Scaffolded formative assessment: fit for purpose?

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Abstract

The existing assessment literature has a large consensus on the benefits of two key pedagogical approaches: formative assessment and scaffolding in assessment. This practical case study focuses on combining these approaches in a quantitative economics module, presenting the implementation of a scaffolded formative assessment. A key aspect of our study involves highlighting the disparity in structure between formative and summative assessments and emphasising the need to explain this contrast to students. The findings suggest that this practice of scaffolded formative assessment is a useful pedagogical tool for both theoretical and practical reasons. Our implementation produced positive student outcomes, improving their feelings of support and engagement, as well as their perceived knowledge and overall learning experience. Furthermore, we found that providing clear and explicit guidance is vital to enhance students' assessment literacy and for them to see the links between the different stages of their learning journey. This formative scaffolded approach has the potential for scalability and applicability in other quantitative and qualitative modules.

Introduction

In the ever-evolving landscape of higher education, fostering an environment that nurtures students' engagement, motivation, and overall learning experience is paramount to their success. In this context, educators need to explore different approaches, balancing pedagogical needs with practicalities and discipline-specific demands. In this case study, we present how we introduced a scaffolded formative assessment in an undergraduate quantitative module with the aim of enhancing students' attitudes towards learning, promoting engagement, and improving their assessment literacy.

The idea of *scaffolded formative assessment* is based (i) on empowering students to develop a comprehensive grasp of complex tasks by breaking them down into manageable steps or patches (Jumaat and Tasir, 2014 for the scaffolding part) and (ii) providing students with feedback before summative tasks (Norton, 2009 cited in Neustadt, 2012 for the formative part). Thus, the aim of a scaffolded formative assessment is to encourage students to approach tasks incrementally, allowing them to build upon their knowledge, skills, and understanding at each stage. This, in turn, should cultivate students' higher-order thinking skills and develop a more holistic vision of the learning process by enabling them to interpret and utilise feedback constructively.

After a brief literature review, we present the design and practical implementation of scaffolded formative assessments in a second-year quantitative economics module. Then, we explore the encountered benefits and challenges and discuss how assessment literacy can be developed through this approach. Thus, our aim is to contribute to the pedagogical literature on the advancement of effective assessment practices and the improvement of students' overall learning experiences.

Literature review

Formative assessments play a crucial role in amplifying and enhancing student learning, as discussed in the critical literature review by Kulasegaram and Rangachari (2018). The approach of these authors is particularly interesting, as they draw on the normative educational theories to focus on the personalisation of the learning experience through assessment for learning; arguing that formative feedback provides an opportunity to adapt behaviours before the summative assessment of learning. These conclusions are in line with the findings of Leeknecht *et al.* (2021), where authors emphasise that formative assessments serve as powerful motivators for students, encouraging them to engage in studying, fostering their awareness of acquired knowledge and identifying areas requiring further attention.

In addition, Weurlander *et al*. (2012) agree that formative assessment can be an effective tool for learning, but only if the formative feedback is supportive, time-appropriate, and forward-looking. We draw inspiration from this study both for our methodology, where we

focus on students' perception of their learning experience instead of attainment outcomes; but also from the findings, which underline that complementarity between different assessment and feedback methods is important. As Weurlander *et al.* (2012) compare two different assessment methods (individual essay and group oral presentation), they implicitly conclude that *how* the assessment(s) are scaffolded will influence both their perception and effectiveness.

Nicol and Macfarlane-Dick (2006) demonstrate that formative assessment and feedback support self-regulated learning in the cognitive, behavioural, and motivational aspects. A good feedback practice enhances clarity regarding the expectations for achieving good performance, including goals, criteria and expected standards. It facilitates the growth of self-assessment skills and reflective practices in learning, provides students with valuable and high-quality information about their own learning progress, and encourages meaningful dialogue among teachers and peers. By fostering collaborative learning and constructive discussions, it is an effective way to motivate students and cultivate positive self-esteem. Furthermore, the insights feedback provides into current performance levels equip teachers to shape and refine their instructional strategies to better bridge gaps for students.

