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(IJMOE)**www.gaexcellence.com/ijmoe**ENHANCING STUDENT ENGAGEMENT AND
PERFORMANCE THROUGH COLLABORATIVE, AI-
INTEGRATED ASSESSMENTS IN HIGHER EDUCATION**Khin Than Myint^{1*}, Wendy Li Ling Law², Yew Hua Ling³¹Department of Accounting and Finance, Curtin University, Malaysia k.t.myint@curtin.edu.my <https://orcid.org/0000-0002-4181-6589>²Department of Account, Finance and Economics, Curtin University, Malaysia Wendy.law@curtin.edu.my <https://orcid.org/0000-0001-6579-1032>³Department of Account, Finance and Economics, Curtin University, Malaysia yh.ling@curtin.edu.my <https://orcid.org/0000-0002-6210-9381>

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Abstract:

This study investigates how redesigned assessments that integrate collaboration, artificial intelligence (AI) tools, and critical thinking activities enhance student engagement and academic performance in higher education. Grounded in Self-Determination Theory, Social Interdependence Theory, and Assessment for Learning principles, the research positions assessment design as a key driver of motivation and learning. A mixed-methods approach was employed, collecting data from 88 undergraduate students enrolled in a first-year commerce unit at a private offshore university. Quantitative data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), while qualitative responses were thematically examined. Results indicate that collaboration quality ($\beta = 0.510$, $p < .001$), AI integration ($\beta = 0.168$, $p < .001$), and critical thinking skills ($\beta = 0.250$, $p < .001$) significantly improve student engagement, which strongly predicts academic performance ($\beta = 0.810$, $p < .001$). Qualitative findings corroborate these results, highlighting gains in teamwork, communication, analytical thinking, and responsible AI use. The study demonstrates that collaborative, AI-integrated assessment design can significantly contribute to engagement and performance, offering actionable insights for educators seeking to align assessment practices with 21st-century learning outcomes. However, the findings are based on a single institutional context. Future research could expand across disciplines and multiple contexts to validate the model's applicability.

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AI In Education, Assessment Design, Collaborative Learning,
Higher Education, Student Engagement



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Introduction

The evolving demands of the 21st-century workplace require graduates to demonstrate strong communication, collaboration, cross-cultural competencies, and proficiency with emerging technologies such as artificial intelligence (AI). However, traditional assessment structures in higher education often struggle to effectively cultivate these capabilities. In the Analytics for Decision Making unit, while students are introduced to analytical tools such as Excel and Tableau, existing assessments, including quizzes, an individual portfolio, and a final examination, offer limited opportunities for collaborative learning, applied problem solving, and analytical writing. The absence of group-based and authentic assessment tasks hinders students' development of essential workplace skills, contributing to the perception that assessments lack depth, relevance, and real-world applicability.

These limitations underscore the need for a redesign of assessments that aligns learning outcomes with contemporary workplace expectations. In response, this study introduces a redesigned portfolio assessment that integrates collaboration, diversity and inclusion, and AI-supported learning within a real-world financial analytics task. Students work in groups of three to apply Modern Portfolio Theory (MPT) to optimise two stock portfolios, analyse risk–return trade-offs, and calculate the Sharpe Ratio using Excel's Solver tool. To foster critical thinking and digital literacy, students compare their analytical outputs with AI-generated recommendations from ChatGPT and critically evaluate the accuracy and practical relevance of these recommendations. Assessment outputs include a structured business report, a detailed Excel model, and a group participation form to document individual contributions.

More broadly, the rapid digital transformation of higher education has intensified calls for innovative assessment approaches that move beyond traditional formats such as standardised tests and individual essays. Such assessment practices have been criticised for their limited capacity to capture higher-order skills, including collaboration, problem solving, and critical thinking (Boud & Soler, 2016). At the same time, the growing presence of AI in educational contexts presents new opportunities to design authentic assessments that reflect contemporary professional practices, while also raising questions about appropriate integration and evaluation (Holmes et al., 2019; Kasneci et al., 2023).

Student engagement is widely recognised as a critical determinant of academic success, encompassing behavioural, cognitive, and emotional dimensions that support persistence and achievement (Kuh et al., 2008; Reeve, 2023). Engagement is shaped by contextual factors such

as collaborative learning environments, the meaningful integration of digital tools, and assessment designs that support students' needs for autonomy, competence, and relatedness (Carless & Winstone, 2023). Research on assessment for learning emphasises that well-designed assessments can function as powerful drivers of engagement by promoting active participation, reflection, and shared responsibility for learning (Nicol, 2009).

