

E-Assessment Based on The Case Method and Team-Based Project on Introduction to Business Course at Medan State University

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ABSTRACT:

The rapid integration of digital technology into higher education requires assessment systems that are not only accessible and efficient but also capable of measuring higher-order competencies and authentic learning outcomes. This study aimed to develop and evaluate an Android-based e-assessment integrating the case method and team-based project (TBP) for the Introduction to Business course at Medan State University. The study employed a research and development design using the ADDIE framework, comprising Analysis, Design, Development, Implementation, and Evaluation. The developed assessment system incorporated contextual business cases, collaborative project activities, assessment rubrics, online discussion, assignment submission, and learning-result reporting. Product feasibility was evaluated through media and material expert validation, while practicality was examined through student and lecturer responses. Effectiveness was assessed by comparing learning outcomes between students using the developed e-assessment and those receiving conventional assessment, supported by independent-samples t-test, N-Gain, and Cohen's d analyses. The results demonstrated that the developed e-assessment achieved a high level of feasibility, with a mean score of 4.10 from the media expert and 4.30 from the material expert. Student responses were highly positive across enjoyment and ease of use (87.15%), interest (86.57%), attention (85.55%), and engagement (88.24%). Lecturer responses indicated an overall practicality level of 91%. The effectiveness analysis revealed a statistically significant difference in learning outcomes between groups ($t = 6.184$, $p < .001$), with an N-Gain of 61.20% and a reported Cohen's d of 3.64. These findings indicate that integrating e-assessment with case method and TBP can provide a feasible, practical, and effective approach to supporting student-centred and outcome-based learning in introductory business education. The study contributes to the development of digitally mediated authentic assessment by demonstrating how mobile technology can be aligned with contextual problem solving and collaborative learning.

Keywords: e-assessment, case method, team-based project, Android-based learning, business education.

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1. Introduction

The rapid transformation of higher education through digital technologies has fundamentally reshaped how teaching, learning, and assessment are designed and implemented. Universities are increasingly expected not only to facilitate students' acquisition of disciplinary knowledge but also to develop transferable competencies, including critical thinking, problem-solving, collaboration, communication, creativity, and digital literacy. This shift has strengthened the movement from teacher-centred instruction toward student-centred and outcome-oriented learning environments, in which assessment is expected to provide meaningful evidence of students' achievement of learning outcomes (Biggs & Tang, 2011; Boud & Molloy, 2013). In this context, assessment should no longer be viewed merely as a mechanism for assigning grades but as an integral component of the learning process that promotes active engagement, higher-order thinking, feedback, and the application of knowledge to authentic problems.

The growing use of digital technologies has further expanded the possibilities for assessment in higher education. Electronic assessment (e-assessment) enables educators to design more flexible, accessible, interactive, and potentially authentic assessment environments. Beyond conventional online quizzes, contemporary e-assessment can incorporate case analysis, collaborative tasks, project-based activities, peer interaction, and performance-oriented evaluation. Such approaches are particularly relevant in business education, where students are expected to understand not only conceptual principles but also how business decisions are made in complex and uncertain organizational contexts. Effective assessment in business education therefore needs to bridge the gap between theoretical knowledge and practical application by presenting students with problems that resemble those encountered in real business environments.

One pedagogical approach that has gained substantial attention in business and management education is the case method. The case method exposes students to realistic or simulated organizational problems and requires them to identify issues, analyze relevant information, evaluate alternatives, and formulate defensible solutions. Its pedagogical value lies in its capacity to move learning beyond the passive acquisition of knowledge toward analytical reasoning and decision-making. A recent scoping review of case-method research in tertiary business education identified extensive use of the approach across business schools, while also highlighting considerable variation in implementation and assessment practices and the need for stronger empirical evidence concerning its effectiveness (Mu & Hatch, 2024). This finding is important because the effectiveness of the case method cannot be assumed solely from its popularity; rather, its learning outcomes depend substantially on how cases are designed, facilitated, and assessed.

The case method can be further strengthened when combined with team-based project (TBP) learning. Team-based project learning provides students with opportunities to collaboratively investigate problems, divide responsibilities, integrate different perspectives, develop solutions, and communicate project outcomes. Collaborative learning has been associated with improvements in students' achievement and the development of interpersonal and higher-order cognitive skills, particularly when students are required to engage actively with learning tasks and with one another (Johnson et al., 2014). In business education, the combination of case analysis and project work is particularly relevant because business problems rarely have a single predetermined answer and are generally addressed through collaborative decision-making. Recent research on team-based case teaching in introductory management education has demonstrated the potential of integrating case teaching with group learning to increase student engagement and deepen learning (Wright et al., 2024). Nevertheless, the combination of case-

based learning, team-based projects, and digitally mediated assessment remains insufficiently explored, particularly in introductory business courses within Indonesian higher education.