Other studies have illustrated that formative assessments play a pivotal role in promoting continuous growth, engagement, and achievement of students: studies such as Rajaram (2011) and Peat and Franklin (2002) provide evidence of the effectiveness of formative assessments in students' learning and grades. Particularly, Rajaram (2011) investigated the efficacy of formative assessment techniques in an economics quantitative (econometrics) course. The learning gains of Rajaram's (2011) extensive formative assessment project are demonstrated by the positive changes observed in students' course grades.

Scaffolding in assessment is another strong option to improve students' outcomes and their assessment literacy. Here, scaffolding refers to the guidance and support from teachers and instructors to help students effectively achieve their learning goals (Jumaat and Tasir, 2014) and relates specifically to breaking a big task into bite-size blocks. The effectiveness of the scaffolding approach is demonstrated, for example by Kruiper *et al.* (2022). These authors describe a training programme based on formative assessment and scaffolding to effectively

implement formative assessment strategies in their practice. Their findings suggested that teachers reviewed the training positively and reported scaffolding theory as a useful addition. Kang *et al.* (2014) investigated the role of scaffolding in assessment tasks and showed that employing a strategic combination of scaffolding tools can effectively encourage students of all achievement levels to apply their knowledge in generating evidence-based explanations.

The same conclusion is reached by another study: Chen *et al.* (2022) describe the implementation of a *combination* of self and peer assessment. The authors develop scaffolding self and peer assessment (SSPA) with the aim of improving student assessment literacy. The key features of SSPA include a carefully timed progression from self to peer evaluation using a rubric and a set of online and face-to-face activities to guide students through the evaluation processes. The results of this study, based on a quasi-experimental setting with a quantitative data analysis, suggested that scaffolding enhanced assessment literacy levels. We draw inspiration from this example of the combination of different known elements; we note particularly the importance of the scaffolding design.

In summary, there seems to be general agreement that employing a combination of formative assessment and scaffolded assessment by introducing a *scaffolded formative assessment* is likely to improve student's performance (Rajaram, 2011; Faulk, 2007), engagement (Neustadt, 2012), knowledge and understanding (Tien *et al.*, 2021), sense of support (Jacoby *et al.,* 2014), and assessment literacy (Chen *et al.,* 2022). This constitutes the rationale behind the design of our interventions to explore whether this scaffolded formative assessment approach would have the desired outcomes in our particular setting. To our knowledge, this type of intervention is novel in an Economics module.

Background

Our case study relates to a relatively small cohort of second-year students studying in the Economics suite of programmes within a specific context of an overseas campus of a Russell Group University. This cohort faced the COVID-19 lockdowns during their previous academic instruction, which, in addition to other factors, led to significant gaps in quantitative skills. Our challenge was to address this gap and to improve students' experience. As illustrated in

Table 1, during their first year of studies, around 30% of this group of students failed Introduction to Mathematics, and 50% failed the Applied Economics and Statistics final exam, both core quantitative modules. In addition, more than 60% of the students failed the first test of the Econometrics module at the beginning of their second year. Thus, our intervention targeted the subsequent assessment in this module in an attempt to improve students' outcomes and learning experience.

This assessment consisted of a Stata coursework, which required students to retrieve country-level secondary data from an online database (e.g. OECD, World Bank, IMF), construct a statistical model to analyse a specific economic question and report and comment on their output for policy implications. Notably, constructing the required model necessitates sound quantitative skills, the foundations of which are taught in the aforementioned first year modules. The absence of a formative assessment for this Stata coursework, which accounts for 25% of the overall grade, has highlighted the need for additional support to improve students' performance and prospects for success. The details of the intervention design and evaluations are described in detail in the next section.

