Promoting Formative Assessment of Transversal Skills in Interdisciplinary Project-Based Learning: Exploring the Role of a Reflective Portfolio

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***Abstract* — Formative and shared assessment offers students feedback on the go *and* promotes self-regulation. When integrated with project-based learning (PBL), portfolios can structure the formative assessment of transversal competencies and support metacognitive development. However, reflective portfolios have not been studied in interdisciplinary settings. This article explores the role of an initial version of a reflective portfolio as a formative assessment that supports self-regulation of learning and the development of transversal competencies in interdisciplinary project-based learning. For this purpose, we first propose an assessment design using a digital portfolio for structured reflection. Second, we report an initial application of the design, adopting a qualitative case study at a master's programme of a higher education institution, involving 38 students from varied undergraduate backgrounds. Data were collected through written reflections and self-assessments of communication and teamwork competencies and subsequently analysed using thematic analysis and lexicometric analysis; self-assessment ratings were analysed descriptively based on their distribution across proficiency levels. The initial resulting themes indicate that students identified a lack of engagement and a disconnect between theory and practice as limitations in their prior educational experiences. Lexicometric analysis indicated the centrality of collaboration-related terms and suggested interest in the new formative experience. Finally, we discuss how the reflective portfolio may have supported metacognitive awareness in the interdisciplinary setting by creating structured moments for students to connect prior experiences to emerging challenges, including psychological safety, complementary strengths, and shared responsibility. These preliminary findings suggest that digital portfolios can help structure self-regulatory processes in formative assessment. As early-stage research reporting a first application of the design, the findings are preliminary and serve primarily to inform the refinement of the proposed assessment design.**

***Keywords* — formative assessment, digital portfolio, project-based learning, interdisciplinarity, higher education, self-regulation, metacognition**

I. INTRODUCTION

Formative and shared assessment has been consolidated as an approach to organising assessment systems in contemporary higher education [1], [2]. Unlike traditional assessment, which centres on classification and certification, formative assessment emphasises the use of assessment processes to improve student learning, enhance teaching practice, and develop teaching-learning processes [1]. Student participation in assessment processes, a central characteristic of shared assessment, has been shown to support self-regulation of learning and the development of professional competencies [2].

Portfolios emerge as an instrument for operationalising formative assessment [17], particularly in their digital version. A recent systematic review of 33 studies confirmed that ePortfolios facilitate observing, monitoring, sharing, and providing feedback on student learning, and that integrating them into formative assessment offers advantages despite implementation challenges [17].[1] The portfolio allows the documentation of the learning process, promotes systematic reflection, and evidences competency development over time [3]. When integrated with project-based learning (PBL) systems, the digital portfolio enhances the articulation between theory and practice and supports the development of personal and social competencies, so-called transversal competencies, for contemporary professional practice.

Project-based learning is a pedagogical approach that places students in front of authentic problems, requiring the mobilisation of knowledge from different areas to develop solutions [4]. In interdisciplinary programmes, this methodology is particularly relevant, as it enables the integration of diverse perspectives and the development of collaboration competencies within heterogeneous teams.

While the use of digital portfolios for formative assessment in PBL is well documented, few studies have examined how reflective portfolio instruments operate in interdisciplinary settings, where students must navigate diverse epistemological backgrounds and develop both personal and social competencies. This gap is particularly relevant given that interdisciplinary programmes require learners to integrate knowledge and methods across fields, a process that demands not only cognitive flexibility but also interpersonal skills that traditional assessment rarely addresses.

This article presents a formative assessment design based on a digital portfolio and its initial application in an interdisciplinary master's programme. The study explores how combining a digital portfolio with structured reflective instruments supports self-regulation of learning and the development of personal and social competencies in PBL contexts.

The digital portfolio in this study was designed to integrate a structured reflection on students' learning pathways as its first component. By inviting students to examine their prior educational experiences, conceptions of collaboration, and expectations for PBL, this initial reflection establishes a baseline for subsequent self-assessment and competency development. Analysing these reflections thus provides insight into how the portfolio functions as an opening tool for self-regulation from the beginning of the learning journey.

Specifically, it seeks to: (a) describe the developed assessment design; (b) analyse student perceptions about their learning pathways through thematic and lexicometric

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analysis; and (c) discuss the role of formative assessment in interdisciplinary contexts. This is early-stage research reporting the first application of the design: the analysis focuses on its student-facing components (structured reflections and self-assessments), while the educators' narrative feedback and portfolio usage are not yet studied.