The integration of case method and team-based project is also consistent with the principles of Outcome-Based Education (OBE), which emphasize the alignment of learning activities, assessment, and measurable learning outcomes. Under an OBE framework, assessment should provide evidence that students have achieved not only knowledge-related outcomes but also competencies that can be demonstrated through authentic performance (Biggs & Tang, 2011). Case analysis and team-based projects provide an opportunity to assess these multidimensional competencies because students must demonstrate their ability to interpret information, formulate arguments, solve problems, collaborate with peers, and communicate results. However, implementing such assessment in conventional formats can create challenges related to time, consistency, documentation, accessibility, feedback, and monitoring of individual and group performance. E-assessment offers an opportunity to address some of these challenges by integrating assessment activities into a structured digital environment.

The importance of developing such an assessment model is particularly evident in the Indonesian higher education context. The implementation of case method and team-based project learning has been promoted as part of the broader transformation toward student-centred higher education. Empirical studies in Indonesia indicate that these approaches can support critical thinking, problem-solving, communication, creativity, and collaborative learning, although their implementation is not always optimal because students may lack understanding of the objectives and procedures of the assignments (Rahmadi et al., 2022). Similarly, recent research has reported that assessment instruments designed around case method and team-based project learning can be used to evaluate multiple competencies, although challenges remain in assessing dimensions such as collaboration effectively (Rosidin et al., 2024). These findings

suggest that pedagogical innovation needs to be accompanied by assessment innovation; changing the learning method without redesigning the assessment mechanism may limit the potential benefits of case and project-based learning.

This issue is highly relevant to the Introduction to Business course at Medan State University (Universitas Negeri Medan), where students are introduced to fundamental concepts concerning business environments, organizational functions, entrepreneurship, management, marketing, finance, and other dimensions of business activity. As an introductory course, it provides an important foundation for subsequent business and management subjects. However, traditional assessment approaches may emphasize students' ability to recall definitions and concepts rather than their ability to interpret business situations, make decisions, solve problems, and work collaboratively. A recent needs-analysis study conducted at the Faculty of Economics, Medan State University, specifically identified the need for an Android-based assessment for the Introduction to Business course, with assessment questions designed using case method and team-based project principles (Sihombing et al., 2025). This finding provides an important empirical basis for developing and examining a more contextualized digital assessment model for the course.

Despite these developments, an important research gap remains. Existing studies have generally examined case method, team-based project learning, or digital assessment as relatively separate pedagogical interventions. Research specifically investigating an integrated e-assessment model that combines case method and team-based project activities in an introductory business course remains limited. Moreover, there is a lack of empirical evidence concerning how such an integrated model can support authentic assessment within an OBE-oriented curriculum in the context of Indonesian public universities. Addressing this gap is important because the value of e-assessment should not be determined merely by its technological features but by its capacity to

improve the validity, authenticity, engagement, and meaningfulness of assessment.

Accordingly, this study examines e-assessment based on the case method and team-based project in the Introduction to Business course at Medan State University. The study seeks to contribute to the literature in three ways. First, it extends research on digital assessment by integrating technology with authentic, case-based, and collaborative assessment practices. Second, it contributes empirical evidence regarding the application of case method and team-based project assessment within an introductory business education context. Third, it provides a context-sensitive model for aligning digital assessment with student-centred and outcome-based learning in Indonesian higher education. By positioning e-assessment not simply as a technological replacement for conventional assessment but as a pedagogical mechanism for evaluating complex competencies, this study responds to the growing demand for assessment systems that are authentic, collaborative, digitally enabled, and aligned with the competencies required in contemporary business environments.

2. Methodology

2.1 Research Design

This study employed a research and development (R&D) design to develop and evaluate an Android-based e-assessment system integrating the case method and team-based project (TBP) for the Introduction to Business course at Medan State University. The development process adopted the ADDIE model, consisting of five sequential phases: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE framework was selected because it provides a systematic instructional-development procedure that facilitates the identification of learning needs, the design of assessment components, the development of the digital product, its implementation in an authentic learning environment, and subsequent evaluation and refinement (Branch, 2009). The use of ADDIE in educational product development is also supported by previous research

demonstrating its applicability for developing technology-mediated learning resources and assessment systems (Putri Weldami & Yogica, 2024).

