

A Framework for Formative Assessments Co-Created with Students for Large Classes

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Abstract

Large university classes with diverse student cohorts pose persistent challenges for maintaining engagement, delivering effective assessment, and providing timely feedback at scale. This paper introduces a participatory approach to co-creating constructively aligned formative assessments with students as a direct response to these challenges, demonstrated through a very large, online, and asynchronous Data Literacy and Analytics (DLA) module across 15 programs at Dublin City University. The Formative Assessments Co-Created with Students (FACCS) framework guided the collaborative design of 500 interactive formative assessment questions with immediate feedback, involving students who had completed the module to ensure learner-aligned, inclusive design grounded in Universal Design for Learning (UDL). Reaching over 2,000 students annually, the approach demonstrates that co-creation is not only pedagogically sound but scalable across large, diverse cohorts. Post-implementation evaluation showed improvements in student engagement, metacognitive awareness, and summative assessment performance. The study offers a transferable, research-informed model for addressing the core challenges of engagement, assessment, and feedback that are amplified in large, online, asynchronous higher education contexts.

Keywords: *Large classes; Formative assessment; Co-creation; Students as partners; Microcurricula; Data Literacy and Analytics*

1. Introduction

Assessment can be understood as a systematic process of collecting, interpreting, and applying evidence about learning (NCCA: National Council for Curriculum and Assessment, 2023). It plays a foundational role in education by evaluating what learners know and can do, by guiding their learning through feedback and reflection. Assessment includes both formative and summative activities that may occur before, during, or after instruction (Watson, 2019), supporting learning as an ongoing process rather than functioning solely as a final evaluation. Assessment also provides students with an opportunity to actively engage in their learning throughout the module (Hanna & Dettmer, 2003).

Designing effective assessments for large and diverse learning environments presents a multifaceted challenge that involves aligning assessments with intended learning outcomes, deliberately embedding universal design principles, and leveraging technology appropriately while prioritising learners' needs (Farrell et al., 2021). Within the context of large, online, and asynchronous classes, formative assessment design and implementation is a complex endeavour (Broadbent et al., 2018; Hornsby, 2020). Consequently, effective practice demands intentional design approaches such as constructive alignment (Biggs, 2003; Kandlbinder, 2014), UDL (Buckland, 2012; CAST, 2018; Emmers et al., 2022; Farrell, 2021) and ABC learning design (Gormley et al., 2023) to ensure accessibility, alignment, and engagement at scale. In online asynchronous environments, student-centred, interactive, and transformative formative assessments, supported by timely and actionable feedback, are particularly important for sustaining participation and fostering meaningful learning. Despite growing interest in formative assessment and student partnership, there remains limited empirical work examining co-created formative assessment at scale in fully asynchronous, multidisciplinary higher education contexts, highlighting a need for context-sensitive, practice-informed research.

Responding to the gap, this paper describes the approach taken to design formative assessments in collaboration with students and outlines the framework underpinning the co-creation process. The study is guided by a pragmatic paradigm to explore both the implementation process and its outcomes across a large and diverse cohort. It presents insights from engaging students as partners in assessment design and reflects on lessons learned from implementing this approach in a large-scale, online, and asynchronous environment. By situating the design within a collaborative, research-informed framework, the study contributes practical and conceptual insights into how student co-creation can support inclusive, scalable, and pedagogically meaningful formative assessment in higher education.

2. Description of the Teaching/Learning Context

Data literacy represents a critical transversal skill for thriving in the 21st-century data-intensive academic, professional, and personal environment. Recognising this imperative, Dublin City University (DCU) initiated a comprehensive re-imagination of undergraduate education, positioning transversal skills development at the core of its pedagogical transformation (Abgaz & Dunne, 2023). As part of this strategic initiative, the *Data Literacy and Analytics (DLA)* module has been designed and implemented across 15 programs since 2022.

Table 1. Number of students and programs enrolled in the DLA module over time

Year	Number of enrolled students	No of programs
2022/23	805	10
2023/24	1924+	11
2024/25	2250+	15

The module employs an innovative microcurricula architecture (Abgaz, 2026; Abgaz et al., 2023; Abgaz & Dunne, 2023; O'Donoghue et al., 2014): seven core Data Literacy and Analytics Topics (DLATs) delivered through fourteen modular units (microcurricula), each allocated 0.5, 0.75, or 1.0 ECTS credits along with the corresponding content, discussion forums, formative and summative assessments. This structure enables both standalone delivery as a 5-credit module and seamless embedding of DLATs within other programmes' curricula. The microcurricula approach offers flexible pathways that accommodate diverse student backgrounds and programme requirements.