II. RELATED WORK

The concept of formative assessment, introduced by Scriven [5] and developed by Black and Wiliam [6], refers to the use of assessment during the teaching-learning process to guide pedagogical decisions and promote learning improvements. It differs from summative assessment, which occurs at the end of a period and serves a classificatory function. Formative assessment is characterised by the systematic collection of learning evidence, the provision of constructive feedback, and the active involvement of students in the assessment process.

López-Pastor and Pérez-Pueyo [1] propose the concept of formative and shared assessment as an integrated system that articulates three dimensions: (1) improvement of student learning processes; (2) continuous professional development of teachers; and (3) enhancement of teaching-learning processes. The "shared" character emphasises active student participation in assessment processes, including self-assessment, peer assessment, and co-assessment with the teacher. This participation is not merely instrumental; it constitutes a learning opportunity in itself, as students develop critical capacity and awareness of quality criteria.

Research over the last three decades has shown that formative assessment, when properly implemented, supports student learning and academic performance [2]. Mechanisms by which formative assessment promotes learning include clarification of criteria and expectations, provision of guiding feedback, activation of self-regulation, and development of metacognition [7]. Hattie and Timperley [8] propose a model of feedback based on three questions: where am I going? (feed up), how am I going? (feed back), and where to next? (feed forward). This tripartite model provides a framework for understanding how feedback functions as a regulatory mechanism within formative assessment systems.

In higher education, implementation of formative assessment faces challenges such as large class sizes, academic cultures oriented towards grading, and resistance from both teachers and students accustomed to traditional models [9]. Nevertheless, experiences documented across different contexts and areas of knowledge demonstrate the viability of this approach when institutional conditions support its implementation.

A. Digital Portfolio as a Formative Assessment Instrument

The portfolio consists of an organised collection of works and reflections that document the student's learning pathway over time [3]. More than a product repository, the portfolio serves as a space for reflection on the learning process, allowing students to connect experiences, identify strengths and areas for development, and set goals for future learning. Paulson, Paulson, and Meyer [10] define the portfolio as an intentional collection of student work that demonstrates effort, progress, and achievement.

In its digital version, the portfolio incorporates the possibilities of information and communication technologies, allowing the integration of multiple media, online collaboration, and ubiquitous access to materials [11]. The digital portfolio also supports the creation of non-linear connections between different elements, enabling a more comprehensive representation of the learning process. Additionally, its digital nature facilitates continuous updating, selective sharing, and long-term preservation.

Zubizarreta [12] highlights three components of the learning portfolio: documentation (learning evidence), reflection (critical analysis of the process), and collaboration (dialogue with mentors and peers). These components articulate in a continuous cycle of evidence collection, learning reflection, and new goal setting, constituting a mechanism of self-regulation. Reflection, in particular, is the element that distinguishes the portfolio from a mere archive of works, giving it pedagogical value.

Different portfolio typologies have been proposed in the literature. Klenowski [3] distinguishes between learning portfolios (focused on process), showcase portfolios (focused on displaying achievements), and assessment portfolios (focused on providing evidence for judgement). For formative assessment purposes, the learning portfolio is particularly relevant, as it emphasises the development process and not only the final products.

B. Self-Regulation of Learning

Self-regulation of learning refers to the processes by which students activate and sustain cognitions, affects, and behaviours systematically oriented towards achieving learning goals [13]. Cyclical models of self-regulation include phases of planning/forethought (strategic planning, involving goal and strategy setting, and self-motivation), monitoring/performance (self-control and self-instruction), and evaluation/self-reflection (self-reaction and self-judgement). Self-regulated students are characterised by taking active responsibility for their own learning, using metacognitive strategies to monitor and adjust their efforts.

Panadero, Jonsson, and Botella [2] reviewed evidence on the relationship between formative assessment and self-regulation, identifying that instruments such as rubrics, self-assessment, and portfolios support the development of self-regulatory competencies. The portfolio, in particular, promotes systematic reflection on one's own learning process, a central element of self-regulation. Self-assessment, when accompanied by clear criteria and feedback, contributes to the development of evaluative judgement.