The development was guided by the learning outcomes specified in the Semester Learning Plan (Rencana Pembelajaran Semester [RPS]) and aligned with the principles of Outcome-Based Education (OBE). Consequently, the assessment system was designed not only to measure students' conceptual understanding but also to facilitate the assessment of analytical thinking, problem-solving, decision-making, and collaborative competencies. The integration of case-based assessment and team-based project activities was intended to create an assessment environment that was contextual, authentic, collaborative, and relevant to the competencies expected in contemporary business education.

2.2 Development Context and Learning Scope

The research was conducted in the Introduction to Business course in the Management Study Program, Faculty of Economics, Medan State University. The development process began with an examination of the existing RPS and the intended learning outcomes of the course. Based on this analysis, eight major content areas were identified as the basis for the e-assessment: (1) business and the business environment; (2) ethics and social responsibility in business; (3) forms of business ownership and business combinations; (4) management aspects of business; (5) the role of marketing in business; (6) product management; (7) human resource management; and (8) business financial management.

Each content area was translated into measurable learning indicators. These indicators included students' abilities to explain fundamental business concepts, identify business-environment factors, analyze ethical dilemmas, understand alternative forms of business ownership, explain managerial functions, analyze marketing components, understand product-management processes, identify strategic human-resource functions, and explain the relationship between financial decisions and organizational

value. The alignment between content, learning outcomes, assessment tasks, and digital implementation constituted the basis for developing the assessment blueprint.

2.3 ADDIE Development Procedure

2.3.1 Analysis

The Analysis phase involved identifying the instructional and assessment requirements of the Introduction to Business course. The researchers examined the RPS and the learning outcomes expected under the OBE-oriented curriculum. The analysis was used to determine the competencies that needed to be assessed and the content areas that would be incorporated into the digital assessment system. Eight content domains were subsequently selected for development.

Particular attention was given to the need for assessment activities that could measure the application of business concepts rather than merely students' recall of theoretical information. Accordingly, case-based tasks were designed to expose students to contextualized business situations, while team-based project activities were incorporated to facilitate collaborative problem-solving and the development of communication and teamwork competencies. This approach is consistent with the pedagogical rationale that assessment should provide meaningful evidence of students' ability to apply knowledge and demonstrate relevant competencies.

2.3.2 Design

In the Design phase, the conceptual and technical blueprint of the e-assessment product was developed. The design incorporated the learning environment, instructional approach, assessment objectives, digital platform, and supporting resources. The assessment blueprint included the construction of assessment instruments and the development of objective and transparent rubrics for evaluating both individual performance and team collaboration.

Case-based assessment tasks were designed around contextual business situations requiring students to interpret information, identify problems, formulate alternatives, and propose

appropriate solutions. Team-based project components were designed to facilitate collaborative work and the application of business concepts to practical situations. The assessment system was also designed to accommodate formative and summative assessment activities.

The design phase therefore established the alignment among learning outcomes, learning content, assessment tasks, assessment criteria, and digital functionality. Such alignment is particularly important within an OBE framework because assessment should provide evidence of the extent to which intended learning outcomes have been achieved.

2.3.3 Development

During the Development phase, the assessment blueprint was transformed into an Android-based mobile application. The application was designed as the principal medium for implementing the e-assessment based on case method and TBP. Development involved the construction of the user interface and user experience (UI/UX), integration of assessment content, and implementation of the main functional features.

The developed application included features for student registration and login, access to assessment materials, examination activities, submission of case-based assignments, online team collaboration, discussion, assessment through rubrics, and access to learning results. The system also incorporated deadline notifications and learning-result reporting. Following the completion of the initial application, limited beta testing was conducted to identify functional problems, interface issues, and potential usability barriers. Feedback obtained during the preliminary testing was used to correct errors and refine the application before broader implementation.

2.3.4 Implementation

The Implementation phase involved applying the developed e-assessment in the Introduction to Business course. Before classroom implementation, the product underwent expert validation involving both a media expert and a

subject-matter expert. The media expert evaluated the technical and visual dimensions of the application, whereas the subject-matter expert evaluated the instructional content, assessment design, and appropriateness of the case method and TBP components.

The classroom implementation was conducted over four meetings, focusing on the topic of Business and the Business Environment. During this phase, students interacted with the Android-based assessment system and completed assessment activities designed around contextualized cases and team-based project tasks. The implementation was intended to examine the feasibility and practical usability of the developed product under authentic instructional conditions.