Despite the extensive literature on student engagement and performance, important gaps remain. In particular, although prior studies (Batdı, 2024; McKay et al., 2024; Reeve, 2025; Wong et al., 2024) have examined AI-integrated learning, collaborative learning, and critical thinking as separate strands of research, limited attention has been given to their integrated application within a unified pedagogical framework. Existing literature (Van Damme et al., 2023; Winkler & Söllner, 2025; Yan et al., 2025) tends to treat collaboration, AI integration, and critical thinking as isolated predictors of learning outcomes, with insufficient consideration of how these elements interact simultaneously to influence student engagement and performance. Moreover, while AI has been widely explored in adaptive learning systems and automated feedback, its role as a comparative analytical tool within assessment contexts remains underexplored. Therefore, a key gap exists in understanding how AI-supported learning, collaborative engagement, and assessment design can be systematically integrated to enhance student learning outcomes in higher education.

By bridging these previously disconnected areas, this study contributes to the literature by proposing an integrated perspective on AI, collaboration, and assessment design, offering both theoretical insights and practical implications for educators in higher education.

To address these gaps, this study proposes and empirically tests a conceptual framework in which redesigned assessments integrating collaboration, AI tools, and critical-thinking activities enhance student engagement, which in turn contributes to improved academic performance. Drawing on Self-Determination Theory (Ryan & Deci, 2020), Social Interdependence Theory (Johnson & Johnson, 2009), and Assessment for Learning perspectives (Nicol, 2009), this research positions assessment design as a central mechanism for fostering engagement and learning outcomes in higher education.

The objectives of this study are to:

1. Foster collaboration, communication, and cross-cultural skills through group-based assessment activities.
2. Integrate AI tools into assessment tasks to develop students' analytical and critical-thinking capabilities.
3. Evaluate the impact of the redesigned assessment on student engagement, academic performance, and self-perceived learning outcomes using a mixed-methods approach.

Literature Review

Theoretical Perspectives

This study integrates three complementary theoretical perspectives to explain how redesigned assessments can enhance student engagement and academic performance. First, Self-Determination Theory (SDT) posits that when instructional design satisfies learners' needs for autonomy, competence, and relatedness, students are more likely to internalise motivation, demonstrate stronger engagement, and achieve higher levels of performance (Ryan & Deci,

2020). Recent research further suggests that behavioural, cognitive, and emotional dimensions of engagement are differentially predictive of academic outcomes, highlighting designable pathways through which need-supportive assessment practices influence learning (Reeve, 2025).

Second, Social Interdependence Theory explains why the quality of collaboration within group-based assessments matters. Positive interdependence fosters promotive interaction, individual accountability, and shared goal pursuit-conditions that enhance individual learning and achievement. Contemporary research in higher education consistently links well-structured group work and high-quality peer interaction to improved learning outcomes and student satisfaction (Johnson & Johnson, 2009; McKay et al., 2024).

Third, the Assessment for Learning (AfL) and Self-Regulated Learning (SRL) perspective conceptualises assessment as a central driver of engagement through feedback, transparency of criteria, and student agency. Recent studies emphasise dialogic and partnership-oriented assessment practices that build students' feedback literacy and self-regulatory capacity, thereby supporting sustained engagement and improved academic performance (Nicol, 2009; Carless & Winstone, 2023; Chan & Chen, 2023).

Taken together, these perspectives suggest that redesigned assessments incorporating collaboration, AI-supported analytical comparison, and structured critical-thinking activities can (1) satisfy students' psychological needs (SDT), (2) create productive interdependence among peers (Social Interdependence Theory), and (3) promote self-regulated learning through feedback-rich assessment design (AfL/SRL). Through these mechanisms, assessment redesign is expected to enhance student engagement and ultimately improve academic performance.

Hypotheses Development

Collaboration Quality

Collaboration is effective when tasks promote interdependence, shared meaning-making, and mutual responsibility (Stahl et al., 2014). High-quality collaborative interactions not only improve academic outcomes but also stimulate students' motivation, participation, and sense of belonging, which are the key dimensions of engagement (Fredricks et al., 2004; Kahu, 2013). Peer assessment and feedback processes strengthen this engagement by encouraging active involvement and reflection (Strijbos & Sluijsmans, 2010; Cho & Cho, 2011). Recent research emphasises that collaboration quality, rather than mere participation, enhances satisfaction and deep learning experiences in digital and blended settings (McKay et al., 2024; Bach et al., 2024). Therefore, high-quality collaboration is expected to foster greater behavioural, emotional, and cognitive engagement among students. In this study, high-quality collaboration is expected to foster greater behavioural, emotional, and cognitive engagement among students. Therefore:

H1: Collaboration quality has a positive effect on student engagement.