The module is managed by a single module coordinator, who is responsible for its design and implementation. Since all module content should be available to students from the start of the semester, before the beginning of a new academic year, the module coordinator updates the content, peer-learning activities, and formative and summative assessments. The module coordinator, along with two teaching assistants, runs synchronous lab sessions and drop-in clinics, and provides feedback on student discussion forums and peer learning activities. The coordinator further liaises with other module coordinators from other programmes who embed one or more microcurriculum in their modules.

The microcurricula approach enabled real-time tracking of pre- and post-module competency, participation, and completion progress, as well as formative and summative assessment results, for each microcurricula available to students and module coordinators.

Each module coordinator embedding the microcurricula has a localised view of this tracking data from the students enrolled in their module.

Student feedback collected at the end of each semester revealed that while lecture content and summative assessments were well received, students requested additional formative assessment opportunities to consolidate their learning, practice skills, and prepare for effective completion of the corresponding summative assessments. In response, the module coordinator invited students who successfully completed the module to co-create formative assessment questions that reflect their disciplinary background and study strategy, enabling us to directly embed student learning experience as part of the formative assessment component. This approach aimed to offer inclusive and diverse assessment practices, enhance active learning through immediate feedback, and promote metacognition by providing students with opportunities to reflect on their learning before summative assessments.

3. Literature Review

Formative and summative assessments are fundamental in higher education, supporting both ongoing learning and end-of-module evaluation (Boud & Falchikov, 2007; Boud & Soler, 2016; Koka et al., 2023). Formative assessment, especially in large classes, fosters self-regulation, reflection, and responsiveness to feedback, yet its delivery at scale is challenging due to the increased workload, resource, and expertise requirements (Broadbent et al., 2018). Deliberate design, guided by constructive alignment (Biggs, 2003; Biggs et al., 2022), inclusive assessment criteria (Björnsdóttir, 2017; O'Donovan, 2021), and UDL principles (Buckland, 2012; Emmers et al., 2022), is essential to address varied learning needs and support engagement in large classes at scale.

In large, asynchronous cohorts, early formative tasks help all students assess their understanding, reflect on strategies, and identify misconceptions, promoting metacognitive awareness and ownership of learning (Bakula, 2010; King, 2022). These assessments also generate evidence for learners and educators, facilitating early responsive interventions (Carnegie Mellon University, 2023; Ismail et al., 2022). However, large class sizes, disciplinary differences, and resource limitations often reduce the opportunity for personalised feedback and pose risks of disengagement (Neumann et al., 2002).

To address these challenges, co-creating formative assessments with students—rooted in social constructivist and connectivist (Siemens, 2005) theories—has emerged as a promising approach. Student partnership can help surface misconceptions, reflect authentic experiences, and create more inclusive, engaging assessments for large, diverse cohorts (Bovill et al., 2011; Cook-Sather & Loh, 2023; Mercer-Mapstone et al., 2017; Sudakova et al., 2022). Technology-mediated collaboration further enables scalable co-creation,

overcoming institutional and resource barriers (Llerena-Izquierdo & Zamora-Galindo, 2021; Unsworth & Posner, 2022). Co-created assessments not only support learning but also serve as diagnostic tools, enhancing engagement, inclusivity, and instructional responsiveness at scale (Goertzen et al., 2023).

In summary, the literature underscores the need for scalable, context-sensitive formative assessment in large asynchronous settings. However, structured frameworks for co-created assessment in such contexts remain limited. This study addresses that gap by examining our framework for Formative Assessments Co-Created with Students (FACcTS) as a research-informed model for designing co-created formative assessments that support engagement, metacognition, and learning performance in large classes.

4. The FACcTS Co-Creation Approach

This section outlines the co-creation approach and describes how the components of the FACcTS framework operationalise participatory formative assessment design in a large-scale asynchronous learning environment.