MODULE	ASSESSMENT	WEIGHT	AVERAGE MARK	PASS/FAIL[10]
INTRODUCTION TO MATHEMATICS	Problem Set	0.25	40.5	> 30% fail
	Problem Set	0.25	60.1	> 10% fail
	Final Exam	0.50	67.5	> 20% fail
APPLIED ECONOMICS & STATISTICS	MCQ Test	0.25	44.08	> 40% fail
	Excel Problem Set	0.25	43.73	> 30% fail
	Final Exam	0.50	32.01	> 50% fail
ECONOMETRICS	MCQ Test	0.25	37.51	> 60% fail

Table 1: Summary of students' performance in the quantitative modules (prior to intervention)

In addition, as this cohort struggled with the required quantitative skills, they felt overwhelmed by the content of the module, as well as the pace of block teaching. This was

[10] "Fail" indicates fail at the first attempt; students had the opportunity to re-sit the module in the supplementary period.

reported by students on different occasions during office hours, personal tutoring meetings, and other informal interactions. There was also a pervasive sense of lack of support among the students and a low engagement with the computer labs that are an integral part of the module, witnessed by the module leaders. Recognising these challenges in addition to the lack of formative assessment for this type of coursework motivated the module leaders to introduce additional support for the students.

The above sets out the broad context of the initial intervention: the challenge was to improve students' engagement, performance, and sense of support without having to change the overall assessment design or module syllabus. These practical considerations led to reviewing pedagogical scholarship (as discussed in the previous section) in the search for existing approaches which would enable us to address this goal within our constraints. Introducing a formative assessment did not require any formal structural changes; scaffolding provided the required level of flexibility to adjust the first task to the students' level. The results and reflections on our approach may be of practical use to colleagues facing similar challenges and constraints.

Design of the interventions

The scaffolded formative assessment was implemented as an intervention in two distinct instances for the same cohort. This was possible as the design of the programme is such that the second-year cohort is split in two: depending on their pathway, some students take the Econometrics module in the first term, while others take it in the second term. This particularity enabled us to run our initial intervention in the first term, collect feedback from students, apply changes to our design accordingly; and then implement the improved intervention again in the second term.

The initial implementation involved breaking down the one task posed in the summative coursework (1000-word report on data analysis of a specific economic problem), into twelve independent formative tasks or questions. Therefore, the *apparent format* of the summative and the formative tasks were *inherently different*.

This distinct structure was initially explained in the classroom, as well as in an online announcement, before introducing the formative assessment. Afterwards, we offered students the opportunity to self-evaluate their work on the formative tasks based on provided solutions. This was then followed by a session of peer feedback using the functionality of Padlet. While all materials were made available to students via a Virtual Learning Environment - (Canvas); the teaching and the feedback sessions took place in person.

Following the long-standing constructivist research tradition (similar to Weurlander *et al.,* 2012 as well as Ogange *et al*., 2018), we collected the data on students' perceptions of their experience, recognising that the data collection, particularly in the focus groups, was influenced by the context of interactions between students and module leaders as researchers. We gathered students' feedback on their experience of the formative assessment via an online questionnaire and in-person focus groups. The questionnaire asked students to select all options that applied to them from a provided list; the focus group discussion consisted of five follow-up questions. This primary data was collected with the ethical approval of the University of Birmingham, (ERN_2022-0687).