AI Integration

Integrating AI in higher education through adaptive tutoring systems, chatbots, and intelligent feedback tools has shown promising effects on student learning and motivation. Meta-analytic reviews reveal that AI applications enhance cognitive engagement by providing adaptive

feedback and personalised learning experiences (Holmes et al., 2019). In higher education contexts, AI-driven chatbots promote interactivity and immediacy, thereby strengthening students' behavioural and emotional engagement (Winkler & Söllner, 2018). Recent meta-analyses have further demonstrated that AI-supported learning tools enhance complex learning and reflective thinking, indicating a deeper cognitive involvement (Yan et al., 2025; Winkler & Söllner, 2025). In this study, students were encouraged to utilise AI tools, such as ChatGPT, to gather recommendations and critically analyse business contexts, an approach that fosters participation, reflection, and sustained interest. The integration of AI tools is expected to enhance student engagement. Therefore:

H2: AI integration has a positive effect on student engagement.

Critical Thinking and Analytical Skills

Critical thinking is a foundational competency that underpins effective learning and engagement in higher education. Meta-analyses indicate that instructional interventions have a significant impact on improving critical-thinking skills, which in turn enhance students' cognitive and behavioural engagement in learning (Hattie et al., 2014; Abrami et al., 2015). Students with strong analytical skills are more likely to interpret, evaluate, and apply knowledge critically, processes central to cognitive engagement. Recent evidence confirms that critical-thinking interventions not only improve achievement but also stimulate reflective participation and persistence (Batdı, 2024). Similarly, large-scale assessments demonstrate that higher education fosters continuous growth in analytical and reflective capacities, contributing to more meaningful engagement with learning (Van Damme et al., 2023). In this study, students were required to critically analyse AI-generated recommendations and assess their practical relevance, which encouraged deeper thinking and sustained attention. In this study, it is expected that critical thinking and analytical skills are expected to influence student engagement positively. Therefore:

H3: Critical thinking and analytical skills have a positive effect on student engagement.

Student Engagement

Prior studies show that engagement is significantly associated with higher grades and persistence, even after controlling for background characteristics (Kuh et al., 2008; Carini et al., 2006). Recent longitudinal evidence similarly confirms that engagement predicts achievement over time, though effects may vary across learners (Zepke, 2018). Furthermore, the meta-analytic evidence demonstrates a moderate association between student engagement and academic achievement, with behavioural engagement often the strongest predictor (Wong et al., 2024; Reeve, 2025). Kassab et al. (2024)'s longitudinal studies in higher education confirm that engagement mediates the relationship between learning environments and academic performance. In this study, student engagement is expected to enhance academic performance. Therefore:

H4: Student engagement has a positive effect on academic performance.

Research Gaps and Contributions

Although existing literature provides substantial evidence linking engagement, collaboration, AI integration, critical thinking, and academic performance, several important gaps remain. First, prior studies have largely examined these constructs in isolation, focusing on engagement (Wong et al., 2024; Reeve, 2025), collaboration (McKay et al., 2024), or critical thinking

(Batdi, 2024) with limited attention to how these factors interact within a unified pedagogical framework. As a result, our understanding of how multiple elements jointly shape student learning outcomes remains incomplete.

Second, although AI integration has received increasing scholarly attention, existing research predominantly emphasises its role in adaptive tutoring and automated feedback systems (Yan et al., 2025; Winkler & Söllner, 2025). Comparatively, its role as an embedded component within assessment design, particularly as a tool to support engagement and learning processes remains underexplored.

Third, while critical thinking and analytical skills are widely recognised as key higher education outcomes, limited empirical research has examined their direct contribution to academic performance within redesigned or innovation-driven assessment contexts (Van Damme et al., 2023).

Finally, although theoretical perspectives such as Self-Determination Theory (Ryan & Deci, 2020), Social Interdependence Theory (Johnson & Johnson, 2009), and Assessment for Learning (Carless & Winstone, 2023; Chan & Chen, 2023) provide valuable insights, few empirical studies have combined these with contemporary innovations, particularly AI and authentic assessment redesign in a unified conceptual framework.

Taken together, limited research has examined the combined effects of AI-supported learning, collaboration, and critical-thinking-oriented assessment within a unified assessment design framework. This study addresses these gaps by developing and testing a model in which assessment design serves as the central intervention, integrating collaboration, AI tools, and critical-thinking activities to enhance student engagement and improve academic performance. Consequently, this research offers theoretical, empirical, and practical contributions to higher education teaching and learning.