In interdisciplinary contexts, self-regulation takes on additional complexity, as students need to navigate among different epistemological and methodological traditions and disciplinary languages. Repko and Szostak [14] argue that interdisciplinary work demands competencies such as the capacity to recognise and integrate diverse perspectives, deal with ambiguity, and build syntheses that transcend isolated disciplinary contributions. The portfolio, by structuring reflection across these boundaries, may serve as a mediating tool for developing such integrative capacities.

III. MATERIALS AND METHODS

This research adopts a qualitative case study design [15], focusing on the implementation of a formative assessment system based on a digital portfolio in an interdisciplinary master's programme. The study context is a higher education institution in Austria that adopts a pedagogical model centred on combining project-based and interdisciplinary learning in computing.

Thirty-eight participants were enrolled in the second semester of the master's programme in 2025. Students have diverse undergraduate backgrounds, including computer science, engineering, design, social sciences, and the

humanities, which characterise the programme's interdisciplinary profile. The curriculum is organised around projects, in which interdisciplinary teams work on authentic challenges using Design Thinking. Each project cycle lasts 6 weeks, during which students work in teams of four to six members under the guidance of a project educator.

The developed assessment design distinguishes between formative and summative assessment. Personal competencies (self-directed learning, self-reflection, adaptability, time management, initiative) and social competencies (collaboration, communication, conflict resolution, interdisciplinary mindset, feedback) are assessed through the digital portfolio: formatively, through narrative feedback provided by coaches and educators during the project, and summatively, with numerical grades at the end of the project. Technical and methodological competencies are assessed separately and assigned grades; they are outside the scope of this study, which focuses on transversal competencies.

The designed assessment process follows five stages as shown in Fig. 1: (1) continuous collection of evidence by the student; (2) creation of a portfolio snapshot at each milestone and at the end of the project; (3) review of each snapshot by the educator; (4) elaboration of narrative feedback; and (5) student reflection and establishment of new goals. Mandatory portfolio elements include self-reflection on learning, reflection on collaboration, evidence of peer feedback, goal updates, and selected artefacts, which together comprise 500–800 words.

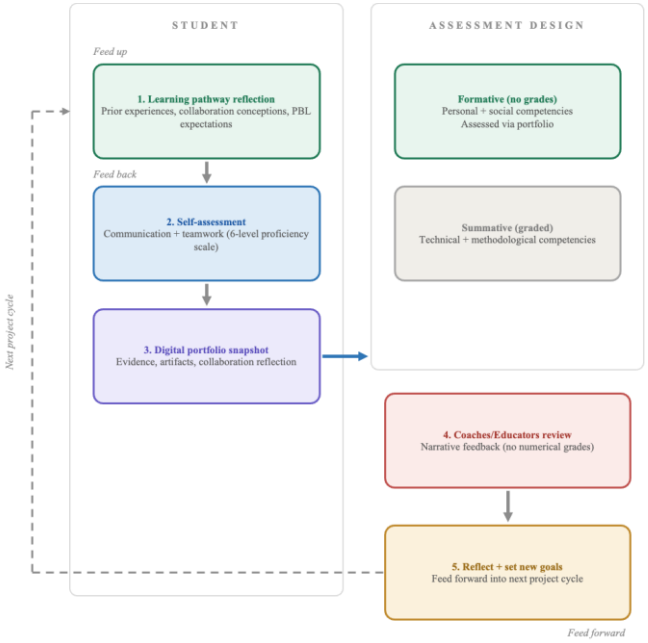


Fig. 1. Portfolio-based formative assessment cycle.

The five stages map onto Hattie and Timperley's [8] feedback model (Feed Up, Feed Back, Feed Forward) and Zimmerman's [13] self-regulation cycle. The dashed arrow indicates that goals from one project cycle inform the next reflection, creating a continuous developmental trajectory.

A. *Ethical Considerations*

This study analysed written reflections collected as part of regular coursework activities, in which students are identifiable for grading purposes. For research purposes, all reflections were anonymised prior to analysis: names and potentially identifying references were removed, and each reflection was assigned a code, so that no personally identifiable information was processed in the research analysis. Under the EU General Data Protection Regulation (GDPR, Recital 26), anonymised data falls outside the scope of data protection legislation. In accordance with Austrian regulations and institutional policy, formal ethics committee approval was not required for this study. All participants were informed that their anonymised reflections could be used for research purposes focusing on course improvement. Student reflections are reported as paraphrased excerpts rather than verbatim quotations: wording was altered and potentially identifying details were removed to prevent re-identification while preserving the original meaning. This procedure follows established guidance for protecting respondent confidentiality when reporting qualitative data [18], [19], [20].

