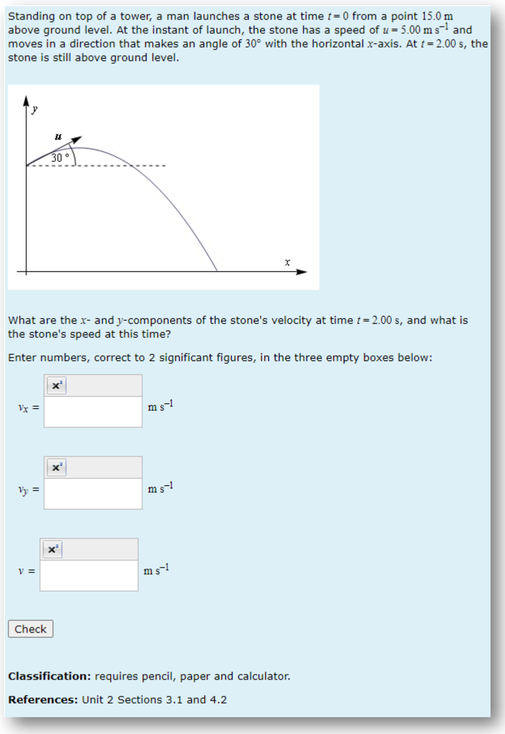
Formative activities are integral for student learning and students engaging with them are more likely to achieve success in summative assessments [1, 2]. However, engagement with optional activities by students can be low. **How should formative activities be incentivised?**

We investigated student engagement with, and perceptions of, interactive online quizzes on a 60 credit Level 2 core physics module.

- Quizzes are indirectly incentivised by reflective item in tutor-marked assignments (TMAs), quizzes carry no direct credit.
- 1 summative TMA, 25% of module grade.
- 5 formative TMAs, students must achieve a threshold to pass module.

Methodology

- Quantitative learning analytics data for 4 academic years investigated (2019/20 – 2022/23, 1900 students).
- Qualitative survey of 2022/23 student cohort (30 responses, 14% response rate).



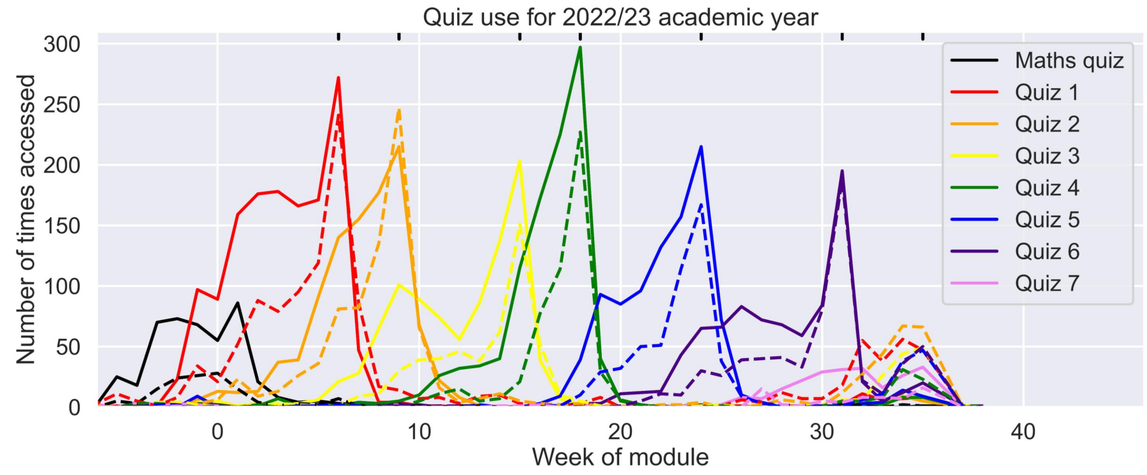
Example of an interactive online quiz question. Students receive immediate feedback on their answers.

When do students attempt quizzes?

Quiz access peaks coincide with TMA deadlines. Students largely attempt quizzes only when prompted by TMA items.

Less than 20% of quiz access occurs after the TMA deadline. Largely, students do not make use of quizzes for exam revision.