By bridging these previously disconnected areas, this study contributes to the literature by proposing an integrated perspective on AI, collaboration, and assessment design. Theoretically, this study extends existing learning theories by integrating insights from Self-Determination Theory, Social Interdependence Theory, and Assessment for Learning into a unified framework that explains how AI-supported, collaborative, and assessment-driven mechanisms jointly influence student engagement and academic performance. Practically, the study provides a foundation for educators to design and implement AI-enabled collaborative assessments, supporting not only student engagement and performance but also the development of higher-order skills such as critical thinking, problem-solving, and teamwork in higher education contexts.

Conceptual Framework

The conceptual framework illustrates the relationships between redesigned assessments and student learning outcomes. It is grounded in established theories of engagement, collaboration, skill development, and technology adoption in education. Student engagement has been widely recognized as a multidimensional construct encompassing behavioral, cognitive, and emotional involvement in learning (Fredricks et al., 2004; Wong et al., 2024). Higher engagement is consistently associated with persistence, achievement, and long-term learning outcomes. Similarly, collaboration quality plays a critical role in shaping performance, as high-quality

peer interactions foster accountability, co-construction of knowledge, and deeper learning (Laal & Ghodsi, 2012; McKay et al., 2024).

AI integration represents the use of emerging digital tools to support personalization, analysis, creativity, and efficiency in learning. Recent meta-analyses confirm that AI-based educational technologies enhance academic outcomes when appropriately embedded into curricula and assessment practices (Dwivedi et al., 2023; Yan et al., 2025). In parallel, critical thinking and analytical skills are essential competencies for navigating complex information and solving problems. These skills, which can be cultivated through structured assessment tasks, have been linked to both academic performance and graduate employability (Facione, 1990; Batdı, 2024).

The framework therefore provides a holistic understanding of how innovative assessment practices can strengthen engagement and prepare students for contemporary, career-oriented challenges.

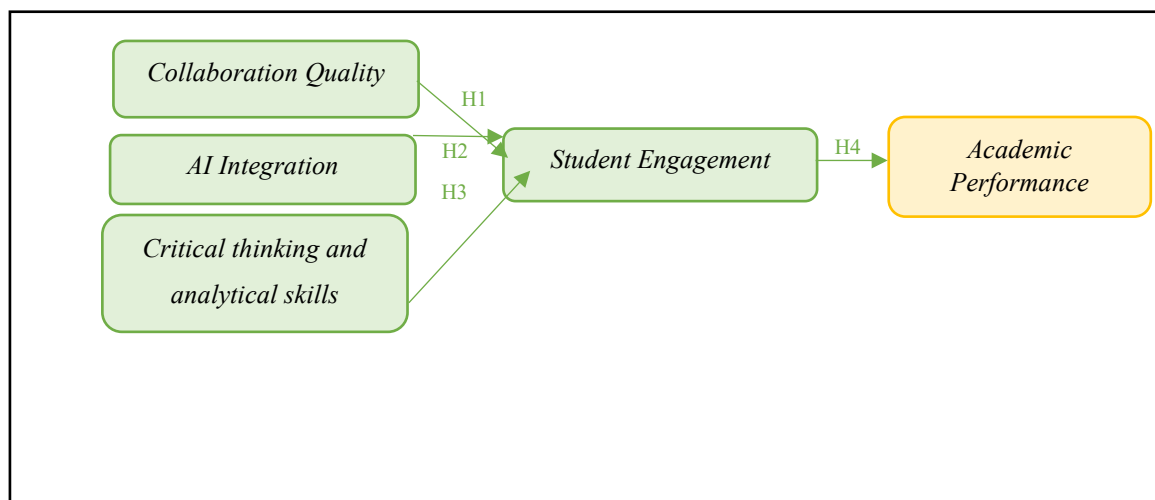


Figure 1: Conceptual Framework of Redesigned Assessments

Building on this conceptual framework, the present study empirically tests the hypothesised relationships between student engagement, collaboration quality, AI integration, critical thinking skills, and academic performance. By situating these constructs within an integrated model, the research seeks to examine the direct effects of each variable.

Methodology

A mixed-methods design was adopted to capture both quantitative and qualitative insights. Quantitative data were collected through a structured questionnaire measuring collaboration quality, AI integration, critical thinking and analytical skills, student engagement, and academic performance. Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to analyse the relationships among variables. Qualitative data were gathered through open-ended reflections to provide deeper insights into students' experiences with the redesigned assessment.

