

Technology-Enhanced Peer Assessment via FeedbackFruits: A Multi-Framework Evaluation of Digital Technology Integration in Pedagogical Design

Xiangping Du and Bobby Pothabathula

University of Hertfordshire Business School, Hatfield, United Kingdom

x.du1@herts.ac.uk

g.pothabathula@herts.ac.uk

Abstract: The rapid digitalisation of higher education has intensified interest in educational technologies that support engagement, collaboration and meaningful learning. However, research consistently demonstrates that technology alone does not improve educational outcomes; rather, impact depends on the quality of pedagogical integration. Emerging educational technologies such as FeedbackFruits are increasingly used to support innovative, student-centred pedagogy in higher education, particularly within digitally mediated and culturally diverse learning environments. This study investigates how the integration of FeedbackFruits within a large postgraduate programme at a UK university influences student engagement, peer interaction, and feedback practices among a predominantly international cohort. This study adopts an integrated theoretical lens combining the Community of Inquiry (Col), Constructive Alignment (CA), and Technological Pedagogical Content Knowledge (TPACK) frameworks to evaluate the pedagogical integration of FeedbackFruits for technology-enhanced peer assessment. The Col framework is used to examine how meaningful learning emerges through the interplay of cognitive, social, and teaching presence in online and blended environments. Within this framing, FeedbackFruits is analysed as a mediating tool that structures and sustains these presences by enabling dialogic peer interaction and iterative feedback processes. CA informs the pedagogical design by emphasising coherence between intended learning outcomes, learning activities, and assessment strategies. The platform's affordances, including rubric-guided peer review and sequenced collaborative tasks, are examined in relation to how they support aligned and transparent assessment practices. The TPACK framework further situates technology use within the intersection of pedagogy and disciplinary content, highlighting that effective integration depends on pedagogical intent rather than technological novelty. Drawing on a case study involving over 700 postgraduate students who were introduced to FeedbackFruits, the research analyses student participation data, reflective feedback, and learning analytics to explore how structured peer review and collaborative activities shape the learning experience. Findings indicate strong evidence of engagement, reflective learning, accountability, feedback literacy and collaborative participation. Students spent substantial time reviewing peer contributions, generated extensive feedback comments and engaged in structured self-assessment processes through FeedbackFruits. The study argues that transformative digital learning emerges when technology is selected through TPACK principles, embedded through CA and enacted through Col processes. Overall, the paper suggests that the value of educational technology lies in its meaningful integration with pedagogical frameworks, offering insights for designing inclusive and engaging learning environments in higher education.

Keywords: Transformative Digital Pedagogy, Educational Technology, FeedbackFruits, Constructive Alignment (CA), Community of Inquiry (Col), Technological Pedagogical Content Knowledge (TPACK)

1. Introduction

The increasing digitalisation of higher education has transformed how teaching, learning and assessment are designed and experienced. Universities worldwide have adopted a growing range of educational technologies to enhance student engagement, support collaborative learning and facilitate flexible modes of delivery. While the COVID-19 pandemic accelerated the adoption of digital learning environments, the subsequent challenge for educators has been to move beyond emergency remote teaching towards sustainable and pedagogically meaningful digital transformation (Rapanta et al., 2021). Within this context, educational technologies are increasingly evaluated not solely on their technical functionality but on their ability to support student-centred learning, critical engagement and inclusive educational practices (Stephenson and Torn, 2023).

Among contemporary educational technologies, FeedbackFruits has gained prominence as a platform designed to facilitate collaborative learning, peer feedback and active student participation. Through features such as structured peer review, collaborative annotation, interactive discussions and rubric-guided assessment, the platform aligns with contemporary pedagogical approaches that emphasise dialogue, reflection and learner agency (FeedbackFruits, 2025). However, early research by Kirkwood and Price (2014) suggests that educational technologies do not generate meaningful learning outcomes simply through their adoption. Rather, their effectiveness depends upon how they are integrated within coherent pedagogical designs. Similarly, Fullan and Langworthy (2014) suggests digital pedagogy extends beyond the use of technological tools and focus instead on how technology reshapes interactions among learners, educators and knowledge. Rapanta et al. (2020)

further affirm the importance of balancing technology, pedagogy and the new normal, and suggest effective digital pedagogy should consider active learning, collaboration, student agency and authentic assessment. This echoes with Stephenson and Torn (2023) who advocate higher education institutions to review, recall and reposition post-Covid and to adapt delivery and design in the digital world. Rather than viewing students as passive recipients of information, digital pedagogy encourages learners to participate actively in knowledge construction through dialogue, reflection and collaborative inquiry. Educational technologies therefore function as mediating tools that support social and cognitive learning processes.

