Journal of Learning Development in Higher Education ISSN: 1759-667X
Issue 27 April 2023

Assessing the benefits of online formative assessments on student performance

Daniel King
Technical University Dublin, Ireland

Abstract

This paper investigates the impact of online formative assessments on students' performance in an introductory Accounting module. The online formative assessments were objective tests and a regression model was developed to test the relationship between formative assessment usage and exam performance. The statistical analysis shows a significant correlation between formative assessment usage and examination performance while controlling for different variables. These findings lead to the conclusion that formative assessments are useful tools that can support students' learning. Implications and recommendations for further research are covered.

Keywords: formative assessment; online assessment; objective tests; accounting; learning support.

Introduction

The Covid-19 pandemic resulted in the closure of many university and college campuses (Sangster, Stoner and Flood, 2020). The measures implemented to prevent the spread of Covid-19 resulted in many universities 'pivoting' online; replacing their on-campus activities with online teaching and learning. This transition to online teaching and learning was already underway but the pandemic accelerated this trend.

Online education environments are often associated with benefits such as increased accessibility and reduced education costs (Reyneke, Shuttleworth and Visagie, 2021). However, online education can also lead to significant challenges such as a lack of student engagement. This lack of engagement can be even more pronounced when a technically

difficult subject such as Accounting is being delivered online to non-Accounting students. As Opdecam and Everaert (2022) highlight, Accounting is a challenging subject, and without practice of the material, it is often difficult for students to master and retain the fundamental concepts and techniques.

This paper investigates the impact of formative assessment on exam performance in an introductory Accounting module. Formative assessments are focused on the development of learning (Vionea, 2018, p.10), they are broadly accepted as good classroom practice (Schildkamp et al., 2020), and are a highly valuable part of teaching (Einig, 2013). One of the key benefits of formative assessment is that it enables the gathering of evidence about student learning and can be used as a guide to support students (Schildkamp et al., 2020). However, findings show that some theories concerning the virtues of using formative assessments have yet to be revealed in practice (Wu and Jessop, 2018, p.1019). Also, given the growing view that formative assessments can be considered and described as mere ‘optional extras’ (McCallum and Milner, 2021) it is important to investigate their value.

Pachler et al. (2010) recommend a refocussed emphasis on online formative assessment while Vionea (2018) also upholds the value of using this type of formative assessments. In light of this evidence base, this paper aims to investigate the potential for online formative assessments to specifically support student learning. In this study the online formative assessments used were objective tests (tests that have a right or wrong answer so they can be marked objectively) which included multiple choice questions (MCQs) and arithmetic questions. Current Virtual Learning Environments (VLEs) allow for a variety of options in preparing and presenting both MCQs and arithmetic questions so these options were utilised.

Background

The study was carried out during the second semester of the 2020/21 academic year and involved first-year undergraduates enrolled on an introductory Accounting module as part of a larger Management degree programme. The students had commenced the undergraduate programme directly after completing their secondary education in May 2020. Only students who took the end of semester examination in May 2021 are included in the study and the introductory Accounting module is a core/compulsory module on the

Management degree programme. During this semester, the module was delivered entirely online and the biggest problem reported by students in relation to studying online was the level of stress experienced (Sangster, Stoner and Flood, 2020). The stress-inducing factors identified included the fact that there was no face-to-face interaction (as all teaching had moved online), the increased workload, and the lack of interaction with a 'university community'. Even without these issues, as Opdecam and Everaert (2022) observe, there is an abrupt transition between secondary school and higher education in terms of atmosphere and expectations.

It is particularly important to note that in this module the topics build upon one another in a sequential way. It is extremely difficult to comprehend a new topic if a topic covered earlier has not been fully understood. I believed that students would benefit from a structured study and revision regime to help them to progress. To address this issue, five online formative assessments were set up that corresponded to the five teaching units on this module's VLE. In using online formative assessments, I created a scaffold for the learning process and through feedback students could gain insight into their own learning progress (Voinea, 2018, p.8). The provision of a clear structure is of tremendous importance for students engaged in online learning (Sangster, Stoner and Flood, 2020) and the online formative assessments were set up so that students could take each one as many times as they required. In addition to the formative assessment, there were two summative assessments during the semester and a final summative exam at the end.