The study involved 88 undergraduate students, an appropriate sample size for exploratory, prediction-oriented research using PLS-SEM (Hair et al., 2011; Hair et al., 2022). The sample also offers contextually rich insight into first-year student adaptation to AI-integrated assessment within a specific institutional setting (Creswell & Plano Clark, 2018; Tinto, 2012). A mixed-methods approach is appropriate given the study's aim to capture both measurable learning outcomes and students' perceptions of collaboration, AI integration, and critical thinking development (Creswell & Plano Clark, 2018).

Context and Participants

The study will be conducted in the first-year Bachelor of Commerce (BComm) core unit, Analytics for Decision Making unit at a private offshore University. This large-enrolment unit attracts a diverse cohort of students from accounting, finance, economics, and management majors. Data will be collected from students enrolled in Semester 1 and 2, 2025. Participation in the research component (survey and interviews) will be voluntary, with informed consent obtained from all participants.

Demographic Profile

The demographic characteristics of the respondents indicate that the sample was predominantly female (70.5%), with male students comprising 28.4% and 1.1% preferring not to disclose their gender. Most participants were between 20 and 24 years old (70.5%), followed by those under 20 (23.9%) and a smaller proportion aged 25–29 (5.7%). Consistent with the target cohort, the majority were first-year students (93.2%), with only 5.7% from the second year and 1.1% from the fourth year and above. Prior experience with AI varied: 52.3% reported using AI multiple times, 45.5% had used it only a few times, and 2.2% had no prior exposure. Similarly, AI familiarity levels showed that 65.9% used AI occasionally, 26.1% used it regularly, and 8.0% had never used AI. Overall, the sample reflects a largely first-year cohort with moderate to substantial exposure to AI technologies.

Intervention: Redesigned Assessment

The redesigned assessment aims to align with 21st-century workplace demands by embedding collaboration, advanced data analysis, and AI-supported decision-making. The mid-semester group assessment requires students to apply Modern Portfolio Theory (MPT) in teams of three to evaluate and optimize stock portfolios. Using Excel's Solver tool, students will calculate risk-return trade-offs and determine the optimal Sharpe Ratio.

To integrate AI tools, students will incorporate recommendations generated by ChatGPT into their analysis and critically assess the reliability and limitations of these outputs. Deliverables include a group business report and an Excel model. This design seeks to foster not only technical skills but also academic writing, communication, and teamwork, while reinforcing critical thinking through real-world application.

Variables and Measurement

To empirically test the proposed hypotheses, the study defines key constructs and their measurement items based on established scales in the literature. Latent constructs (student engagement, collaboration quality, AI integration, and critical thinking) will be measured using

multi-item Likert scales adapted from prior studies, while academic performance will be assessed using objective scores from the course assessments.

Each construct in this study is operationalised using validated measurement items adapted from established literature to suit the higher education assessment context. Student engagement is conceptualised as the behavioural, emotional, and cognitive investment students demonstrate in learning activities. It is measured through items assessing active involvement in the redesigned assessment, motivation to participate, perceived relevance of the task, and the effort dedicated to completing it, drawing from Fredricks et al. (2004) and Wong et al. (2024). Collaboration quality captures the extent to which students shared responsibilities and interacted constructively during group work. Adapted from Laal and Ghodsi (2012) and McKay et al. (2024), the items evaluate students' enjoyment of teamwork, effectiveness of communication, perceived improvement in collaboration skills, and feelings of inclusion within the group.

AI integration reflects students' perceptions of the usefulness, reliability, and overall impact of AI tools in supporting the assessment process. Guided by Dwivedi et al. (2023) and Yan et al. (2025), the items assess perceived usefulness of tools such as ChatGPT, their role in enhancing group discussion quality, comfort with incorporating AI into learning, and the value of AI-generated insights. Critical thinking and analytical skills, grounded in Facione (1990) and Batdı (2024), are measured through items evaluating students' ability to analyse problems from multiple angles, generate innovative solutions, strengthen problem-solving skills, and work effectively with peers from diverse backgrounds.

To capture academic performance, the study draws on Richardson et al. (2012), assessing students' confidence in completing the redesigned assessment successfully. Finally, the redesigned assessment intervention itself is measured as a construct that integrates collaboration, AI tools, and critical-thinking activities. Items adapted from Carless and Winstone (2023) and Evans et al. (2023) examine the perceived effectiveness of the new format, its inclusiveness, relevance to real-world applications, and students' willingness to recommend the assessment for future cohorts. Collectively, these established instruments enhance both the content validity and the comparability of findings with prior research. All constructs are grounded in validated measures from reputable studies, with adaptations made to suit the higher education context. Using these well-established instruments ensures both content validity and comparability with prior research. The redesigned assessment itself functions as the intervention, operationalized through group-based tasks integrating collaboration, AI tools, and critical thinking activities.