2.3.5 Evaluation

The Evaluation phase was conducted to determine the quality, practicality, and effectiveness of the developed e-assessment system and its alignment with the intended learning outcomes. Evaluation considered three principal dimensions: functional usability, user experience, and learning-related outcomes.

Data were collected through questionnaires, interviews, observations, expert assessments, and analysis of student achievement. The evaluation focused on the ease of using the application, clarity of assessment instructions, appropriateness of the assessment rubrics, functionality of collaborative features, and the application's ability to support case analysis and team-based project activities. In addition, the evaluation examined student engagement, understanding of course content, and the development of soft skills, particularly communication and problem-solving.

2.4 Participants and Expert Validation

The validation process involved two expert roles. First, one digital learning media expert evaluated the technical and visual quality of the application, including layout clarity, readability, navigation, responsiveness, authentication, question presentation, Android compatibility, loading speed, application stability, and data-management

functions. The media validation instrument consisted of 20 assessment items.

Second, one subject-matter expert evaluated the instructional and content dimensions of the assessment system. The material-validation instrument consisted of 20 items covering alignment with learning objectives, OBE implementation, blended learning support, content depth, case-method suitability, analytical skills, critical thinking, decision-making, collaboration, clarity of instructions, currency of content, assessment literacy, time allocation, and the ability of the assessment to measure students' understanding and application of business concepts.

For the practicality assessment, the study involved five lecturers of the Introduction to Business course. Their responses were used to evaluate the usability, clarity of instructions, assessment efficiency, support for case method and TBP, and the capacity of the system to monitor student progress. Student responses were also collected to examine their perceptions of usability, interest, attention, and engagement with the e-assessment system.

2.5 Research Instruments

Several instruments were employed to evaluate the developed product. The first instrument was a media-validation questionnaire, which assessed the technical and visual characteristics of the Android application. The second was a material-validation questionnaire, which assessed the quality and relevance of the assessment content and its alignment with learning outcomes and the case-method and TBP approaches. The third instrument was a student-response questionnaire, which examined perceptions of usability, interest, attention, and engagement. The fourth instrument was a lecturer-response questionnaire, which assessed practicality, instructional suitability, efficiency, and the functionality of the assessment system.

In addition, observation, interviews, and learning-outcome data were incorporated into the evaluation process. The use of multiple sources of evidence was intended to provide a more comprehensive assessment of the developed

product rather than relying exclusively on a single evaluation instrument.

2.6 Data Analysis

The quantitative data obtained from expert validation and user-response questionnaires were analyzed descriptively using total scores, mean scores, and percentages. The media and material validation results were interpreted according to the established feasibility criteria. In the original development study, the media expert's assessment produced a total score of 82.50 with a mean of 4.10, while the material expert produced a total score of 86.00 with a mean of 4.30; both were categorized as highly feasible. Practicality was analyzed through the percentage of positive responses from students and lecturers. Student responses were examined across four dimensions: enjoyment and ease of use, interest, attention, and engagement. Lecturer responses were analyzed according to ease of use, clarity of instructions and assessment procedures, assessment efficiency, and support for case method and TBP.

For the effectiveness analysis, student learning outcomes were compared between the experimental and control groups. The original study employed an independent-samples t-test to determine whether there was a statistically significant difference in learning outcomes between the two groups. Learning improvement was further assessed using the N-Gain score, while the magnitude of the intervention effect was evaluated using Cohen's d effect size. The original study reported a t-value of 6.184 with a significance value of $< .001$, an average N-Gain of 0.6120 (61.20%), and a Cohen's d of 3.64.

2.7 Ethical and Quality Considerations

The development process emphasized alignment between assessment content, intended learning outcomes, and the pedagogical principles underlying case method and TBP. The assessment instruments were reviewed by experts before implementation, while usability and practicality were examined through feedback from lecturers and students. The iterative nature of the ADDIE framework allowed findings from validation and implementation to inform

subsequent refinement of the digital assessment product.

Overall, the methodological design combined instructional development, expert validation, user evaluation, and effectiveness testing. This combination was intended to establish not only whether the Android-based e-assessment could be developed technically, but also whether it was instructionally appropriate, practically usable, and capable of supporting the intended learning outcomes in the Introduction to Business course.