The shift towards student-centred approaches is particularly significant in higher education, where diverse student populations increasingly participate in blended and online learning environments. International postgraduate cohorts often bring varied educational experiences, cultural perspectives and expectations regarding learning and assessment. Consequently, digital learning environments must support not only academic achievement but also social integration, intercultural communication and equitable participation (Mittelmeier and Rienties, 2024)

Despite a growing body of research recognising FeedbackFruits as an effective platform for active learning and collaborative peer assessment, with demonstrated benefits for student satisfaction, reflective practice, feedback quality, and the overall peer assessment experience (Campbell et al., 2020; Vaz-Serra, 2023; Myklebust, 2025), limited attention has been paid to the pedagogical design underpinning its implementation or the theoretical foundations that explain its effectiveness, particularly within diverse international student cohorts. To address this gap, this paper draws on three influential theoretical perspectives that collectively provide a robust foundation for understanding the pedagogical value of FeedbackFruits in higher education: the Community of Inquiry (Col) framework, Constructive Alignment (CA), and the Technological Pedagogical Content Knowledge (TPACK) framework. It argues that these complementary perspectives are intrinsically interconnected and, when considered together, offer a holistic explanation of how technology-enhanced learning environments can foster meaningful engagement, collaborative knowledge construction, reflective learning, and transformative educational experiences.

2. Literature Review

2.1 Community of Inquiry (Col): Understanding the Learning Processes

The Community of Inquiry (Col) framework, developed by Garrison, et al. (2000), remains one of the most influential theoretical models for understanding learning in online and blended environments. Rooted in social constructivist perspectives, the framework conceptualises meaningful educational experiences as emerging through the interaction of three interconnected dimensions: cognitive presence, social presence and teaching presence. Cognitive presence refers to the extent to which learners can construct and confirm meaning through sustained reflection and discourse. It emphasises higher-order thinking, problem-solving and critical inquiry (Akyol and Garrison, 2011). Social presence concerns learners' ability to project themselves socially and emotionally within a learning community. It involves the development of trust, communication and interpersonal relationships that facilitate collaboration (Garrison et al., 2010). Teaching presence encompasses instructional design, facilitation and direct instruction. It reflects the role of educators in creating and sustaining productive learning environments (Garrison, et al., 2010). Shea and Bidjerano (2009) argue that within Col framework, teaching presence significantly influences both cognitive and social presence by providing guidance, scaffolding and opportunities for interaction.

Recent studies have extended the Col framework to contemporary digital learning environments characterised by learning analytics, collaborative platforms and artificial intelligence-supported tools (Fiock, 2020; Li, et al., 2025). These developments suggest digital and AI tools help revolutionise higher education as they boost student engagement in learning through constructive and social collaborative learning. Meanwhile, technologies should not be viewed merely as delivery mechanisms but as mediating artefacts that facilitate the interactions underpinning meaningful learning. FeedbackFruits, as an emerging digital technological tool exemplifies this approach by structuring dialogue, guiding peer assessment and supporting iterative feedback processes that strengthen all three dimensions of the Col framework. Myklebust's (2025) research affirms that FeedbackFruits provide a digital learning environments supporting participation, discussion and reflection which knowledge is constructed with cognitive presence. Structured peer interaction facilitated by digital platforms can help establish connections between learners and foster a sense of belonging. However, despite the widespread adoption of Col and its relevance in analysing student engagement and collaborative learning in

digitally enhanced higher education, Cleveland-Innes and Campbell (2012) has argued that the model underrepresents emotional engagement and learner identity, particularly within multicultural learning contexts. Fiock (2020) echoes that in culturally diverse setting, the ability to socially and emotionally engage is particularly important as students navigate differences in educational backgrounds, communication styles and cultural expectations.