Data Analysis Techniques

Quantitative data will be analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. PLS-SEM is appropriate for this study as the proposed model includes multiple latent constructs and adopts a prediction-oriented, exploratory approach to examining academic performance (Hair et al., 2021). The technique is well suited to complex models and relatively smaller sample sizes, making it robust for applied educational research. Data analysis will follow a two-stage approach, measurement model assessment and structural model assessment (Hair et al., 2021).

Furthermore, qualitative data from open-ended survey responses will be analyzed thematically (Braun & Clarke, 2022) to complement quantitative findings. The integration of quantitative and qualitative results will provide a comprehensive understanding of the impact of redesigned assessments on student engagement and academic performance.

Results

Assessment of Measurement Model

In this study, all constructs were modelled as reflective constructs. For the reflective measurement model, reliability and validity were assessed in terms of scale reliability, convergent validity, and discriminant validity. Scale reliability was evaluated using composite reliability (CR). The CR values for all five constructs ranged from 0.920 to 0.974, exceeding the recommended threshold of 0.70, thereby indicating satisfactory internal consistency. Convergent validity and discriminant validity at the item level were assessed using factor loadings and cross-loadings, respectively. All items demonstrated factor loadings above 0.60 (ranging from 0.828 to 0.968) and loaded highly on their respective constructs while loading low on other constructs. These results confirm adequate convergent and discriminant validity at the item level.

At the construct level, Average Variance Extracted (AVE) was used to assess convergent validity. In contrast, the Fornell–Larcker criterion, which compares the square root of each construct’s AVE with the inter-construct correlations, was employed to assess discriminant validity. The square roots of AVEs, ranging from 0.791 to 0.924, were all greater than the corresponding inter-construct correlations, providing evidence of satisfactory convergent and discriminant validity at the construct level. Furthermore, a more robust assessment of discriminant validity was conducted using the Heterotrait–Monotrait Ratio of Correlations (HTMT) criterion. The HTMT values ranged from 0.600 to 0.885, which are below the recommended threshold of 0.900, thus further confirming discriminant validity. Overall, the results indicate that the measurement model demonstrates adequate reliability, convergent validity, and discriminant validity, supporting the soundness of the constructs used in this study.

Table 1: Measurement Model Assessment (Outer Loadings, Reliability, and Convergent Validity)

Construct	Item Code	Outer Loading	Cronbach’s Alpha	CR	AVE
Collaboration Quality (CQ)	CQ1	0.968	0.973	0.974	0.924
	CQ2	0.942			
	CQ3	0.980			
	CQ4	0.955			
AI Integration (AI)	AI1	0.934	0.956	0.962	0.884
	AI2	0.941			
	AI3	0.929			
	AI4	0.956			
Critical Thinking and Analytical Skills (CT)	CT1	0.940	0.930	0.951	0.828
	CT2	0.926			
	CT3	0.942			
	CT4	0.828			

Student Engagement (SE)	SE1	0.886	0.915	0.940	0.798
	SE2	0.938			
	SE3	0.907			
	SE4	0.840			
Academic Performance (AP)	AP1	0.916	0.912	0.917	0.791
	AP2	0.865			
	AP3	0.912			
	AP4	0.862			

Assessment of Structural Model

After confirming the adequacy of the measurement model, the structural model was assessed to examine the hypothesised relationships among the constructs. The assessment included tests for path coefficients, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). Path coefficients were used to evaluate the strength and significance of the hypothesised relationships. The results indicate that all hypotheses are supported.

H1: Collaboration Quality → Student Engagement ($\beta = 0.510, t = 3.872, p < 0.001$)

H2: AI Integration → Student Engagement ($\beta = 0.168, t = 2.103, p < 0.001$)

H3: Critical Thinking and Analytical Skills → Student Engagement ($\beta = 0.250, t = 2.173, p < 0.001$)

H4: Student Engagement → Academic Performance ($\beta = 0.810, t = 16.581, p < 0.001$)

These results suggest that collaboration quality, AI integration, and critical thinking and analytical skills have a significant and positive impact on student engagement, which in turn has a strong and positive effect on academic performance. Among the predictors, collaboration quality ($\beta = 0.510$) exhibited the strongest influence on student engagement. The R^2 value for Student Engagement (SE) was 0.687, indicating that collaboration quality, AI integration, and critical thinking and analytical skills jointly explain 68.7% of the variance in student engagement. The R^2 for Academic Performance (AP) was 0.656, suggesting that student engagement accounts for 65.6% of the variance in academic performance.