This paper investigates whether the use of the online formative assessments helped to increase students' performance in the end of semester exam and is carried out using data analysis and regression modelling. The investigation allows me to draw conclusions in respect to the impact of online formative assessments on students' performance in the summative exam.

Literature review

Assessment

Assessment is at the heart of formal higher education, it is a core component of effective learning and can be described as any process that appraises an individual's knowledge, understanding and skills (Gikandi, Morrow and Davis, 2011). According to Sambell (2016)

assessment exerts a major influence on students' approaches to study in higher education and can be used to effectively promote learning (Marriott and Lau, 2008). Educationalists are becoming more aware of the need for assessment tools, which could be used to actively promote and enhance learning rather than merely to measure it via assessment and grading (Issac and Jacob, 2010).

Marriott and Lau (2008) point out that assessments can serve a variety of purposes including evaluation, feedback, motivation, and student learning, and, according to Sambell (2016), assessment is an important factor in enabling students to develop as learners. Researchers have been advocating a shift in HE assessment culture so that assessment should be considered as a way to promote learning rather than simply to measure it and there is widespread recognition of the need for approaches to assessment which focus specifically on stimulating and improving student learning.

Summative assessment

Summative assessment is a formal method to evaluate learning through comparison with a standard or benchmark and often takes the form of a unit or module test. Marriott and Lau (2008) state that the compulsory nature of summative assessments means that they are often used as a performance indicator to gauge the learner's success in meeting the assessment criteria. Whilst well respected and widely employed, the summative nature of this type of assessment can conversely be regarded as having little intrinsic value when it comes to supporting learning. Summative assessment alone provides limited opportunity for student development or grade improvement as learning is essentially assessed through a single submission of work such as an end of semester exam.

Formative assessment

Formative assessment (also termed 'assessment for learning') can take place at any point within a course or module and it thereby provides students with feedback that can improve, accelerate, and enhance learning (Marriott and Lau, 2008). Formative assessment also provides lecturers with feedback on how topics and content are being received by their students. Across a variety of education settings, formative assessment is used as an effective classroom intervention for improving student learning outcomes.

Schildkamp et al. (2020) state that, although there is still no clear consensus on what the term ‘formative assessment’ encompasses it is broadly accepted as good classroom practice for teachers. The core unifying characteristic of formative assessment is the focus on gathering evidence about student learning and using this evidence to guide further development. Schildkamp et al. (2020) argue that formative assessment is a key component in the support of student learning and that the provision of feedback is crucially important (Gipps, 2005; Einig, 2013; Schildkamp et al., 2020). Ozan and Kincal (2018) argue that formative assessment is at the very centre of the concept of feedback. Formative feedback is information transmitted to students that allows or encourages them to improve their learning as they go. The outcome of any formative assessment should be one that ultimately helps improve learning by familiarising students with the levels of learning required, informing them about any gaps in their understanding, and providing feedback they can use to shape the direction of learning (Evans, Zeun and Stainer, 2014).

Formative assessments come in different forms and online assessments are becoming increasingly popular. Online assessments have the advantage that students can use them according to their own preferred ways of learning, e.g., take them in their own time, repeat them on multiple occasions, and receive feedback immediately. Gaining immediate feedback after each exercise is of utmost importance as this positively affects students’ engagement with the learning process (Blondeel, Everaert and Opdecam, 2022, p.310). Einig (2013) argues that feedback has the biggest impact on students’ learning when given directly after the assessment.