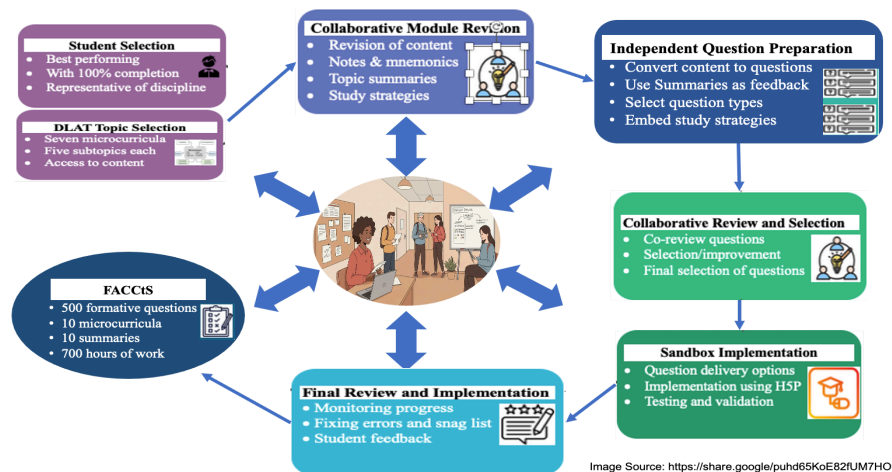


Figure 1. FACcTS Framework outlining the stages of formative assessment co-creation process.

4.1. FACcTS Framework

The FACcTS framework positions students and the module coordinator at the centre of the formative assessment design process. Students act as primary contributors to the creation of assessment questions, while the module coordinator assumes a facilitative role in the early stages and a quality assurance role in later stages (Figure 1). The six stages collectively operationalise the FACcTS principles by promoting learner agency, collaborative knowledge construction, iterative feedback, transparency in design, and scalable

implementation within a large online module delivered across multiple programmes at Dublin City University.

Stage 1: Student and Topic Selection. This stage involves the purposeful selection of student contributors from cohorts that previously completed the module. Selection criteria included engagement with interactive content, knowledge checks, peer learning activities, discussion forums, and summative assessments. High-performing students were invited to participate to ensure familiarity with module expectations and learning challenges; however, their contributions were complemented by broader student feedback gathered through module evaluations. Initial topic selection reflected enrollment distribution across programmes, resulting in seven core topics, later expanded to include three additional programming-focused areas. In the first cycle, four students who completed the 5-credit module from three programs participated intensively over a four-week period (cumulatively totalling 400+ hours of work) to ensure feasibility and depth of engagement. In the second cycle, two students participated in the design process following the same procedure. The number of students are kept small due to the limited budget and time available to the module coordinator.

Stage 2: Collaborative Revision. Participants collaboratively revisited module content with the goal of producing structured learning artefacts, including summaries, mnemonics, and documented learning strategies. Peer dialogue during this stage enabled participants to articulate disciplinary perspectives and identify conceptual difficulties experienced during their learning. Shared digital workspaces (Google Docs and Spreadsheets) supported collaborative refinement of outputs that informed subsequent assessment design.

Stage 3: Independent Question Preparation. Students collaboratively developed learning artefacts into formative assessment questions, incorporating immediate corrective feedback. Participants received targeted guidance on formative assessment design and were encouraged to use multiple interactive formats, including multiple choice, true/false, matching, and interactive task-based items. This stage generated an extensive pool of draft formative questions aligned with module learning outcomes.

Stage 4: Collaborative Review and Selection. Participants collectively reviewed draft questions to evaluate clarity, accuracy, relevance, and pedagogical value. This stage facilitated disciplinary dialogue, surfaced diverse learning strategies, and reduced redundancy through peer validation. The module coordinator subsequently conducted an academic quality review to ensure alignment with learning outcomes and assessment standards.

Stage 5: Sandbox Implementation. Validated questions were converted into interactive assessments using H5P and embedded within a sandbox environment on Loop (DCU's Moodle-based virtual learning platform). Participants received training in interactive

assessment authoring and in the design of immediate feedback before the implementation phase. Peer testing ensured fidelity between conceptual design and digital implementation.

Stage 6: Final Review and Live Implementation. The module coordinator conducted final validation of assessment alignment, technical accuracy, and integration within the learning environment. Students were acknowledged as co-creators and granted access to the final assessment resources prior to deployment.

4.2. Output and Impact

The implementation produced approximately 500 interactive formative assessment questions across two development cycles. These assessments were embedded as optional preparatory activities preceding summative assessment tasks. The co-created assessments incorporated immediate feedback mechanisms, supported self-regulated learning, and were designed to accommodate diverse learner needs in line with Universal Design for Learning principles.