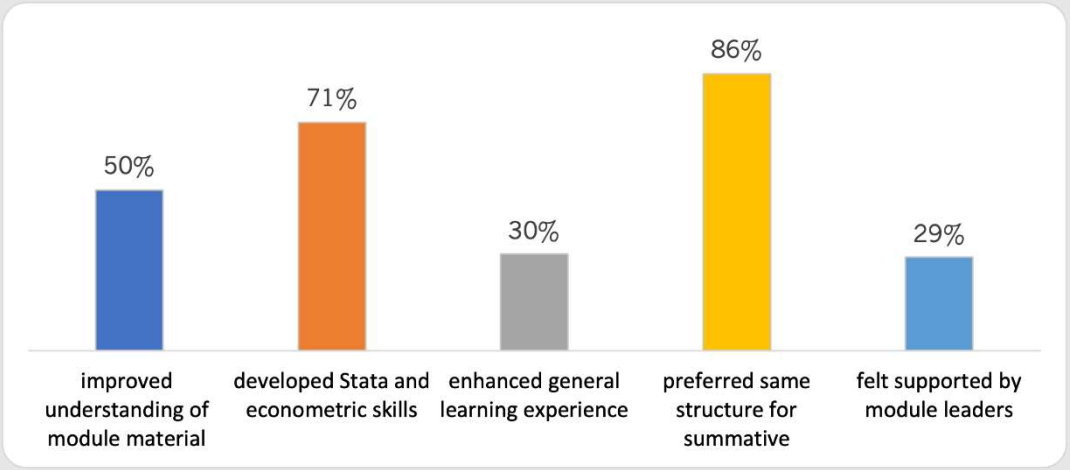

Figure 1: Results of the first online questionnaire

Note: students were asked to select all options that applied to them among the following (i) I felt supported by my module leaders prior to the summative coursework; (ii) I found that the answers have enhanced my understanding of the module material content; (iii) I would have preferred if the formative assessment had the same structure as the summative coursework; (iv) The formative assessment has improved my general learning experience; (v) The formative assessment has enhanced my use of Stata and general econometric skills, and (vi) None of the above. The % represents the share of respondents who have selected this option.

Figure 1 represents the results of the questionnaire (with a response rate of 78%) after the first intervention which reveals that our aim was achieved only in part. As self-reported, students' understanding of the material and their analytical skills were improved; however, the overall experience and feeling of support were not augmented. Students in the corresponding focus group (n=5) reported that they struggled to make connections between the two different assessment formats, highlighting the need for improvements and clarifications. Specifically, *students did not identify that the collection of twelve questions in the formative assessment represented the steps to answering the overall question* of the summative one.

Based on students' feedback and insights gathered from the initial focus group, several innovations and advancements were introduced to improve the effectiveness of the scaffolded formative assessment and to make it more fit-for-purpose. These improvements were introduced for the same module and assessment type in the second term, and included the following:

- *Bridging the Gap:* The scaffolding strategy was more explicitly outlined and explained to students during the formative feedback session before the release of the summative coursework. We emphasised the inherent difference in the structure of the formative from the summative assessment.
- *Connecting the Dots:* A clear mapping between each formative task (patch) and the overall summative coursework was provided. This mapping aimed to show students how each task contributed to their preparation for the coursework, helping them see the relation between the two assessments.
- *Making Time to Practice:* Students were given sufficient time to work on the formative tasks independently, allowing them to develop their skills and understanding at their own pace. This self-directed learning was meant to foster more autonomy.
- *Engaging with Feedback:* As students reported they preferred to work individually to avoid free-riding problems, but that they valued guided group discussions, structured instructor-led feedback sessions were introduced to facilitate and guide peer support. These feedback mechanisms helped students

gauge their progress and make improvements before the summative coursework.

	FIRST TERM	SECOND TERM
PERFORMANCE ON STATA COURSEWORK	57.6 (all pass)	57.5 (all pass)
ENHANCED UNDERSTANDING OF MATERIAL	57%	100%
IMPROVED GENERAL LEARNING EXPERIENCE	29%	83%
IMPROVED USE OF STATA AND ECONOMETRIC SKILLS	71%	100%
SENSE OF SUPPORT	29%	83%
PREFERRED SAME STRUCTURE	86%	33%

Table 2: Summary of students' performance and perceptions after the intervention

The feedback collected following the above-listed modifications showed that the incremental improvements were successful. Table 2 illustrates this by presenting the results of the same questionnaire, run after the first intervention (in the first term with a response rate of 78%) and the second one (in the second term with a response rate of 86%). Notably, all students in both iterations have passed the coursework, showing remarkable improvement from their first year. However, there is no marked difference between the performance after the first and the second iteration as the re-design of the intervention was not aimed at the content or performance improvement, but rather at addressing students' feedback.