3. Results

3.1 Development of the Android-Based E-Assessment

The development process resulted in an Android-based e-assessment system designed to integrate the case method and team-based project (TBP) into the assessment of the Introduction to Business course at Medan State University. The product was developed using the ADDIE framework, encompassing Analysis, Design, Development, Implementation, and Evaluation stages. The analysis stage identified eight major learning domains that were subsequently incorporated into the assessment system: business and the business environment; business ethics and social responsibility; forms of business ownership and business combinations; management aspects of business; the role of marketing; product management; human resource management; and business financial management.

The development process emphasized alignment between the assessment content and the learning outcomes specified in the Outcome-Based Education (OBE)-oriented curriculum. The assessment was therefore designed to move beyond the measurement of factual knowledge and incorporate analytical, decision-making, problem-solving, and collaborative competencies. In the design stage, assessment blueprints, contextual case questions, assessment rubrics, and formative and summative assessment procedures were developed. The application was subsequently equipped with features supporting student registration, examination activities, learning materials, score access, case-task

submission, online collaboration, discussion, rubric-based assessment, deadline notifications, and learning-result reporting.

This configuration demonstrates that the developed e-assessment represents more than a digital replacement for paper-based testing. It constitutes a pedagogical environment in which assessment is connected to contextual problem solving and collaborative learning. Such integration is consistent with the broader shift toward technology-enhanced assessment, in which digital platforms can facilitate more flexible, interactive, and authentic assessment practices (Jurâne-Brêmeane, 2023). It is also consistent with the view that team-based project learning can facilitate students' development of

collaborative and applied learning competencies (Rosidah & Pramulia, 2021).

3.2 Expert Validation of the E-Assessment

The first dimension examined was the feasibility of the developed e-assessment through expert validation. The media expert evaluated 20 aspects of the application, including layout clarity, colour selection, text readability, graphic quality, design consistency, navigation, interface responsiveness, authentication, question presentation, Android compatibility, loading speed, system stability, and data-management functions. The assessment produced a total score of 82.50, with a mean score of 4.10, which was categorized as highly feasible.

Table 1. Summary of Media Expert Evaluation Results

No.	Evaluation Item	Score
1	Clarity of the application layout	4.00
2	Appropriateness of color selection	4.50
3	Text readability	4.50
4	Quality and relevance of graphics	3.50
5	Consistency of design across pages	4.00
6	Attractiveness of the application layout	4.00
7	Attractiveness of the color composition and design	4.00
8	Ease of navigation within the application	4.50
9	User interface responsiveness	4.50
10	Smoothness of the login/authentication process	4.50
11	Accuracy of examination question display	4.50
12	Compatibility across different Android versions	4.00
13	Appropriateness of font type and size	4.50
14	Application loading speed	4.00
15	Application stability (absence of crashes/errors)	4.50
16	Performance across different screen sizes	3.00
17	Quality of supporting media (images, audio, and video)	4.50
18	Ease of exporting/importing examination data	4.50
19	Appropriateness of interface design for the target user level	3.50
20	Ease and simplicity of operation	3.50
	Total Score	82.50
	Mean Score	4.10
	Criterion	Highly Feasible

Note: The evaluation criteria and scoring follow the assessment framework used in the study.

The result indicates that the application achieved an acceptable level of technical and visual quality for implementation in the learning environment. In particular, the relatively high scores for navigation, responsiveness, authentication,

question presentation, and system stability suggest that the application was sufficiently functional to support assessment activities. This finding is important because the effectiveness of digital assessment is partly dependent on the

usability and reliability of the technological platform. An assessment system that is pedagogically sound but technically difficult to operate may create additional cognitive and administrative burdens for both students and lecturers.

The finding also supports previous research emphasizing the potential of Android-based educational technologies to provide accessible learning environments. Utami et al. (2023) reported the potential of Android-based interactive multimedia to support student learning activities, while Abdul Gani et al. (2021) demonstrated the feasibility of Android-based computer-based testing as an alternative digital assessment medium. The present study extends these findings by applying the Android platform not only to conventional testing but also to

assessment activities incorporating contextual cases and team-based projects.

3.3 Material and Instructional Validation

The second validation focused on the instructional and content dimensions of the e-assessment. The material expert assessed 20 indicators covering alignment with learning objectives, support for OBE, blended-learning compatibility, content depth, case-method suitability, analytical skills, critical thinking, decision-making, collaboration, clarity of instructions, currency of content, assessment literacy, time allocation, and the effectiveness of the assessment in measuring students' understanding and application of business concepts. The assessment produced a total score of 86.00, with a mean of 4.30, and was categorized as highly feasible.