Online assessment

Advances in Information Technology (IT) are having a dramatic impact on the delivery and assessment of higher education courses with virtual learning environments (VLE) and computer aided assessments (CAA) now being commonplace (Marriott and Lau, 2008). Research by Einig (2013) and McNulty et al. (2015) found that participation in online formative assessments can have a positive impact on student performance and the literature shows that regular usage of online MCQs for assessment purposes are associated with improved examination performance (Massoudi et al., 2017). In higher education, however, emphasis continues to be placed on summative assessment with formative assessment receiving less attention, despite its crucial role in promoting and supporting student learning. Pachler et al. (2010) recommends a refocused emphasis on

online formative assessment in order to create learner and assessment centred learning environments.

Methodology

Introduction

This study uses data collected from the delivery of an introductory Accounting module during the second semester of the academic year 2020/21. During this year delivery was totally online and the students included in this study were first-year undergraduate Management students. The Accounting module logically divided into five units/topics (which were available to students on the VLE) and, to enhance student engagement, a series of five online formative assessments (based on objective tests) which aligned with the five topic/units of the module were developed. As highlighted earlier, there were also two summative assessments and a final examination.

Although the final examination was not based on objective tests, the objective tests used in the formative assessment were largely based on past examination questions that were adapted. This was to ensure that the formative assessments were well aligned and to help students feel prepared for their final examination. This type of alignment can lead to beneficial influences on student performance (Blondeel, Everaert and Opdecam, 2022, p.310). The students could attempt each formative assessment as many times as they wished and after each attempt the results were issued to the students as a percentage. Students also received detailed feedback on their tests alongside solutions to all the questions.

Impact on examination performance.

The VLE offers a range of tools to monitor students' use of the formative assessments and these tools were used to track which assessments were completed by individual students and whether there was a link between completion rates and exam performance. Furthermore, to assess the impact of formative assessments on results, a regression model was developed. In line with this paper's objectives examination performance ('Exam') was used as the dependent variable and to test the impact of formative assessments a variable called 'Form' was introduced. This variable took the value of '0'

(Form=0) if no formative assessments were attempted up to a value of '5' (Form=5) if all the formative assessments were attempted.

Other variables which could potentially have an impact on attainment were 'controlled' for in this study. Firstly, attendance at the weekly lectures was included in the model. All first-year undergraduate students had their attendance monitored by the university as it is believed that attendance has an impact on engagement and examination performance. Therefore, a dummy variable 'Attendance' is included in the model. Secondly, it is likely that prior academic achievement could have an impact on the examination performance (Potter and Johnston, 2006; Opdecam and Everaert, 2022). The students had not studied accounting before coming to university, so the average of their first semester results was used as a measure of academic performance. It was expected that students' results in the first semester would be closely correlated to results in the Introduction to Accounting module. To control for this, the variable PRIOR is included.

Finally, previous studies (Potter and Johnston, 2006; Opdecam and Everaert, 2022) have indicated that gender could have an impact on academic performance. This is a contested issue as some studies indicate no significant relationship between gender and performance (Byrne and Flood, 2008) yet others argue that gender has a significant effect on academic performance (Garkaz, Banimahd and Esmaeili, 2011). According to Opdecam and Everaert (2022) the differing impacts of gender on academic performance may be explained by the different learning approaches of the students' study effort and the format of the assessment. Therefore, a variable called 'GENDER' is included in the analysis to control for its potential effect. A value of '0' was included for male students and '1' for female students. Thus, the hypothesised model is as follows:

$$EXAM = \beta_0 + \beta_1 FORM + \beta_2 ATTENDANCE + \beta_3 PRIOR + \beta_4 GENDER + \varepsilon$$

Results/findings

Background information

During this semester, all teaching had moved online because of the Covid-19 pandemic. As can be seen from Table 1 below, 105 students sat the final exam, and the average mark (mean) was 59%. Of the 105 students 33 were male (31%) and 72 (69%) were

female. Attendance information was available for all 105 students as was prior academic performance.

Table 1. Descriptive statistics.

