Using Automated Feedback to Consolidate Lectures

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Discipline
Computing

Class Size
160

Feedback Approaches
Automated feedback, separating grades and feedback, feedforward.

Technologies
Moodle Quiz, Python.

Challenge & Aim

This case study concerns a technology-enhanced formative feedback intervention within the Digital Systems module taken by first year students of Computing and Multimedia Web Development at Dundalk Institute of Technology. Digital Systems introduces key concepts of logic, networking and system administration, interwoven with their related mathematical underpinnings.

The lecture is the key nexus aligning the constituent components. Assessment of the module is divided among practical exercises (45%), mathematics tests (15%) and a final examination (40%).

The challenge of consolidating quantitative concepts delivered in lectures was addressed by the provision of automated formative feedback using Moodle quizzes.

Evidence from the Literature

The large lecture class remains a key instructional method within higher education (Bertozzi 2016). Although efficient as an information transfer medium, the lecture can be pedagogically limited by its one-way nature (Felder and Brent 2005). However, a growing body of literature favours improving lectures in preference to their abandonment (Richardson 2008).

Proposed changes include active learning activities within the lecture itself (Revell and Wainwright 2009), many of which repurpose well-known classroom assessment techniques (Angelo and Cross 1988) as formative reinforcement tools providing feedback. Students also require empowerment towards self-regulated learning once they leave the lecture, and thus need accessible rapid feedback to assess and improve their performance (Nicol and Macfarlane-Dick 2006).

Technology-enhanced feedback tools now enable this level of feedback in large classes with minimal marginal increases in staff workload. In particular, the reported success of automated formative quizzes within Marketing (McKendrick and Markham 2007) suggested that a similar intervention could benefit *Digital Systems.* Technical subjects present a particular problem, as the inbuilt quiz engines in common VLEs cannot accommodate many quantitative questions of moderate complexity. However, combining the inbuilt quiz engine with custom scripting (Zeileis et al. 2012) could feasibly realise this aim.

Feedback Approach

I chose to pilot revision quizzes on three different areas of the material covered in Digital Systems during 2016/17 Semester 1: digital logic, electrical basics, and number bases. For each topic a new quiz was created on Moodle. Of the available delivery methods, the Adaptive Mode in Moodle was used to allow re-tries of each question, providing opportunities to improve performance (Nicol and Macfarlane-Dick 2006). As a formative intervention, the displayed score did not contribute to the module grade but acted as a gamified holistic performance metric.

To stimulate engagement with course material and promote dialogue with staff and peers, only the correct/incorrect indication was given during the quiz for each question.

The full solutions were withheld until the student finished the quiz. A score penalty of 33% for each incorrect try encouraged students to strive for first-time correct answers.

Question types were chosen to avoid multiple choice as much as possible, in favour of short answers and calculations to promote deeper engagement (Nicol 2007). The first two quizzes combined short answer, matching and quantitative questions, which were easily set up as calculated questions using spreadsheet-like formulas. When the student exited the quiz, they could immediately start a fresh new session to improve their overall score.

Feedback Approach

The third quiz involved hexadecimal and binary number bases, which are beyond the capabilities of Moodle's quiz engine. Moodle (and most other VLEs) can, however, import batches of questions from a text file in a relatively simple format called GIFT, as well as a more complex XML format. Handily, both of these can be generated using spreadsheet formulas or by more advanced scripting tools (Zeileis et al. 2012).

Having a programming background, I developed short Python scripts to generate approximately 200 variants of a number of questions in the GIFT format. These were then imported to separate categories in Moodle, and a Random Question was inserted into the quiz from each category.

Outcomes

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Data captured by Moodle reported engagement by students with the quizzes, with 61% of students accessing at least one quiz. The majority of students who attempted each quiz received scores in excess of 90% by their last recorded attempt.

Student Response

Student feedback was sought by means of a voluntary open-ended hardcopy survey, which posed the following three questions:

1. Did you use any of the three revision quizzes at all?
2. What aspects did you like or find useful about the revision quizzes on Moodle?
3. What aspects did you not like or find not to be useful?

The majority of students who completed the survey accessed the revision quizzes at least once. Positive aspects cited included the ease of use, opportunity to repeat the quiz and instantaneous feedback. Students suggested that the quizzes be extended throughout all areas of the course in the future.

Recommendations

- Start small and stay focused, choosing perhaps 1-3 areas of the curriculum that would benefit most from this intervention.
- Use your VLE's calculated question type for quantitative exercises, rather than manually creating multiple cases.
- Don't be limited by the calculated question type in your VLE. More complicated quantitative questions can be created offline using a spreadsheet (such as Microsoft Excel) or a script (such as in Python, R or MATLAB), and then uploaded.
- If you're not a technologist or programmer, seek help from someone competent in these tools.
- Use the reporting tools to target review of the key concepts where difficulty is evident.

References

Angelo, T. A. and Cross, K. P., 1988. Classroom assessment techniques. Jossey-Bass.

Bertozzi, C. R., 2016. Back to the Lecture. *ACS Central Science,* 2, 483-485.

Felder, R. M. and Brent, R., 2005. Death by PowerPoint. *Chemical Engineering Education*.

McKendrick, M. & Markham, P., 2007. Principles of Marketing Case Study Report. University of Strathclyde.

Nicol, D., 2007. E-assessment by design: using multiple-choice tests to good effect. *Journal of Further and Higher Education*, 31, 53-64.

Nicol, D. J. & Macfarlane-Dick, D., 2006. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in higher education*, 31, 199-218.

Revell, A. and Wainwright, E., 2009. What Makes Lectures Unmissable? Insights into Teaching Excellence and Active Learning. *Journal of Geography in Higher Education*, 33, 209-223.

Richardson, D., 2008. Don't dump the didactic lecture; fix it. *Advances in Physiology Education*, 32, 23-24.

Zeileis, A., Umlauf, N. and Leisch, F., 2012. Flexible Generation of E-Learning Exams in R: Moodle Quizzes, OLAT Assessments, and Beyond. Faculty of Economics and Statistics, University of Innsbruck.

Contact

If interested in finding out more about this approach or the technologies employed, please contact Peadar Grant at Peadar.Grant@dkit.ie. The author is happy to share the developed Python scripts to assist other practitioners.

Cite as;

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