A second development cycle extended the framework to programming-focused topics, generating an additional set of student-co-created formative assessments. Across iterations, the framework enabled scalable deployment across programmes and cohorts, while maintaining iterative evaluation through student feedback and performance analysis. This design–implementation–evaluation cycle supports continuous refinement of formative assessment practice within large asynchronous higher education contexts.

5. Analysis, Reflection and Implications

This section presents the findings and design reflections to examine the pedagogical contribution of the FACcTS framework as a co-created formative assessment model for large-scale, asynchronous online learning. Guided by a pragmatic mixed-methods design, quantitative indicators of performance and engagement were analysed. A standard t-test is used to compare the results of students ($N = 2190$) who completed FACcTS against those who did not, across the seven DLATs. Completion of FACcTS across the seven DLATs varies, with a mean completion rate of 17.2%, ranging from 9.2% in DLAT7 to 26.6% in DLAT4. Further qualitative data collected using the annual survey is also analysed using structured thematic analysis (Braun & Clarke, 2006) to provide a context-sensitive understanding of impact.

The results show that implementing FACcTS was associated with improved performance across five of the seven DLATs, with statistically significant gains in two DLATs and increased engagement across all seven DLATs, with significant improvement in four DLATs. Students who engaged with the formative assessments demonstrated greater persistence in completing summative tasks through repeated attempts. Qualitative findings

contextualised these outcomes by indicating that students perceived the activities as supportive, motivating, and aligned with their learning needs. Interactive formats supported active knowledge construction and sustained participation. Thematic analysis further indicated enhanced metacognitive awareness, with students reporting improved recognition of knowledge gaps and readiness for assessment, as well as transfer of learning to assignments and subsequent modules. These findings position FACcTS as a pedagogically integrated framework supporting self-regulated learning, inclusivity, and scalable student partnership in online asynchronous environments.

Several implications arise. Sustaining and extending the co-creation model appears warranted, particularly through structured involvement of additional students to maintain peer relevance. Immediate, actionable feedback emerged as a key mechanism supporting learning gains, indicating the value of adaptive feedback and targeted explanatory resources. The flexible, self-paced structure supported self-regulation, though optional scaffolding and differentiated pathways may further optimise outcomes. Managing cognitive load remains critical; multimedia integration and earlier engagement may mitigate overload associated with dense content. While co-creation enhances relevance and engagement, implementation at scale requires ongoing attention to representational equity, academic oversight, and institutional constraints.

The evaluation identified several directions for further research. Future work will examine how student participation in assessment co-creation influences peer learning dynamics, self-regulated learning behaviours, and participation patterns in large, multidisciplinary cohorts. Additional investigation is required to determine scalable mechanisms for sustaining meaningful student partnership in assessment design.

The FACcTS methodology—particularly the structured involvement of high-achieving students in generating assessment tasks and peer-learning supports—offers a transferable strategy for programmes adopting large-scale asynchronous delivery. Beyond local implementation, the framework contributes to scholarship on inclusive and scalable assessment by demonstrating how co-created formative assessment can serve simultaneously as a learning support, a diagnostic mechanism, and a design strategy. The evaluation approach developed in this study provides a replicable model for examining the impact of co-created assessment in diverse higher education contexts.

5. Conclusion

This paper presents the design and implementation of co-created formative assessments using the FACcTS framework in a large-scale, online, asynchronous learning context. By integrating student perspectives into assessment design, the framework enabled the

development of peer-relevant, interactive learning tasks that supported self-regulated learning and facilitated knowledge transfer across the DLA curriculum.

Beyond measurable outcomes, the study highlights the pedagogical value of positioning students as partners in the assessment design process. Co-creation functioned not only as a design strategy but also as a mechanism for improving inclusivity, responsiveness, and authenticity in large and diverse online asynchronous environments. At the same time, the findings underscore the importance of managing cognitive load, sustaining meaningful feedback loops, and addressing scalability challenges when implementing collaborative assessment practices.

Overall, the FACcTS framework offers a transferable, research-informed model for integrating student partnership into formative assessment design in online higher education. Future research should further examine the long-term impacts of learning, participation dynamics, and scalable implementation strategies across disciplinary contexts.

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