B. *Instruments and Analysis Procedures*

Two instruments were integrated in the implementation of the digital portfolios and analyses for this study: written reflections on learning pathways and self-assessments of communication and teamwork competencies. The reflection asked for responses to four questions about challenges in traditional teaching, prior experiences, conceptions of collaboration, and expectations for PBL. The self-assessment used a six-level proficiency scale.

Written reflections were examined following the thematic analysis [16] to identify recurring themes. Self-assessment ratings were analysed descriptively, based on the distribution of responses across the proficiency levels. Lexicometric analysis was conducted to detect semantic patterns in the textual corpus. This included word cloud generation to visualise the most frequent terms, similarity analysis to map co-occurrence networks among terms, and categorisation of terms into topical categories based on aggregated frequency to identify the dominant orientations in student discourse.

IV. RESULTS AND DISCUSSION

Analysis of reflections from 38 students identified three main themes: (1) critiques of traditional teaching and recognition of experiential learning; (2) conceptions about collaboration and teamwork; and (3) expectations and strategies for project-based learning. These themes are presented below, followed by the results of lexicometric analysis.

A. *Critiques of Traditional Teaching and Recognition of Experiential Learning*

Students identified a lack of engagement and a disconnect between theory and practice as recurring limitations in their prior educational experiences. Lack of interactivity emerged as a recurring theme, associated with difficulty in sustained engagement and motivation. One student, for instance, described how staying engaged in lecture-based settings was difficult because learning revolved mainly around listening, taking notes, and memorising for examinations. Another, arriving from a bureaucratic educational model, described the first weeks in the programme as a contrast with that background, one that renewed their motivation to pursue a project-based path. A third student anticipated a cascading effect in which active involvement in one's own learning would strengthen motivation and, in turn, retention.

The disconnect between theory and practice was frequently mentioned. Students reported that traditional settings offered limited opportunities to apply knowledge to concrete situations, resulting in surface-level learning oriented

towards examinations rather than understanding. The contrast reported upon entering the programme suggests that the paradigm shift is perceived when the assessment and learning environment are deliberately restructured. These perceptions are consistent with critiques of the transmissive model documented in the literature [4].

Students arrived at the programme with varied repertoires of experiences: e.g., some learned through experimenting, learning by doing, and interacting with others in professional contexts, even when their formal education was predominantly traditional. The portfolio, by prompting reflection on these previous experiences, allows students to recognise and value experiential learning. This process aligns with the self-regulation framework proposed by Zimmerman [13], in which the forethought phase involves activating prior knowledge and setting goals based on past experience.

B. Conceptions about Collaboration and Teamwork

Reflections indicated conceptions of collaboration that go beyond task division, emphasising psychological safety, complementary strengths, and shared responsibility. One student framed good collaboration as setting oneself aside and putting the collective first, stressing that teamwork requires the freedom to voice ideas and viewpoints openly and to feel safe in doing so. Another emphasised that effective teams recognise members' different strengths and weaknesses and, rather than forcing everyone into a single mould, seek to match complementary strengths to different tasks. A third student described the decision to devote the first week to team-building activities as a worthwhile investment, after which team members communicated openly and asked for help when needed.

These conceptions align with the literature on collaborative competencies in interdisciplinary contexts [14], which emphasises the importance of creating psychologically safe environments in which diverse perspectives can be integrated. Students recognised that diversity within teams enriches both collective results and individual learning. The complementarity between members with different skills was highlighted as a factor that supports both project outcomes and personal development.

The collaboration contract, in which team members collectively define expectations, roles, and communication norms, functions as a formative and shared assessment instrument within the portfolio system. By involving students in defining the criteria by which their teamwork quality will be evaluated, the contract puts into practice a central principle of shared assessment: student participation in constructing assessment parameters [1] that are used by both students and teachers in formative assessment. Many students reported that negotiating the contract helped them establish shared values, surface implicit assumptions about collaboration, and understand each member's goals, creating a foundation for effective collaboration that could be revisited throughout the project.

C. Expectations and Strategies for PBL

Students expressed expectations oriented both towards tangible outcomes and the iterative development process. One student expected to leave the project with demonstrable skills, emphasising the desire to be able to do something rather than merely understand it. Another recalled entering the programme with a fixed idea of the fields to explore, but followed a professor's advice not to fixate on the final destination and to remain open to opportunities on the way. A third student anticipated that challenges would arise and planned to rely on previously successful strategies, such as staying organised, breaking large problems into smaller parts, and asking for help when needed.