2.2 Constructive Alignment (CA): Designing Meaningful Learning and Assessment

While Col explains how learning occurs, Constructive Alignment (CA) provides a framework for understanding how learning environments should be designed. Introduced by Biggs (1996), CA provides a foundational framework for instructional design and assessment in higher education. The theory combines constructivist learning principles with systematic curriculum alignment, arguing that effective learning occurs when intended learning outcomes, teaching activities and assessment tasks are coherently integrated. The core of CA is the premise that learners actively construct knowledge through engagement with learning activities. Therefore, educational design should ensure that teaching methods and assessment strategies directly support the achievement of intended learning outcomes (Biggs, et al., 2022). Misalignment between these elements can lead to superficial learning, confusion and lack of motivation. The relevance of CA has increased significantly in digital education contexts where educators often face challenges integrating technology with pedagogical objectives. CA also has implications for inclusivity and learner diversity, especially with assessment. It supports transparent assessment criteria and clear expectations which helps reduce ambiguity for international students who may be unfamiliar with local academic conventions.

Contemporary higher education increasingly emphasises self-assessment, peer assessment and feedback literacy as mechanisms for promoting active learning and self-regulation (Carless and Winstone, 2023). Peer assessment has been regarded as an effective learning tool as Topping (2017) where students are learning by judging and discussing the work of other learners. The research of Iglesias Pérez, et al. (2022) on self and peer assessment reveals they are more effective than lecturer feedback, especially when anonymity retained through online learning platforms. It supports critical, responsible and reflective learners as students benefit as much from providing feedback as from receiving it, as the evaluative process encourages deeper engagement with assessment criteria and learning standards.

Digital tools like FeedbackFruits supports these approaches through structured self and peer review processes, rubric-guided evaluation and opportunities for iterative improvement (Campbell, et al. 2020). Meanwhile, they provide explicit rubrics, and guided feedback processes can therefore contribute to more equitable learning experiences across diverse cohorts. By embedding peer review within a structured framework, FeedbackFruits aligns assessment activities with intended learning outcomes and promotes transparency in evaluation practices (Myklebust, 2025).

2.3 Technological Pedagogical Content Knowledge (TPACK): Technology Integration

While the Col framework focuses on learning processes and CA addresses curriculum design, the TPACK framework provides a lens for understanding effective technology integration in educational practice. Developed by Mishra and Koehler (2006), TPACK model proposes that effective teaching with technology requires the integration of three domains: content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). Chai, et al. (2013) suggest meaningful educational technology use occurs at the intersections of these domains; while Koehler, et al. (2013) argue that successful technology integration depends more on pedagogical intentionality than technological sophistication and technology should be selected and implemented in ways that support disciplinary learning objectives and pedagogical goals. Thus, rather than assuming that educational technologies automatically improve learning, the framework emphasises the importance of pedagogical decision-making. Meanwhile, it also highlights the importance of contextual factors influencing technology adoption. Institutional culture, disciplinary norms, student characteristics and available resources all shape how educational technologies are implemented (Koehler, et al., 2013).

This perspective is particularly relevant when examining platforms such as FeedbackFruits employed in higher education, where digital tools must accommodate complex disciplinary knowledge and increasingly diverse student populations. The educational value of the platform does not derive solely from its digital features but from how those features support collaborative learning, assessment and disciplinary knowledge construction (Vaz-Serra et al, 2023). In business studies amongst an internationally diverse groups, these contextual considerations become particularly significant as students bring varying levels of digital literacy and diverse

educational experiences (Li, et al., 2025). Therefore, it is vital to understand how FeedbackFruits decodes the relationship between pedagogy, technology and content knowledge in business studies under TPACK model.

2.4 Integrating Col, Constructive Alignment and TPACK

Although Col, CA and TPACK each provide valuable insights, none individually offers a complete explanation of transformative digital pedagogy. Col focuses on learning experiences, CA emphasises curriculum coherence and TPACK addresses pedagogical decision-making regarding technology use. Importantly, all three frameworks share a common assumption: technology is not inherently transformative. Instead, educational technologies become valuable when integrated within pedagogically informed learning environments that support engagement, collaboration and knowledge construction. This perspective aligns with contemporary scholarship advocating a shift from technology-centred to pedagogy-centred approaches to digital transformation in higher education (Kirkwood and Price, 2014).

Together, the three frameworks offer complementary perspectives on educational technology integration. They suggest that the platform's effectiveness lies not in its technological capabilities alone but in its capacity to support collaborative learning, aligned assessment and pedagogically purposeful engagement. Collectively, they offer a robust theoretical foundation for examining the educational value of FeedbackFruits in higher education. As higher education continues to evolve within increasingly digital and culturally diverse contexts, these frameworks provide valuable guidance for designing inclusive, engaging and effective learning experiences.