The f^2 values show the individual contribution of each exogenous construct to the endogenous variables.

Collaboration Quality → Student Engagement: 0.314 (medium effect)

AI Integration → Student Engagement: 0.061 (small effect)

Critical Thinking → Student Engagement: 0.074 (small effect)

Student Engagement → Academic Performance: 1.904 (large effect)

The Q^2 predict values, obtained via the PLS-Predict procedure, ranged from 0.298 to 0.666 for Student Engagement indicators and from 0.409 to 0.613 for Academic Performance indicators. All Q^2 values were greater than zero, confirming that the model has strong predictive relevance for both endogenous constructs.

In summary, both the measurement and structural model assessments demonstrate that the model is reliable, valid, and theoretically robust. The findings highlight the pivotal role of student engagement as a direct outcome of collaboration quality, AI integration, and critical thinking, and as a significant predictor of academic performance. These results provide a strong

empirical foundation for further discussion on the implications of these relationships in the following section.

Qualitative Findings

To complement the quantitative analysis conducted using SmartPLS, qualitative data were collected from 88 student responses to three open-ended questions. These questions explored students' perceptions of the redesigned assessment's benefits, challenges, and their experience of using AI in group tasks. The responses were coded and analysed thematically using NVivo. Three key themes emerged from the analysis: (1) perceived benefits of the redesigned assessment, (2) challenges encountered, and (3) experiences with AI integration. The qualitative insights provide a deeper understanding of students' learning experiences and support the quantitative results.

Perceived Benefits of the Redesigned Assessment

Analysis of 88 qualitative responses revealed that students identified multiple benefits of the redesigned assessment, primarily related to real-world skill development, proficiency in Excel, collaboration, communication, and the integration of AI tools. These insights highlight that the redesigned assessment successfully promoted active, authentic, and skill-based learning experiences.

Collaboration and teamwork emerged as the most frequently mentioned benefit, particularly in relation to working across campuses and cultural backgrounds. Students highlighted shared responsibility, peer learning, and exposure to diverse perspectives as valuable aspects of the group task:

“Understand and work with different people from other campuses, different backgrounds and so on.” (Student 5)

Development of real-world and analytical skills was another prominent theme. Students described the assessment as relevant and aligned with practical applications, enabling them to apply theoretical knowledge to realistic decision-making contexts. Eight participants noted that the assessment helped improve their communication skills, particularly in articulating ideas clearly during group discussions.

“The format and question asked is relevant to real world applications.” (Student 84)

In addition, students reported improvements in *digital and technical skills*, particularly in Excel and analytical modelling. Hands-on engagement with Excel functions and portfolio optimisation tools was perceived as beneficial for future employability:

“Doing the MPT model in Excel was beneficial, as it taught us how to use it well.” (Student 82)

Overall, these findings suggest that the redesigned assessment fostered active, skill-based learning and strengthened students' engagement through collaboration and the design of authentic tasks.

Challenges of the Redesigned Assessment

Despite the overall positive perceptions, students also reported several challenges that influenced their learning experience. These challenges were grouped into three main areas: understanding assessment requirements, teamwork and coordination issues, and technical or digital difficulties. Some students experienced difficulty *understanding assessment instructions and expectations*, particularly when engaging with unfamiliar tools and datasets:

“The guideline document was a bit confusing.” (Student 81)

Teamwork and coordination challenges were also evident, especially in relation to unequal participation, communication breakdowns, and scheduling across campuses and time zones:

“Unequal contribution.” (Student 7)

In addition, *technical challenges*, particularly related to Excel functions and data handling, were frequently reported. While these difficulties initially caused frustration, several students acknowledged that overcoming them contributed to learning persistence and skill development:

“Excel quite challenging when I found out there is small mistake and need to rewatch the video again.” (Student 73)

These challenges highlight areas for improvement in future iterations, including clearer guidance, structured milestones, and targeted technical support to enhance students' confidence and collaboration.

Experiences of Using AI in Group Assessment

Students reported mixed but largely positive experiences with integrating AI tools, such as ChatGPT, into their group assessments. Two key themes emerged: AI as a learning aid and concerns regarding reliability and trust. Most students perceived AI as a *useful and efficient support tool*, particularly for brainstorming, clarification, and refining ideas when used responsibly:

“AI helps you learn things in a more efficient way saving your time.” (Student 28)

However, some students expressed *caution regarding AI accuracy and reliability*, noting the need to verify outputs and avoid over-reliance:

“AI cannot be fully trusted because it gives me inaccurate figures.” (Student 61)

These reflections indicate that students adopted a reflective and critical stance towards AI use, recognising both its educational potential and limitations. The findings suggest that AI can enhance engagement and learning when embedded within structured tasks that emphasise ethical use and critical evaluation.