Table 2. Summary of Material Expert Evaluation Results

No.	Evaluation Item	Score
1	Alignment with the learning objectives	5.00
2	The application supports the achievement of OBE-based learning objectives	4.00
3	The application supports the implementation of blended learning	5.00
4	Depth of the learning materials	4.50
5	Alignment with the case method	4.00
6	Potential to develop analytical skills	4.50
7	Alignment with the expected competencies	4.00
8	Clarity and readability of sentences and paragraphs	4.50
9	Systematic and coherent organization of the learning materials	4.00
10	Clarity of case descriptions and information	4.00
11	Potential of the cases to develop critical thinking	3.50
12	Encouragement of active student engagement	4.00
13	Potential to develop decision-making skills	4.50
14	Potential to develop collaboration skills	4.00
15	Use of appropriate and comprehensible terminology	4.50
16	Clarity of instructions	4.50
17	Currency and up-to-dateness of the assessment materials	4.50
18	Incorporation of the four OBE literacy dimensions in the assessment	4.50
19	Appropriateness of the time allocation relative to task complexity	4.50
20	Effectiveness in measuring students' understanding and application of business concepts	4.00
	Total Score	86.00
	Mean Score	4.30
	Criterion	Highly Feasible

Note: The evaluation criteria and scoring follow the assessment framework used in the study.

The higher mean score obtained from the material expert compared with the media expert suggests that the instructional content and assessment structure were particularly well aligned with the intended learning outcomes. The assessment was considered capable of supporting OBE and of facilitating analytical thinking, decision-making, and collaboration. This result is theoretically important because OBE requires assessment to demonstrate the extent to which students achieve intended competencies rather than simply complete instructional activities (Arinindyah & Nurhayati, 2024).

The result also indicates the relevance of integrating case method and TBP into business education. Case-based assessment provides opportunities for students to interpret complex situations and apply conceptual knowledge to practical problems, whereas team-based project activities provide a mechanism for collaborative knowledge construction. Harlanu (2024) similarly

emphasizes the relevance of case method and team-based project learning for collaborative classroom strategies. Thus, the high material-validation score suggests that the developed assessment model successfully translated these pedagogical principles into an operational digital assessment system.

3.4 Practicality from the Students' Perspective

The practicality of the e-assessment was subsequently examined from the students' perspective. The student-response questionnaire focused on four dimensions: enjoyment and ease of use, interest in the e-assessment, attention, and student engagement. The results showed highly positive responses across all four dimensions. The percentage for enjoyment and ease of use was 87.15%, interest in the e-assessment was 86.57%, attention was 85.55%, and student engagement reached 88.24%.

Table 3. Results of the Student Response Questionnaire

No.	Aspect	Percentage	Criterion
A	Enjoyment and Ease of Use	87.15%	Very Positive
B	Interest in the E-Assessment	86.57%	Very Positive
C	Attention	85.55%	Very Positive
D	Student Engagement	88.24%	Very Positive

These findings indicate that students responded positively to both the technological and pedagogical characteristics of the application. The high engagement score is particularly noteworthy because digital assessment can potentially become a purely procedural activity if students perceive it as simply another form of online testing. In the present study, however, the contextual nature of the cases and the collaborative components of the team-based projects appear to have contributed to a more engaging assessment experience.

Students also reported that the application helped them understand course content in a more contextual manner because assessment tasks were related to real-world business situations. The collaborative features were perceived as

supporting teamwork and communication, while the Android platform facilitated access to assessment activities and assignment submission.

This finding is consistent with the pedagogical rationale of authentic assessment, which emphasizes the application of knowledge to meaningful and realistic situations. Jurāne-Brēmane (2023) argues that digital assessment should be understood within the broader transformation of technology-enriched education rather than simply as a technological mechanism for delivering conventional tests. The present findings provide empirical support for this perspective by demonstrating that digital delivery can be combined with contextualized and collaborative assessment.

3.5 Practicality from the Lecturers' Perspective

The lecturers' responses provided additional evidence concerning the practicality of the developed system. Five lecturers teaching the Introduction to Business course participated in the practicality assessment. The overall

practicality level reached 91%, indicating a highly positive evaluation. Specifically, 92% of lecturers assessed the application as easy to use, 88% evaluated the clarity of instructions and assessment procedures positively, 90% reported benefits in assessment efficiency, and 93% considered the application supportive of case method and team-based project implementation.