Variable	N	Min %	Max%	Mean	Standard Deviation
Exam	105	8	90	59	18.17
	N	%			
Male	33	31%			
Female	72	69%			
Attendance	105				
Prior Academic Performance	105				

Students use of formative assessments

As discussed, there were five online formative assessments which aligned with the five topics/units of the module. Table 2 shows the number of students completing each formative assessment throughout the semester. The first formative assessment was completed by 79% of the students however this dropped to 57% for the second and to approximately 47% for third and fourth formative assessments. The final formative assessment dropped to 39%. This pattern is consistent with other studies which also report declining usage of online formative assessments (Massoudi et al., 2017, p.15).

Table 2. Number of students completing the formative assessments.

	Formative 1	Formative 2	Formative 3	Formative 4	Formative 5
Number of students attempting each formative assessment	83	60	49	50	41
Percentage of total attempting each formative assessment	79%	57%	47%	48%	39%

Regression results

The results of the regression analysis are presented in Table 3.

The t-test statistic was used to determine the correlation between the dependent variable (examination performance/EXAM) and the independent variables. A high t-value indicates a high correlation while a low t-values indicated low correlation.

A positive coefficient indicates that as the value of the independent variable increases the mean of the dependent variable also tends to increase and vice versa.

The results of the regression analysis indicate that formative assessment usage is indeed positively correlated to examination performance (t = 3.37; Coefficient = +3.74). As expected, prior academic performance also has a statistically significant positive impact on examination performance (t= 4.64; Coefficient = +86.3). Generally, any t-value greater than +2 or less than – 2 is acceptable therefore, gender (t = -0.85) and attendance (t = -1.16), seem to have little or no statistically significant influence on examination performance.

Table 3. Regression results.

$EXAM = \beta_0 + \beta_1 FORM + \beta_2 ATTENDANCE + \beta_3 PRIOR + \beta_4 GENDER + \varepsilon$

	Coefficients	*Standard Error*	*t Stat*
Intercept	3.744065599	10.53837526	0.355279206
Formative Attempts	3.457610661	1.026349941	3.368841875
Attendance Grade	-9.620226822	8.262458438	-1.16432983
Prior Academic Achievement	86.30091766	18.58368954	4.643906555
Gender	-2.740137221	3.228503766	-0.84873286

To further investigate the association between formative assessment completion rates and grades in the final exam the correlation coefficient (r) between formative assessments attempts and mean/average mark in the final summative exam was calculated. As can be seen from Table 4, 15 students attempted only one formative assessment (Form = 1) and achieved an average mark in the final exam of 50.8%. 18 students attempted all five of the formative assessments (Form = 5) and achieved an average mark of 74.5%. Table 4 indicates a high positive relationship between formative assessment attempts and examination grade (correlation = 0.91). A slightly unusual result is that the 11 students who attempted no formative assessments (Form = 0) achieved a higher average grade than that achieved by the 15 students who attempted one formative assessment (FORM = 1). A further analysis revealed that four students out of the eleven who did not attempt any

of the formative assessments (FORM = 0) achieved relatively high grades and brought the average up.

Table 4. Range of grades in final exam.

Variables	N		Mean mark (%)
Exam	105		58.9
Formative Assessment Attempts			
Form = 5	18	17.1%	74.5
Form = 4	19	18.1%	65.3
Form = 3	18	17.1%	56.9
Form = 2	24	22.9%	52.2
Form = 1	15	14.3%	50.8
Form = 0	11	10.5%	51.6
N =	105	100%	

The correlation coefficient (r) between formative assessments attempts and mean/average mark in the final exam is 0.91.

Discussion and conclusion

Summary

This study has illustrated that formative assessments using objective tests can be effective learning tools. As the objective tests were based on past examination questions, the formative assessments were well aligned with the summative assessments and students were aware of what they had to do to succeed in the module. Also, the objective tests provided immediate feedback to students, which helped them to identify areas of weakness and helped to guide them in their studies.