Overall, the qualitative findings reveal that the redesigned assessment effectively supported student engagement by promoting collaboration, authentic learning, and digital skill development, while also presenting challenges related to coordination, technical complexity,

and the responsible use of AI. These insights complement the quantitative results by illustrating how and why the redesigned assessment influenced students' engagement and academic experiences. The findings are interpreted with caution as the sample size are within single institutional context. However, this study provides contextually rich insights into first-year students' adaptation to AI-integrated assessment environments.

Discussion

The findings provide robust empirical evidence that redesigned assessments integrating collaboration, AI tools, and critical thinking significantly enhance student engagement and academic performance. In alignment with Self-Determination Theory, the redesigned tasks fulfilled students' intrinsic needs for autonomy, competence, and relatedness. The strong effect of collaboration quality ($\beta = 0.510$) confirms the vital role of social learning and shared accountability in engagement (Johnson & Johnson, 2009). Students reported improved communication and an increased appreciation for diverse perspectives, consistent with previous studies that have emphasised the impact of cooperative learning on motivation and achievement (Reeve, 2025).

The inclusion of AI tools yielded a moderate but significant influence on engagement ($\beta = 0.168$). This aligns with emerging literature that positions AI as a facilitator of personalised and feedback-rich learning environments (Winkler & Söllner, 2025; Yan et al., 2025). Students' reflections revealed growing digital literacy and ethical awareness, underscoring the importance of teaching responsible AI use to complement, not replace, human judgment.

Critical thinking and analytical skills also showed a notable effect ($\beta = 0.250$), supporting prior findings that authentic, problem-based assessments cultivate deeper cognitive engagement (Batdi, 2024). By embedding real-world scenarios, the redesigned tasks encouraged higher-order thinking and applied learning, thereby bridging the gap between academic and professional skill development.

Furthermore, lecturers should move beyond traditional assessment approaches and design authentic, real-world tasks that incorporate structured group collaboration, the use of AI tools and activities that require critical evaluation of outputs. Importantly, the findings suggest that the quality of collaboration, rather than mere participation, plays a central role in driving student engagement. Curriculum designers should integrate these elements systematically across courses to ensure progressive development of teamwork, problem-solving, and digital literacy skills. At the institutional level, universities should establish clear guidelines on the ethical use of AI, provide training for both students and educators, and redesign assessment policies to support innovative, technology-enhanced learning. Collectively, these efforts position assessment design as a strategic mechanism for enhancing student engagement, academic performance and graduate employability. Overall, the study presents a comprehensive model that demonstrates how technology-enhanced and collaborative assessment can enhance both student engagement and academic achievement.

Conclusion

This study advances the understanding of student engagement in higher education by demonstrating how redesigned assessments that integrate collaboration, AI tools, and critical thinking can enhance learning outcomes. Students not only developed analytical and digital

competencies but also strengthened essential soft skills, including teamwork, communication, and ethical reasoning. For educators, the findings underscore the value of intentionally designed assessments that align with authentic, real-world problem-solving. Institutions should incorporate structured opportunities for collaboration, guided AI use, and reflective practice within assessment frameworks. Training on academic integrity and the responsible application of AI is crucial for sustaining responsible innovation.

Limitations and Recommendations for Future Research

While this study provides valuable insights into how redesigned assessments enhance engagement and academic performance, several limitations should be acknowledged. First, the study was conducted within a single university context and involved a relatively small sample ($n = 88$), which may limit the generalizability of findings. Second, the reliance on self-reported data may introduce response bias, as students' perceptions might not fully reflect actual performance. Third, the cross-sectional design limits the ability to establish causality between assessment redesign and long-term learning outcomes. Despite these limitations, the study offers a strong empirical foundation and provides meaningful implications for educators seeking to improve assessment practices through collaboration, AI integration, and critical thinking.

Future research could expand across disciplines and contexts to validate the model's applicability. Longitudinal studies are recommended to explore lasting impacts on employability and lifelong learning. Additionally, future studies could employ paired-samples t-tests or pre- and post-assessment designs to measure how students' engagement, critical thinking, and academic performance improve before and after implementing redesigned assessments. Such approaches would provide stronger evidence of causal relationships and the sustained effects of assessment redesign. As education continues to evolve in an AI-augmented era, purposeful assessment redesign offers a transformative pathway for fostering engagement, equity, and excellence in higher learning.

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