Table 4. Results of the Lecturer Response Questionnaire for the Introduction to Business Course

No.	Aspect	Percentage	Criterion
A	Ease of Application Use	92%	Very Positive
B	Clarity of Instructions and Assessment Procedures	88%	Very Positive
C	Efficiency of Student Assessment	90%	Very Positive
D	Support for Case Method and Team-Based Project Learning	93%	Very Positive

The results suggest that the application addressed several practical challenges commonly associated with implementing complex assessment activities. The rubric and reporting features were perceived as reducing the time and effort required for evaluation, while the system's monitoring capabilities enabled lecturers to observe student progress. The original evaluation further indicated that 89% of lecturers considered student-progress monitoring to be easily accessible in real time.

The particularly high score for support of case method and TBP (93%) is significant because it indicates that the technological system was perceived not merely as an administrative tool but as an enabler of the intended pedagogical model. This finding strengthens the argument that effective educational technology should be designed around pedagogical requirements rather than technology alone. In other words, the value of the Android platform lies in its ability to facilitate learning and assessment processes that would otherwise be more difficult to manage.

3.6 Effectiveness of the E-Assessment

Beyond feasibility and practicality, the study examined the effectiveness of the developed e-assessment in improving student learning outcomes. The effectiveness analysis compared learning outcomes between an experimental

group using the developed e-assessment and a control group. The independent-samples t-test produced a t-value of 6.184 with a significance value of $p < .001$, indicating a statistically significant difference in learning outcomes between the two groups.

The improvement was further examined using the N-Gain analysis. The mean N-Gain score was 0.6120, equivalent to 61.20%, which was interpreted in the source study as a very good improvement. In addition, the calculated Cohen's d effect size was 3.64, indicating a very large intervention effect.

These results suggest that the developed e-assessment was associated with substantially better learning outcomes among students who experienced the intervention. The result can be interpreted through the interaction between three elements: contextualized assessment, collaborative learning, and digital accessibility. First, case-based tasks require students to apply concepts to concrete business situations rather than merely recall information. Second, team-based projects create opportunities for discussion, negotiation, and collaborative problem solving. Third, the Android-based platform provides flexible access to the assessment environment.

The finding is consistent with previous research showing the potential of case method and team-based project learning to foster active learning and higher-order competencies. Harlanu (2024), for example, identified the relevance of case method and TBP for collaborative learning strategies. Similarly, Rosidah and Pramulia (2021) emphasized the role of case method and TBP in developing student competencies through collaborative learning. The present study adds to this literature by demonstrating that these pedagogical approaches can be operationalized through an integrated mobile e-assessment environment.

4. Discussion

4.1. Discussion: Integrating Technology, Authentic Assessment, and Collaborative Learning

Taken together, the results demonstrate that the developed Android-based e-assessment achieved three important characteristics: feasibility, practicality, and effectiveness. The feasibility results indicate that both the technological platform and instructional content were considered highly appropriate by experts. The practicality results demonstrate that students and lecturers could use the system effectively, while the effectiveness results indicate a statistically significant difference in learning outcomes accompanied by a substantial N-Gain and a very large reported effect size.

The findings provide an important conceptual implication for the design of digital assessment in higher education. The study suggests that the pedagogical value of e-assessment depends not simply on digitizing existing examination procedures but on redesigning assessment around authentic learning experiences. The case method creates a bridge between theoretical business concepts and practical business problems, while TBP extends this learning process into collaborative problem solving. The Android platform then provides the technological infrastructure for delivering, monitoring, and evaluating these activities.

This integrated model is particularly relevant to OBE because it enables assessment to capture

multiple dimensions of learning outcomes. Rather than focusing exclusively on cognitive recall, the assessment environment provides opportunities to evaluate analytical reasoning, decision-making, communication, collaboration, and application of business knowledge. The material-validation results, which specifically assessed analytical thinking, decision-making, and collaboration, provide evidence that these competencies were intentionally incorporated into the assessment design.

The results also reinforce the importance of alignment among curriculum, pedagogy, assessment, and technology. The eight content domains were derived from the course RPS and learning outcomes, while assessment activities were designed around case analysis and team-based projects. The application was then developed to support these activities. This alignment provides a stronger pedagogical rationale than adopting mobile technology merely because of its popularity or accessibility.

4.2. Comparison with Previous Research and Contribution of the Study

The findings are broadly consistent with previous studies on digital assessment and active learning but extend them in several respects. Previous research has examined digital assessment as a mechanism for improving accessibility and flexibility (Nurlina et al., 2022), Android-based assessment as an alternative to conventional computer-based testing (Abdul Gani et al., 2021), and case method and TBP as approaches for developing collaborative competencies (Harlanu, 2024; Rosidah & Pramulia, 2021). However, the present study integrates these three dimensions into a single assessment environment specifically designed for an introductory business course.