In addition, this study indicates a high positive relationship between formative assessment attempts and examination grade, but it is important to point out that correlation does not imply causation. It is possible that hard working and engaged students would have

achieved high marks in the final examination even if they had not attempted the formative assessments. However, students generally value the features of online formative assessments, such as the provision of instant feedback, the opportunity to work at their own pace and the identification of areas in which they need to improve (Einig, 2013). Furthermore, Einig (2013) found that virtually all students perceived formative assessments as being useful while McCallum and Milner (2021) report that formative assessments encouraged students to work consistently throughout the semester. They also argue that if students perceive a benefit from the formative assessments, then this is likely to lead to greater engagement (McCallum and Milner, 2021).

In conclusion, formative assessments have been shown to be a useful support to students' learning and they provide a structured exercise regime that allows students to revise and practise the material discussed in the lectures.

Limitations

This study has some limitations, which are indicative of areas for possible future research. While the study resulted in some interesting findings and indicated a positive correlation between formative assessment attempts and examination performance, it is not possible to draw definitive conclusions as to whether or not there is a causal relationship between formative assessment and examination performance. Additional research into this area, such as the use of interviews or focus groups, could provide further insights into this relationship.

Another limitation is that this study controlled for three variables in the regression analysis: attendance, prior academic achievement, and gender. There may be further factors influencing students' performance that were not measured in this study such as personal motivation, effort, ambition, and so on. Also, it is impossible to identify which aspect of the objective tests led to the positive results. It could have been the formative feedback, or it could be that the formative assessments simply encouraged students to spend more time revising and practising the material.

Further research could thus attempt to identify additional factors influencing students' performance as well as further investigating the impact of objective tests as compared to

other types of formative assessment. It is possible that qualitative methods like interviews or focus groups could provide further insights and a deeper understanding of how students use objective tests to support their learning and to outline the specific aspects of these tests that students find particularly useful.

References

Blondeel, E., Everaert, P. and Opdecam, E. (2022) 'Stimulating higher education students to use online mid-term take-home tests', *Assessment & Evaluation in Higher Education*, 47(2), pp.297-312. https://doi.org/10.1080/02602938.2021.1908516.

Byrne, M. and Flood, B. (2008) 'Examining the relationships among background variables and academic performance of first year Accounting students at an Irish University', *Journal of Accounting Education*, 26(4), pp.202-212. https://doi.org/10.1016/j.jaccedu.2009.02.001.

Einig, S. (2013) 'Supporting students' learning: the use of formative online assessments', *Accounting Education*, 22(5), pp.425-444. https://doi.org/10.1080/09639284.2013.803868.

Evans, D., Zeun, P. and Stainer, R. (2014) 'Motivating student learning using a formative assessment journey', *Journal of Anatomy*, 224, pp.296-303.

Garkaz, M., Banimahd, B. and Esmaeili, H. (2011) 'Factors affecting Accounting students' performance: the case of students at the Islamic Azad University', *Social and Behavioural Sciences*, 29(2), pp.122-128. https://doi.org/10.1016/j.sbspro.2011.11.216.

Gikandi, J. W., Morrow, D. and Davis, N. E. (2011) 'Online formative assessments in higher education: a review of the literature', *Computers & Education*, 57, pp.2333-2351. https://doi.org/10.1016/j.compedu.2011.06.004.

Gipps, C. (2005) 'What is the role for ICT-based assessment in universities?', *Studies in Higher Education*, 30(2), pp.171-180. https://doi.org/10.1080/03075070500043176.

Issac, B. and Jacob, S. (2010) 'Effects of online MCQ tests on student learning', in Iskander, M., Kapila, V. and Karim, M. A. (eds.) *Technological developments in education and automation.* Springer, Dordrecht, pp.403-408.