3. Methodology

3.1 Research Design

This case study research (Yin, 2018) investigated the pedagogical impact of a technological tool of FeedbackFruits within a large postgraduate marketing module at a UK University in the 2025-26 academic year. The module enrolled 701 students and was among the largest postgraduate modules within the University. The cohort was highly international, representing a diverse range of cultural, linguistic, and educational backgrounds. This diversity provided an opportunity to explore technology-supported peer learning within multicultural environments. Informed by three conceptual frameworks: Community of Inquiry (Col), Constructive Alignment (CA), and Technological Pedagogical Content Knowledge (TPACK), this study examined how technology-enhanced peer evaluation supports student involvement, feedback literacy, and collaborative learning within a culturally diverse higher education environment.

The study was situated within an authentic assessment in which students worked collaboratively to develop a strategic digital marketing campaign for a live client organisation, including evidence-based marketing solutions informed by consumer insights, market research, and campaign planning. The assessment comprised a group poster exhibition, a self-assessment and a peer-evaluation activity using FeedbackFruits within the University's virtual learning environment (VLE). FeedbackFruits was implemented as a structured self- and peer-assessment mechanism to address challenges commonly associated with group assessment, such as unequal contributions, free-riding, and perceptions of unfairness, and accordingly designed to promote accountability, transparency, critical reflection, and feedback literacy (Campbell, et al., 2020). Accordingly, students were instructed to evaluate their peers against five criteria: Contribution, Timeliness, Quality of Work, Team Collaboration, and Reflection which were preset within FeedbackFruits.

This study adopted a quantitative approach using institutional learning analytics generated through the FeedbackFruits platform to evaluate student engagement, peer assessment behaviour, reflective practice feedback literacy (Carless and Winstone, 2023; Iglesias Pérez, 2022). Students were introduced to FeedbackFruits through face-to-face teaching sessions and written guidance provided within the VLE. The purpose of the peer evaluation activity, assessment criteria, expectations for constructive feedback, and the contribution of peer evaluation to the overall module assessment were clearly explained. Students were encouraged to complete all components of the activity, although completion of every task was not mandatory to pass the module. Throughout the assessment, FeedbackFruits automatically generated learning analytics, including participation rates, review completion, self-assessment progress, peer ratings, review duration, and qualitative feedback comments. This platform generated analytics formed the primary dataset for this study.

The dataset included:

- Student Completion Records
- Peer review participation
- Self-assessment completion rates
- Review duration metrics
- Feedback comments generated
- Peer evaluation ratings
- Group-level engagement indicators

The data were then reported and analysed using descriptive statistics, including frequencies, percentages, means, and distributional characteristics. The analysis concentrated on four key dimensions:

1. Student engagement
2. Peer review performance
3. Feedback literacy and Reflective learning
4. Collaborative learning within international cohort

3.2 Findings and Analysis

3.2.1 Student Engagement with FeedbackFruits

Of the 701 postgraduate students enrolled on the module, 397 students successfully completed all required peer evaluation activities, while a further 192 students partially completed the activity, resulting in an overall engagement rate of 84%. This indicates that a substantial proportion of students accessed the platform and participated in the peer review process. Further findings showed that feedback completion reached 62%, while self-assessment completion reached 77%, demonstrating substantial engagement with reflective and evaluative learning activities. Students generated an average of 12 feedback comments per group and spent an average of 164 minutes engaging with review activities (see Table 1 below).

Table 1: Summary of FeedbackFruits Peer Review Engagement Metrics

Engagement Metric	Engagement Data
Students Completing All Tasks	397
Students Partially Completing Tasks	192
Full Engagement Rate	56.6%
Overall Engagement	84.0%
Feedback Completion Progress	62%
Self-Assessment Completion Progress	77%
Average Comments per Group	12
Average Review Duration	164 minutes

The high engagement rates suggest that students were willing to invest substantial time and effort in the peer-evaluation process. The average review duration and number of comments generated indicate meaningful engagement with assessment and feedback literacy.

3.2.2 Peer Review Performance

Students evaluated one another against five criteria: Contribution, Timeliness, Quality of Work, Team Collaboration, and Reflection. Although the example shown in Figure 1 demonstrates maximum ratings across all categories, the average peer-evaluation score across the 397 fully engaged students was 4.728 out of 5.