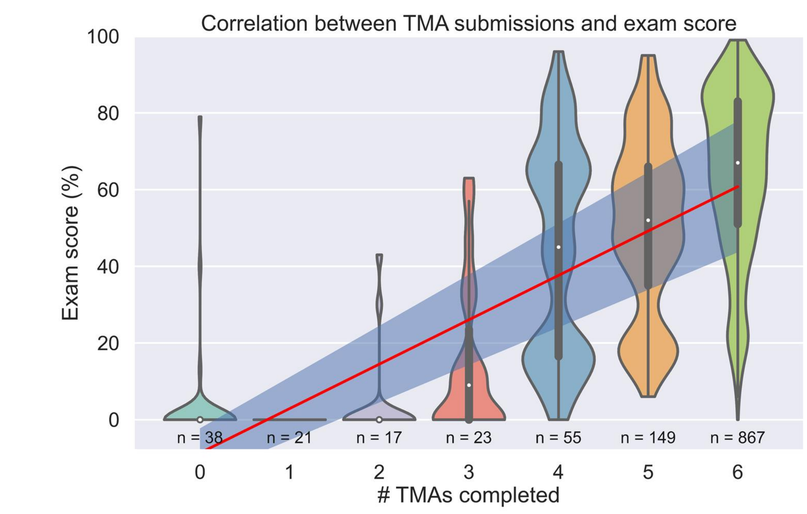
- **81% of students attempt at least 1 quiz.**
- **57% of students repeat at least 1 quiz.**
- **68% of quiz attempts are repeat attempts.**



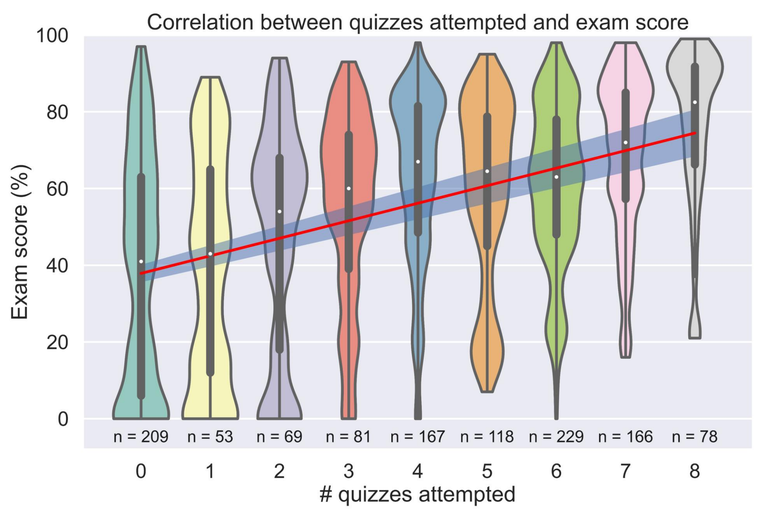
Quiz access instances for first attempts (solid lines) and repeat attempts (dashed lines) of quizzes. Black dashes along the top of the graph indicate the submission deadlines for the 6 TMAs and the exam date. Maths quiz and Quiz 7 do not have a corresponding TMA.

Is quiz use an indicator of exam success?

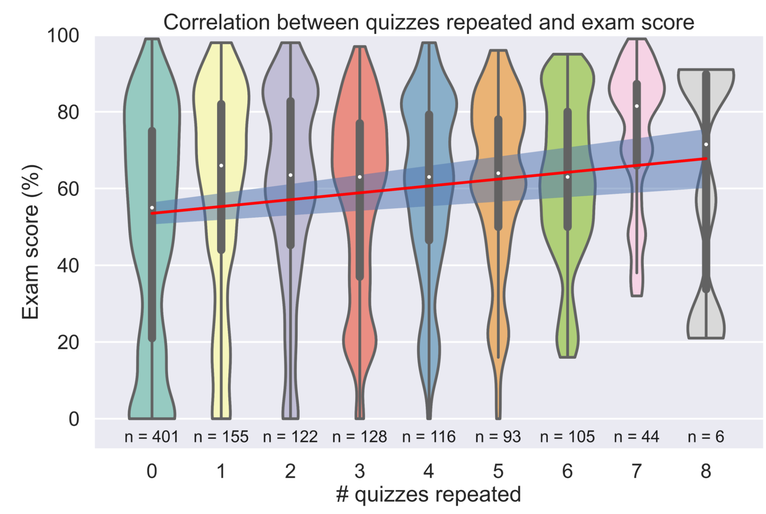
TMA completion rates, and quiz use and reuse were investigated as factors influencing exam success. Exam score shows a positive correlation with TMA completion, quiz use and reuse.