The contribution therefore lies in the integration of digital assessment technology with authentic case-based and collaborative assessment. Rather than treating e-assessment, case method, and TBP as independent interventions, the developed system positions them as mutually reinforcing components. The digital platform facilitates implementation; the case method provides

contextual and analytical tasks; and TBP provides a collaborative structure for solving those tasks.

The study also contributes context-specific evidence from a public university in Indonesia. This is relevant because digital assessment models developed in highly technologically resourced educational environments cannot necessarily be transferred directly to other contexts. The positive responses from both lecturers and students suggest that an Android-based platform can provide a practical mechanism for integrating active assessment into the Introduction to Business course at Medan State University.

4.3. Overall Interpretation

Overall, the results indicate that the Android-based e-assessment based on case method and TBP was highly feasible, highly practical, and effective in improving student learning outcomes. The media expert's mean score of 4.10 and material expert's mean score of 4.30 establish strong evidence of product feasibility. Student responses exceeding 85% across all measured dimensions demonstrate positive acceptance and engagement, while the 91% overall lecturer practicality score indicates strong usability in instructional practice. Most importantly, the statistically significant difference in learning outcomes ($t = 6.184$, $p < .001$), N-Gain of 61.20%, and reported Cohen's d of 3.64 indicate substantial learning improvement associated with the intervention.

The findings therefore support the proposition that e-assessment can become more pedagogically meaningful when digital technology is deliberately integrated with contextualized case analysis and collaborative project work. The results further suggest that the developed model can serve as a potential reference for designing assessment systems in other higher-education courses where students are expected to apply theoretical knowledge, solve authentic problems, and demonstrate collaborative competencies.

Nevertheless, the findings should be interpreted within the scope of the reported implementation. The classroom implementation described in the

source article was conducted over four meetings and focused on the Business and Business Environment topic. Therefore, the reported effectiveness should not automatically be generalized to all eight content domains or to other courses and institutions without further validation. Future research should examine the model across larger and more diverse student populations, longer implementation periods, and multiple business topics, while also examining individual contribution within team-based assessment and the reliability of collaborative-performance measurement.

5. Conclusion

This study developed and evaluated an Android-based e-assessment integrating the case method and team-based project (TBP) for the Introduction to Business course at Medan State University. The findings demonstrate that the developed assessment system provides a viable integration of digital technology, authentic assessment, and collaborative learning within an outcome-based educational framework.

The expert validation results indicate that the developed product was highly feasible from both technological and instructional perspectives. The media expert assigned a mean score of 4.10, while the material expert assigned a mean score of 4.30. These results indicate that the application possessed appropriate technical functionality, interface quality, assessment structure, content relevance, and alignment with the intended learning outcomes.

The practicality findings further demonstrate strong acceptance among both students and lecturers. Student responses were highly positive in terms of enjoyment and ease of use, interest, attention, and engagement, with percentages ranging from 85.55% to 88.24%. The overall lecturer practicality assessment reached 91%, indicating that the application was considered easy to use and capable of supporting assessment efficiency, student-progress monitoring, case-based assessment, and team-based project implementation.

The effectiveness results provide additional evidence of the value of the developed

assessment model. Students who participated in the e-assessment intervention demonstrated significantly different learning outcomes compared with the control group, as indicated by the independent-samples t-test ($t = 6.184$, $p < .001$). The N-Gain score of 61.20% indicated substantial learning improvement, while the reported Cohen's d of 3.64 indicated a very large effect. Taken together, these findings suggest that the integration of case method, TBP, and mobile e-assessment can support students' ability to engage with business concepts through contextualized and collaborative learning experiences.

The principal contribution of this study is therefore the development of an integrated assessment model in which technology functions not merely as a medium for delivering conventional examinations but as an infrastructure for authentic, contextual, and

collaborative assessment. The model demonstrates how digital assessment can be aligned with OBE principles by providing opportunities to assess not only conceptual understanding but also analytical thinking, problem-solving, decision-making, communication, and collaboration.

Nevertheless, the findings should be interpreted within the scope of the study. The implementation reported in the source study was conducted over four meetings and focused on the Business and Business Environment topic. Consequently, the findings should not be generalized automatically to all topics within the Introduction to Business course or to other educational contexts. Further empirical testing involving larger samples, longer implementation periods, multiple institutions, and a broader range of course topics is necessary to establish the robustness and transferability of the model.

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