Group Members Evaluation								
Name	Contribution for 20%	Timeliness for 20%	Quality of Work for 20%	Team Collaboration for 20%	Reflection for 20%	Optional grade adjustment	Published to Canvas	Overall grade
^	20	20	20	20	20			
	20	20	20	20	20		✓ a month ago	100 %
	20	20	20	20	20		✓ a month ago	100 %
	20	20	20	20	20		✓ a month ago	100 %
	20	20	20	20	20		✓ a month ago	100 %
	20	20	20	20	20		✓ a month ago	100 %

Figure 1: FeedbackFruits peer review rubric and grading dashboard

Table 2: Peer evaluation ratings

Peer Review Criteria	Contribution	Timeliness	Quality of Work	Team Collaboration	Reflection
Average grade	4.737	4.614	4.697	4.755	4.740

Table 2 presents the average ratings for each assessment criterion. Ratings were consistently high across all dimensions, with Team Collaboration receiving the highest average score (4.755/5), followed by Reflection (4.740/5) and Contribution (4.737/5). These findings suggest that students generally perceived positive levels of participation, cooperation, and accountability within their groups.

3.2.3 Feedback Literacy and Reflective Learning

Figure 2 below presents anonymised examples of students' given and received peer reviews. Students provided both ratings and qualitative comments against the assessment criteria, while tutors were able to monitor participation and review progress through the dashboard. Receiving peer feedback enabled students to reflect on their performance, identify strengths and areas for improvement, and engage with feedback as an active learning process. Students therefore occupied dual roles as both feedback providers and feedback recipients.

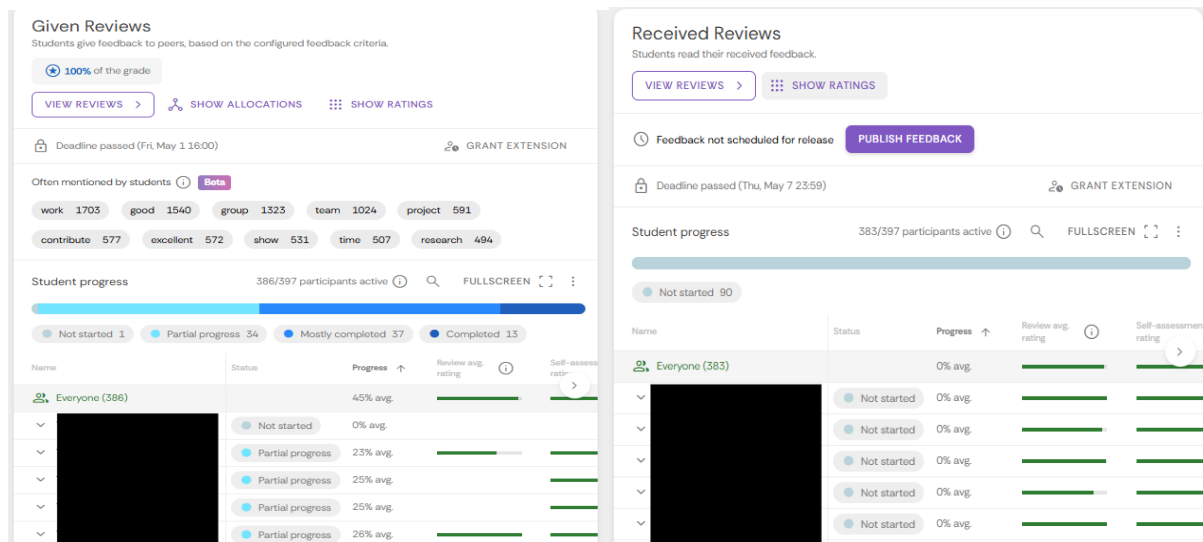


Figure 2: FeedbackFruits 'Given Reviews' and 'Received Reviews' dashboard

The combination of peer review, self-assessment, and qualitative feedback appears to have supported the development of evaluative judgement and reflective practice. The average of 12 comments per group and substantial review duration further suggest that students actively engaged in feedback processes rather than merely completing assessment requirements.

3.2.4 Collaborative Learning Within International Cohort

The findings suggest that FeedbackFruits enhanced collaborative learning and interaction among students. This resembles the research of Li et al. (2025) investigating a different digital tool within which international students

feel safe and secure to collaborate and learn. The strong ratings for Team Collaboration and Reflection indicate that students actively recognised the contributions of others and engaged in collaborative reflection throughout the project. Given the highly international nature of the cohort, the peer evaluation process provided opportunities for intercultural dialogue, communication, and teamwork. Students were required to negotiate expectations, evaluate contributions, and reflect upon team performance, supporting the development of collaborative working practices.