In this context, the results in Table 2 highlight the evident difference in how students *perceived* the intervention and the additional support offered. Students' perceived understanding of the material, as well as their general learning experience, has significantly improved from the first to the second term. Furthermore, the additional materials provided had a positive impact on students' ability to apply the necessary skills effectively. More importantly, the data outlined a noticeably greater sense of support among students in addition to a substantial fall in the percentage of students who preferred a consistent structure for both assessments. The latter point highlights that more students were

convinced of the usefulness of the scaffolded (different) format of the formative assessment in preparing them for the summative coursework.

Together with the feedback from the focus groups, this indicates that the efforts to map more clearly the formative tasks to the summative coursework have contributed to a significant improvement in students' understanding of the overall assessment design and their perception of support during their learning process.

These findings provide useful insights into the effectiveness of scaffolded formative assessments and highlight areas for further exploration. By breaking down the summative coursework into component tasks, providing clear explanations and mapping, allowing independent practice, and offering feedback, students' understanding, quantitative skills, and learning experience were enhanced. We find that explaining the relationship between the formative and the assessment tasks, when structures are different, is crucial to successful implementation.

It is important to note that our findings and recommendations are drawn on the basis of a relatively limited case study, both in terms of student numbers and repeat iterations; the case is limited to one specific module. To substantiate these findings, such interventions need to be conducted and evaluated at a larger scale and across other disciplines.

Conclusions and recommendations

Overall, we have found that scaffolded formative assessment is an interesting and useful tool to consider for both good pedagogical practice and practical reasons. The practical reasons for implementing scaffolding in a formative, rather than in a summative assessment are: firstly, instructors may be constrained by the existing approved modules and assessment specifications which are usually more stringent and time constrained to change; and secondly, instructors are likely to feel freer to experiment with the design of a formative assessment, where the stakes for students are lower.

More importantly, there are sound theoretical foundations for a scaffolded formative assessment: it corresponds to the best practice principles discussed in the literature review.

Clarity of instructions, expectations, and feedback play a key role in this success. Taking this point further, subsequent practice and research could investigate whether the scaffolded approach could be taught as a skill for students to use going forward. In other words, by explaining to students how the big task was broken down into smaller steps, the scaffolding would be used beyond the specific content, as a transferrable skill, rather than simply the instructor's tool.

It is very important to underline that where the structures of assessment differ, as in our case between formative and summative assessments, instructors cannot take students' understanding of the links for granted. Rather, these links need to be explicitly explained and highlighted. We can take this conclusion further: students need clear guidance to see the links between different assessments within the same module and between modules. This issue of assessment literacy and the ability to interpret the feedback for future tasks is particularly challenging for large cohorts, where individual conversations with students require more extensive resources. However, the approach we propose is, at least in part, scalable. The explanations of links can be provided at a cohort level, within recorded or live materials.

More generally, students could be explicitly guided to look for and analyse the links between different assessments and tasks, particularly at higher levels of study. This type of reflection should be encouraged, rather than expected, especially at the entry level and for students from different educational backgrounds. Finally, we believe that these findings can be further extended and experimented with, to achieve longer-term effects with a focus on students' transferable skills and assessment literacy.

Acknowledgements

*We would like to express our thanks to colleagues from the ERiE group (Department of Economics, BBS) and colleagues at the HEFi 2023 conference (University of Birmingham) for their helpful feedback and comments on the initial versions of this work.

Note: the research on which this article is based was approved under the University Application for Ethical Review: ERN_2022-0687

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