The tension between outcome-oriented expectations, centred on demonstrable skills, and process-oriented openness to unforeseen opportunities reflects a productive tension that the portfolio-based assessment system is designed to address. By structuring reflection at multiple points in the learning journey, the portfolio allows students to revisit and refine their goals as their understanding of the interdisciplinary context develops.

D. Lexicometric Analysis of Reflections

Lexicometric analysis of the 38 reflections identified semantic patterns that complement the qualitative thematic analysis. Fig. 2 presents the word cloud generated from the textual corpus. The centrality of terms such as "learning" (208 occurrences), "team" (150), "collaboration" (139), and "project" (104) is observed, suggesting an emphasis on collaborative and experiential dimensions in student discourse.



Fig. 2. Word cloud of student reflections on PBL (n=38).

Similitude analysis, presented in Fig. 3, reveals the co-occurrence structure of the main terms. The graph shows that "learning" functions as the central node, with the strongest connections to "team" (188 co-occurrences), "collaboration" (178), and "project" (174). "Collaboration" in turn connects to "communication" (80) and "goals" (64), suggesting that students articulate collaboration not as an isolated activity but as a process mediated by communication and oriented towards shared goals.

The cluster formed by "challenges," "solving," and "project" indicates that problem-solving is discursively linked to the project context rather than to individual academic tasks. Similarly, the connection between "learning," "knowledge," and "understanding" on the lower portion of the graph points to a conception of learning as a process of meaning-making rather than information accumulation.

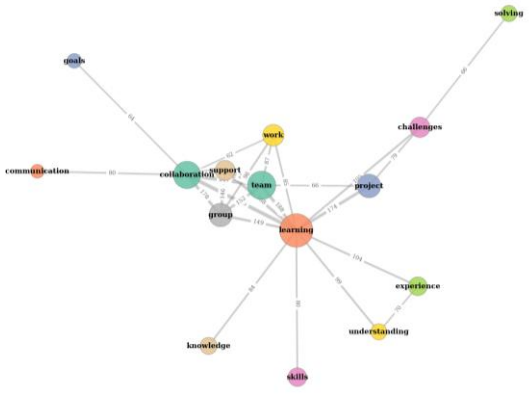


Fig. 3. Similitude analysis: term co-occurrence in reflections.

Fig. 4 presents the aggregated term frequencies by topical category. “Collaboration and Teamwork” presented the highest frequency (460 occurrences), followed by “Real-World Problems” (292), “Self-Regulation and Reflection” (173), “Communication and Feedback” (119), “Experiential Learning” (105), and “Critique of Traditional Teaching” (102).

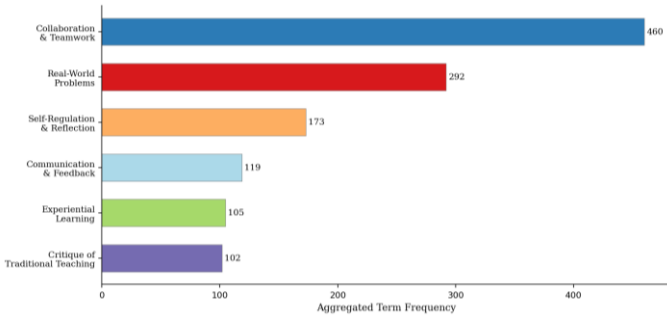


Fig. 4. Term frequency by topical category.

The distribution of topical categories shows that the “Critique of Traditional Teaching” category (102) is substantially lower than collaboration-oriented categories. This pattern indicates that students’ reflective discourse is predominantly forward-looking, oriented towards the new formative experience rather than retrospective critique. This observation has implications for portfolio design: reflection prompts that invite students to articulate expectations and strategies may generate richer data on learning processes than prompts focused on past shortcomings.

E. Structured Reflection in the Digital Portfolio

The digital portfolio design idea is to articulate different moments and types of reflection. The reflection on the learning pathway, conducted at the beginning of the journey, establishes a baseline by inviting students to examine their previous experiences and formulate expectations. This design incorporates self-regulation principles proposed by Zimmerman [13], creating structured opportunities for planning, monitoring, and self-assessment.