Meanwhile, the findings provide substantial evidence of feedback literacy development. Students were positioned as both feedback providers and recipients, enabling them to actively engage in generating, interpreting, and responding to feedback. The peer evaluation process created multiple opportunities for students to engage in evaluative judgement and develop a deeper understanding of assessment expectations. Through reviewing peers and reflecting on their own performance, students strengthened their ability to make informed judgements about academic work, a skill recognised as essential for lifelong learning.

In addition, the results show that students spent an average of 164 minutes on review activities and generated an average of 12 comments per group. The substantial time investment suggests that students engaged in reflective evaluation rather than simply completing administrative assessment requirements. These findings indicate that FeedbackFruits supported greater engagement with assessment criteria and encouraged students to become active participants in the evaluation process. In all, the findings demonstrate that through the deliberate alignment of technology, pedagogy, and assessment design, FeedbackFruits served as an effective peer assessment platform which encouraged students to participate actively, reflect on their performance, and engage constructively with peers.

4. Discussion

Viewed through the Community of Inquiry, Constructive Alignment, and TPACK frameworks, the study supports growing evidence that educational technologies achieve their greatest impact when embedded within coherent curricular strategies rather than implemented as standalone innovations (Kirkwood and Price, 2014). Summarised from the findings, Table 3 echoes the effectiveness of FeedbackFruits as a structured peer evaluation platforms to offer scalable mechanisms for promoting engagement, feedback literacy, belonging, and student success, and how they are aligned with the theoretical frameworks.

Table 3: Findings, evidence and link to theoretical frameworks

Finding	Evidence	Framework
High engagement	84% participation	Social Presence
Reflective learning	Reflection score 4.74	Cognitive Presence
Structured assessment	Rubrics & guidance	Teaching Presence
Technology-enabled assessment	FeedbackFruits integration	TPACK
Alignment with outcomes	Peer review criteria	Constructive Alignment

The analysis above supports the argument that transformative digital pedagogy emerges through the purposeful interaction of pedagogical design, technology integration, and learner engagement. From a Community of Inquiry (CoI) perspective, the findings provide evidence of cognitive, social, and teaching presence within FeedbackFruits. (Garrison, et al. 2001) Cognitive presence was strengthened through reflective evaluation, feedback generation, and critical engagement with assessment criteria where students were required to analyse peer contributions, compare performance against standards, and provide constructive feedback, encouraging deeper reflection and evaluative judgement. Social presence emerged through collaboration, dialogue, and recognition of peer contributions, particularly within a diverse international cohort. Teaching presence was evident in the structured design of the activity, including the use of clear rubrics, assessment guidance, and scaffolded peer review processes that supported student participation and engagement.

The study also reinforces the principles of Constructive Alignment (CA) (Biggs, et al., 2022) when peer assessment was intentionally linked to module learning outcomes relating to teamwork, communication and reflection. Students were therefore not engaging in isolated technological tasks but participating in activities that directly contributed to the achievement of both disciplinary knowledge and skills around digital marketing. The close alignment between learning outcomes, assessment requirements, and peer evaluation activities helped ensure that engagement with FeedbackFruits remained meaningful and relevant.

Similarly, the results support the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra and Koehler, 2006), which argues that effective technology integration occurs when technological tools are aligned with pedagogical goals and disciplinary content. The findings suggest that FeedbackFruits supported learning not because of the technology itself, but because its functionality was purposefully embedded within a coherent pedagogical and assessment strategy. This reinforces the view that educational technologies achieve their greatest impact when used to enhance learning design rather than simply digitise existing practices.

The study also contributes to the growing literature on feedback literacy. Students were positioned as both feedback providers and recipients, requiring them to actively generate, interpret, and respond to feedback. Through reviewing peers and reflecting on their own performance, students developed evaluative judgement and a deeper understanding of quality standards and assessment expectations. These findings align with previous research suggesting that feedback is most effective when learners actively participate in feedback processes rather than passively receiving comments from educators (Carless and Winstone, 2023).