- Pearson's correlation coefficient: $r = 0.946$
- Gradient: $(12 \pm 2)\%\ \mathbf{TMA^{-1}}$



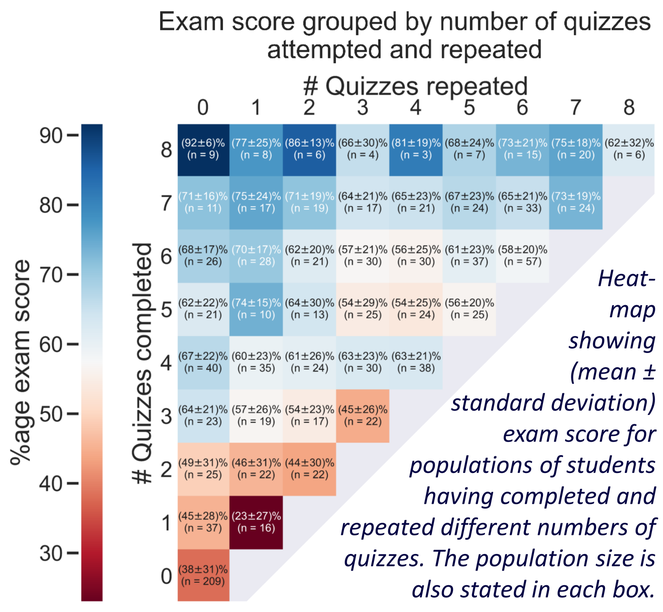
- Pearson's correlation coefficient: $r = 0.964$
- Gradient: $(4.6 \pm 0.5)\%\ \mathbf{quiz^{-1}}$



- Pearson's correlation coefficient: $r = 0.746$
- Gradient: $(1.8 \pm 0.6)\%\ \mathbf{quiz^{-1}}$

Violin plots showing the distribution of exam scores for student populations completing different numbers of TMAs (left), attempting quizzes (middle), and repeating quizzes (right). The white dot shows the median of each population and the population size is shown below each violin. Red line shows a straight line model fit to the underlying data, blue shaded region indicates the uncertainty in the model.

Quiz repetition behaviour in more detail



Heat-map showing (mean ± standard deviation) exam score for populations of students having completed and repeated different numbers of quizzes. The population size is also stated in each box.

Looking at the intersection between the number of quizzes attempted and the number repeated reveals a more complex behaviour.

There is an anticorrelation between quiz reuse and exam score, for a given number of quizzes completed.

For students completing fewer than 5 quizzes, quiz reuse does not appear to be an effective learning strategy.

For students completing 5 or more quizzes, light reuse seems to be optimal.

Why do students attempt quizzes?

An anonymous student survey was conducted between deadlines for TMAs 5 and 6.

The survey asked about students quiz use behaviours. 90% of respondents had completed all relevant quizzes up to that point of the module (Maths quiz and quizzes 1–5). Our sample consists of strongly self-motivated and highly engaging students.

Regarding enjoyment, 63% of respondents enjoyed the quizzes 'Quite a lot' or 'A great deal', with only 13% 'Not at all'.

Regarding difficulty of questions, 80% of respondents felt the difficulty was 'About right', 20% found the questions 'Too hard', and no respondents found the questions 'Too easy'.

In free-text comments, respondents remarked that attempting the quizzes was useful for revision (over 50% of respondents planned to repeat quizzes as part of their exam revision) but time consuming. Opinion was divided on the reflective task, with 50% or respondents finding it useful and 50% finding it not useful.

Conclusions

Studies by Kibble and Agnew, Kerr and Watt both found module credit of 1% per quiz yielded nearly 100% engagement whereas engagement was approximately 50% without [3, 4]. 80% of students in this study engaged with quizzes, which suggests indirect incentivisation through reflective items in other assignments is an effective assessment strategy for engagement.

We found that quiz use and reuse are correlated with exam success. The effects are weaker than engagement with substantive tutor-marked assignments (TMAs), but can still have a significant effect. An intersectional analysis of quiz use and reuse shows a more complex behaviour than requires further investigation.

Our survey of student motivations revealed that the quiz difficulty is appropriate for the course, they are useful for revision despite the time commitment needed, and that students enjoy the quizzes. This indicates that the quizzes in this study are authentic assessment activities and valued by students, potentially contributing to the high levels of engagement [5].

References

[1] Rust, C., O'Donovan, B. & Price, M., 'A social constructivist assessment process model: how the research literature shows us this could be best practice', Assessment & Evaluation in Higher Education, 30(3), pp. 231–240 (2005).

[2] Jordan, S. & Butcher, P.G., 'Using e-assessment to support distance learners of science', in The GIREP-EPEC & PHEC 2009 International Conference, 17-21 Aug 2009, Leicester, UK (2010).

[3] Agnew, S., Kerr, J. & Watt, R., 'The effect on student behaviour and achievement of removing incentives to complete online formative assessments', Australasian Journal of Educational Technology, 37(4), pp. 173–185 (2021).

[4] Kibble, J., 'Use of unsupervised online quizzes as formative assessment in a medical physiology course: effects of incentives on student participation and performance', Advances in Physiology Education 31(3), pp. 253–260 (2007).

[5] Gikandi, J.W., Morrow, D. & Davis, N.E., 'Online formative assessment in higher education: A review of the literature', Computers & Education, 57(4), pp. 2333–2351 (2011).