The absence of numerical grades for personal and social (transversal) competencies represents a deliberate choice, based on the understanding that formative assessment functions more effectively when unlinked from classificatory consequences [6]. Narrative feedback, oriented by proficiency descriptors, serves as the primary mechanism for communicating progress. This approach shifts the function of assessment from sorting students to supporting their development, consistent with the principles of assessment for learning articulated in the literature [7], [8].

F. Self-Assessment of Communication and Teamwork Competencies

In addition to written reflections, students completed self-assessments of their communication and teamwork competencies using a six-level proficiency scale (Not Yet Demonstrated, Basic, Intermediate, Advanced, Highly Advanced, and Not Applicable). These self-assessments, integrated into the digital portfolio, provide a quantitative complement to the qualitative reflections analysed above.

For communication competencies, students rated themselves highest on foundational skills such as information transmission and active listening (predominantly Intermediate to Advanced), whereas more complex skills, such as adapting communication styles to different contexts and registers, received lower self-ratings (predominantly Basic to Intermediate). This pattern suggests that students recognise a gap between basic communicative proficiency and the situated communication demands of interdisciplinary teamwork.

A similar pattern emerged for teamwork competencies. Students reported higher proficiency in core principles of teamwork and collaboration (Intermediate to Advanced) than in conflict management and professionalism under pressure (Basic to Intermediate). This finding is consistent with the qualitative themes identified in Section IV.B, where students emphasised psychological safety and complementary strengths but acknowledged limited experience with navigating disagreements constructively.

These baseline self-assessments guide a dual function within the portfolio-based assessment design: they provide students with a structured opportunity to evaluate their own competency levels (supporting self-regulation), and they establish a reference point against which teachers’ summative assessments and subsequent formative assessments can be compared across project cycles. The convergence between self-assessment patterns and qualitative reflection themes suggests that the portfolio instruments capture complementary dimensions of student awareness about their transversal competencies.

V. CONCLUSION

This exploratory study pursued three aims: (a) to describe a portfolio-based design for the formative assessment of transversal skills in an interdisciplinary master’s programme; (b) to analyse student perceptions of their learning pathways through thematic and lexicometric analysis; and (c) to discuss the role of formative assessment in interdisciplinary contexts. Regarding student perceptions, the reflections indicated critical awareness of the limitations of traditional teaching, conceptions of collaboration centred on psychological safety and complementary strengths, and expectations oriented towards both tangible outcomes and personal development.

Addressing the first aim, the proposed assessment design puts the principles of formative and shared assessment into practice by structuring a reflection that integrates evidence documentation, systematic reflection, and guiding feedback. The distinction between formative narrative assessment and summative numerical assessment is intended to allow each dimension to be assessed with appropriate instruments and criteria.

Lexicometric analysis indicated the centrality of collaboration-related terms in student reflections. Frequency analysis by topical category showed that collaboration-oriented themes were more frequent than retrospective critique in the reflective discourse, suggesting a forward-oriented reflective stance.

Addressing the third aim, the structured reflection in the digital portfolio created moments for students to connect prior experiences with emerging challenges, which may support metacognitive awareness. The digital portfolio, in this context, may function not only as an assessment instrument but also as a support for developing new learner identities in an interdisciplinary environment.

This early-stage study reports the first iteration of the proposed design; its results are preliminary and serve primarily to inform the refinement of the assessment design. The analysis covered the student-facing components of the design (structured reflections and self-assessments); no data were collected on the educators’ narrative feedback or on portfolio usage, so the formative assessment element was explored only in part. The first iteration also does not yet

permit an evaluation of the assessment system's longitudinal impact. The analysis is based on a single cohort and on reflections produced at one point in the learning journey. Future research should follow student development across multiple semesters, analysing how competencies evolve through successive cycles of reflection-action-feedback. It would also be relevant to investigate educator perspectives on the process of providing narrative feedback and the calibration challenges between different evaluators.

The reported experience provides inspiration for institutions seeking to implement formative assessment systems in project-based learning contexts. The combination of a digital portfolio, structured reflective instruments, and narrative feedback may help structure self-regulatory processes and support the development of transversal competencies in interdisciplinary programmes, provided that the assessment design deliberately separates formative from summative functions.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

M.D.C. designed the portfolio-based assessment system, collected and analysed data, and wrote the paper; C.B. co-designed the assessment system; S.D. contributed to the research design and reviewed the manuscript, supervised the implementation and research. All authors have read and approved the final version.