The findings also demonstrate the value of structured peer evaluation within large cohorts (Topping, 2017). FeedbackFruits provided a scalable mechanism for promoting accountability, transparency, and meaningful interaction among more than 700 students. However, the findings also identify opportunities for future enhancement. While overall engagement reached 84%, only 56.6% of students completed all peer evaluation activities. This suggests that although most students accessed and engaged with the platform, not all students completed every stage of the review process. Furthermore, feedback completion (62%) was lower than self-assessment completion (77%), indicating that students may have been more comfortable reflecting on their own performance than providing constructive feedback to peers. Future iterations of the module could explore additional strategies to strengthen participation, such as providing further guidance on feedback practices, integrating formative peer-review opportunities earlier in the semester, and offering exemplars of effective feedback comments.

Finally, similar to Li, et al. (2025) identified that the international nature of the cohort provides important insights into constructive and collaborative learning through digital technology tools. Students from diverse cultural, linguistic, and educational backgrounds participated successfully in collaborative activities supported by transparent criteria and structured evaluation processes. The findings therefore suggest that technology-enhanced peer assessment can contribute to intercultural engagement, community building, and a stronger sense of belonging within diverse higher education environments.

Overall, the study demonstrates that FeedbackFruits can support engagement, feedback literacy, accountability, collaboration, and reflective practice when embedded within a pedagogically aligned assessment strategy. As higher education institutions continue to expand digitally enhanced provision, structured peer evaluation platforms like FeedbackFruits can offer scalable approaches for fostering student success and creating more inclusive and participatory learning environments.

5. Conclusion

This study examined the implementation of FeedbackFruits within a large postgraduate marketing module at a UK higher education institution to investigate its contribution to student engagement, feedback literacy, accountability, reflective learning, and collaborative participation. Drawing on the frameworks of Community of Inquiry (Col), Constructive Alignment (CA), and Technological Pedagogical Content Knowledge (TPACK), the findings demonstrate that FeedbackFruits can serve as more than a digital peer-assessment platform when embedded within a coherent pedagogical design. Rather than technology alone driving learning outcomes, its educational value emerges through the purposeful alignment of technology, pedagogy, curriculum, assessment, and meaningful student interaction.

The findings indicate that FeedbackFruits supported student engagement, reflection, collaboration, and feedback literacy through a structured peer-evaluation process aligned with intended learning outcomes. Importantly, the study suggests that technology-enhanced peer assessment provides a scalable and pedagogically robust approach for fostering accountability, engagement, and a sense of belonging within large and culturally diverse higher education classrooms. These findings reinforce the importance of designing technology-enhanced learning experiences that prioritise pedagogical intent over technological functionality.

The study also makes a theoretical contribution by demonstrating the complementary value of integrating Col, CA, and TPACK as a multi-framework lens for evaluating technology-enhanced peer assessment. While each framework offers distinct insights into collaborative learning, curriculum alignment, and technology integration,

their combined application provides a more comprehensive understanding of how digital technologies can support meaningful, inclusive, and transformative learning experiences. This integrated perspective extends existing research, which has largely focused on student satisfaction and platform usability, by explaining the pedagogical mechanisms through which educational technologies create value.

However, several limitations should be acknowledged. The research was conducted within a single postgraduate marketing module at one UK institution and relied primarily on learning analytics and peer-evaluation data. Although the cohort was highly international, students' prior levels of digital literacy were not measured, making it difficult to determine how digital competence may have influenced engagement with FeedbackFruits or peer-assessment behaviours. Future research should therefore incorporate qualitative methods to explore students' lived experiences, examine implementation across different disciplines and institutional contexts, investigate the influence of digital literacy on technology-enhanced assessment, and evaluate the longer-term development of feedback literacy and collaborative learning.

Ultimately, this study argues that the transformative potential of educational technology resides not in the technology itself, but in the quality of its pedagogical integration. By positioning FeedbackFruits within an integrated Col-CA-TPACK framework, the study provides both a theoretical foundation and practical guidance for educators seeking to design technology-enhanced peer assessment that is pedagogically coherent, scalable, and capable of supporting inclusive and engaging learning in increasingly diverse higher education environments.

Ethics Declaration

Formal ethic approval was not required as this study involved the analysis of anonymised data automatically generated by University-licensed digital technology platform, i.e. FeedbackFruits suited within the University's Virtual Learning Environment and collected as part of the module performance evaluation process.

AI Declaration

ChatGPT was used to support the exploration of theoretical frameworks and proofreading during the preparation of this manuscript. All substantive academic content, analysis, interpretation of findings, and final editorial decisions were undertaken by the authors.

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