Marriott, P. and Lau, A. (2008) 'The use of on-line summative assessment in an undergraduate Financial Accounting course' *Journal of Accounting Education*, 26, pp.73-90. https://doi.org/10.1016/j.jaccedu.2008.02.001.

Massoudi, D., Koh, S., Hancock, P. J. and Fung, L. (2017) 'The effectiveness of usage of online multiple-choice questions on student performance in introductory Accounting', *Issues in Accounting Education*, 32(4), pp.1-17. https://doi.org/10.2308/iace-51722.

McCallum, S. and Milner, M. (2021) 'The effectiveness of formative assessment: student views and staff reflections', *Assessment & Evaluation in Higher Education*, 46(1), pp.1-16. https://doi.org/10.1080/02602938.2020.1754761.

McNulty, J. A., Espiritu, B. R., Hoyt, A. E., Ensminger, D. C. and Chandrasekhar, A. J. (2015) 'Associations between formative practice quizzes and summative examination outcomes in a medical anatomy course', *Anatomical Sciences Education*, 8(1), pp.37-44. https://doi.org/10.1002/ase.1442.

Opdecam, E. and Everaert, P. (2022) 'Effects of a summer school on formative and summative assessment in Accounting education', *Journal of Accounting Education*, 58. https://doi.org/10.1016/j.jaccedu.2022.100769.

Ozan, C. and Kincal, R. (2018) 'The effects of formative assessment on academic achievement, attitudes toward the lesson and self-regulation skills', *Educational Sciences: Theory & Practice*, 18(1), pp.85-118.

Pachler, N., Daly, C., Mor, Y. and Mellar, H. (2010) 'Formative e-assessment: practitioner cases', *Computers & Education*, 54(3), pp.715-721. https://doi.org/10.1016/j.compedu.2009.09.032.

Potter, B. and Johnston, C. (2006) 'The effect of interactive on-line learning systems on student learning outcomes in Accounting', *Journal of Accounting Education*, 24, pp.16-34. https://doi.org/10.1016/j.jaccedu.2006.04.003.

Reyneke, Y., Shuttleworth, C. C. and Visagie, R. G. (2021) 'Pivot to online in a post-Covid-19 world: critically applying BSCE 5E to enhance plagiarism awareness of Accounting students', *Accounting Education*, 30(1), pp.1-21. https://doi.org/10.1080/09639284.2020.1867875.

Sambell, K. (2016) 'Assessment and feedback in higher education: considerable room for improvement?', *Student Engagement in Higher Education Journal*, 1(1).

Sangster, A., Stoner, G. and Flood, B. (2020) 'Insights into Accounting education in a Covid-19 world', *Accounting Education*, 29(5), pp.431-562. https://doi.org/10.1080/09639284.2020.1808487.

Schildkamp, K., van der Kleij, F., Heitink, M., Kippers, W. and Veldkamp, B. (2020) 'Formative assessments: a systematic review of critical teacher prerequisites for classroom practice', *International Journal of Educational Research*, 103. https://doi.org/10.1016/j.ijer.2020.101602.

Voinea, L. (2018) 'Formative assessment as assessment for learning development', *Journal of Pedagogy*, 1, pp.7-23. https://doi.org/10.26755/RevPed/2018.1/7.

Wu, Q. and Jessop, T. (2018) 'Formative assessment: missing in action in both research-intensive and teaching focused universities?', *Assessment & Evaluation in Higher Education*, 43(7), pp.1019-1031. https://doi.org/10.1080/02602938.2018.1426097.

Author details

Daniel King is lecturer in Financial Management at Technological University Dublin (TU Dublin). Lecturing in Financial Accounting, Management Accounting and Financial Management to undergraduate and postgraduate students in TU Dublin, he is also a year

tutor for the BA in Tourism Management. He is an external examiner for South East Technological University (SETU), the first technological university in south-east Ireland. Daniel has written and presented many papers in the areas of Financial and Management Accounting and Accounting Education at national and international conferences.

Licence