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REFERENCES

1. [1] V. M. López-Pastor and Á. Pérez-Pueyo, Coords., Evaluación Formativa y Compartida en Educación: Experiencias de Éxito en Todas las Etapas Educativas. León: Universidad de León, 2017.
2. [2] E. Panadero, A. Jonsson, and J. Botella, "Effects of self-assessment on self-regulated learning and self-efficacy: Four meta-analyses," Educ. Res. Rev., vol. 22, pp. 74–98, 2017. doi: 10.1016/j.edurev.2017.08.004
3. [3] V. Klenowski, Developing Portfolios for Learning and Assessment. London: RoutledgeFalmer, 2002.
4. [4] W. N. Bender, Project-Based Learning: Differentiating Instruction for the 21st Century. Thousand Oaks, CA: Corwin, 2012.
5. [5] M. Scriven, "The methodology of evaluation," in Perspectives of Curriculum Evaluation, R. W. Tyler, R. M. Gagné, and M. Scriven, Eds. Chicago: Rand McNally, 1967, pp. 39–83.
6. [6] P. Black and D. Wiliam, "Assessment and classroom learning," Assess. Educ., vol. 5, no. 1, pp. 7–74, 1998. doi: 10.1080/0969595980050102
7. [7] D. J. Nicol and D. Macfarlane-Dick, "Formative assessment and self-regulated learning: A model and seven principles of good feedback practice," Stud. High. Educ., vol. 31, no. 2, pp. 199–218, 2006. doi: 10.1080/03075070600572090
8. [8] J. Hattie and H. Timperley, "The power of feedback," Rev. Educ. Res., vol. 77, no. 1, pp. 81–112, 2007. doi: 10.3102/003465430298487
9. [9] D. Carless, Excellence in University Assessment. London: Routledge, 2015.
10. [10] F. L. Paulson, P. R. Paulson, and C. A. Meyer, "What makes a portfolio a portfolio?" Educ. Leadersh., vol. 48, no. 5, pp. 60–63, 1991.
11. [11] H. C. Barrett, "Researching electronic portfolios and learner engagement: The REFLECT Initiative," J. Adolesc. Adult Lit., vol. 50, no. 6, pp. 436–449, 2007. doi: 10.1598/JAAL.50.6.2
12. [12] J. Zubizarreta, The Learning Portfolio, 2nd ed. San Francisco: Jossey-Bass, 2009.
13. [13] B. J. Zimmerman, "Becoming a self-regulated learner: An overview," Theory Pract., vol. 41, no. 2, pp. 64–70, 2002. doi: 10.1207/s15430421tip4102_2
14. [14] A. F. Repko and R. Szostak, Interdisciplinary Research, 4th ed. Los Angeles: Sage, 2020.
15. [15] R. K. Yin, Case Study Research and Applications, 6th ed. Los Angeles: Sage, 2018.
16. [16] V. Braun and V. Clarke, "Using thematic analysis in psychology," Qual. Res. Psychol., vol. 3, no. 2, pp. 77–101, 2006. doi: 10.1191/1478088706qp063oa
17. [17] E. Gün-Tosik, B. Atasoy, and A. O. Yüksel, "The role of ePortfolios in formative assessment: A systematic literature review," J. Meas. Eval. Educ. Psychol., vol. 14, Special Issue, pp. 299–319, 2023. doi: 10.21031/epod.1276063
18. [18] A. Corden and R. Sainsbury, Using Verbatim Quotations in Reporting Qualitative Social Research: Researchers' Views. York, UK: Social Policy Research Unit, University of York, 2006.
19. [19] K. Kaiser, "Protecting respondent confidentiality in qualitative research," Qual. Health Res., vol. 19, no. 11, pp. 1632–1641, 2009. doi: 10.1177/1049732309350879
20. [20] A. Markham, "Fabrication as ethical practice: Qualitative inquiry in ambiguous Internet contexts," Inf. Commun. Soc., vol. 15, no. 3, pp. 334–353, 2012. doi: 10.1080/1369118X.2012.641993

[1] For a practical example of digital portfolio implementation for formative assessment at the secondary level, see the Professional Development Service for Teachers (PDST) initiative in Ireland: https://www.assessforlearning.eu/toolkit/case-studies/formative-assessment-using-digital-portfolios

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