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DEVELOPMENT AND EXPERT VALIDATION OF A PROBLEM-BASED LEARNING ACCOUNTING E-MODULE INTEGRATED WITH GAMIFICATION

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Abstract

This study aims to develop a gamification-integrated Problem Based Learning (PBL) e-module based on Moodle and to examine its feasibility as instructional material for eleventh-grade accounting students at vocational high school. The study was motivated by the low level of students' critical thinking skills and learning outcomes, particularly in recording trading company transactions, which are still dominated by conventional teaching approaches. This research employed a Research and Development (R&D) method using the ADDIE model, consisting of the stages of analysis, design, development, implementation, and evaluation. The research subjects were eleventh-grade accounting students at SMK Negeri 1 Patumbak in the 2025/2026 academic year. Data were collected through expert validation involving material experts, media experts, and instructional design experts, as well as product trials including individual testing, small group testing, and large group testing. The results indicate that the gamification-integrated PBL e-module is feasible for use in accounting learning. Material expert validation obtained an average score of 3.9 (78%) categorized as valid, media expert validation obtained a score of 4.15 (83%) categorized as very valid, and instructional design expert validation obtained a score of 4.11 (82%) categorized as very valid. The individual trial resulted in a feasibility percentage of 80% (valid), the small group trial achieved 83% (very valid), and the large group trial reached 93% (very valid). Overall, the e-module achieved an average feasibility score of 83%, categorized as very valid. These findings indicate that the developed e-module meets feasibility criteria in terms of content, media, and instructional design, and has strong potential to support interactive, contextual, and student-centered accounting learning.

Keywords: e-module, problem based learning, gamification, Moodle, vocational accounting education

INTRODUCTION

The development of 21st-century education requires learners not only to master conceptual knowledge but also to possess higher-order thinking skills, particularly critical thinking and problem-solving abilities. This is consistent with the findings of Rusmin et al. (2024), who emphasize that critical thinking and problem-solving are essential competencies that students must acquire in the 21st century. Increasingly complex global dynamics cannot be addressed solely through conceptual knowledge; rather, they demand the ability to analyze problems, critically evaluate information, and formulate appropriate and contextual solutions. Therefore, 21st-century education must be oriented toward the development of higher-order thinking skills so that learners are able to adapt, make decisions, and solve real-life problems effectively. These skills are regarded as essential competencies to enable graduates to adapt to the increasingly complex, unstructured, and technology-based world of work. However, various international studies indicate that Indonesian students' critical thinking skills remain relatively low. The 2023 OECD Programme for International Student Assessment (PISA) consistently shows that Indonesian students' reasoning, analytical, and problem-solving abilities are still below the OECD average. In response to these challenges, the Merdeka Curriculum was designed to promote more meaningful, contextual, and student-centered learning. This curriculum emphasizes strengthening critical, creative, and collaborative competencies through the implementation of active learning approaches. One recommended approach is Problem-Based Learning (PBL). Problem-Based Learning is an instructional approach that begins with the presentation of contextual problems as learning triggers, encouraging students to actively

explore knowledge through questioning, discussion, information seeking, data processing, and formulating solutions based on logical arguments. Research by Widiansyah et al. (2024) demonstrates that the implementation of Problem-Based Learning within the Merdeka Curriculum significantly improves students' conceptual understanding as well as their critical thinking and collaborative skills, with post-test scores showing a significant increase compared to conventional methods. In the context of vocational education, particularly Vocational High Schools (SMK), strengthening critical thinking skills becomes increasingly crucial. The workplace demands that SMK graduates possess not only technical skills but also analytical, critical, and adaptive thinking abilities to solve real-world problems in professional environments (Widiastuti et al., 2023). In accounting subjects, critical thinking plays a vital role, as students are required to analyze transactions, evaluate alternative recording methods, and make decisions based on financial data. Without critical thinking skills, accounting learning risks becoming a mechanical activity focused on procedures without deep conceptual understanding.

In line with these needs, innovation in digital learning media is an important aspect of supporting effective learning. One relevant medium for supporting the implementation of Problem-Based Learning is the e-module. An e-module is a digital teaching material that is interactive, flexible, and supports independent learning. E-modules allow the integration of various multimedia features, such as videos, simulations, and interactive quizzes, which can enhance student engagement in the learning process. Direct involvement in authentic problem solving habituates students to analyze situations, evaluate information, and make rational decisions. In addition to positively impacting students, the implementation of Problem-Based Learning also encourages a transformation in the teacher's role from information provider to learning facilitator. Teachers are required to design relevant problems, manage discussions, and guide student reflection to ensure alignment with learning objectives.

Despite its strong potential in fostering critical thinking skills, the implementation of Problem-Based Learning in classrooms still faces various challenges. Sa'diah (2019) revealed that not all students are able to construct knowledge independently in problem-based learning environments. Some students tend to be passive, reluctant to ask questions, and experience difficulties in identifying and critically analyzing problems. This condition indicates that the success of Problem-Based Learning is not determined solely by the learning model itself but also depends heavily on the availability of learning media that can continuously facilitate active student engagement. These issues are also evident in vocational high schools, particularly in the subject of Trading Company Accounting. Accounting instruction inherently requires analytical, logical, and systematic thinking in processing financial transaction information. However, in practice, many students still focus on memorizing recording procedures without understanding the conceptual meaning and flow of the accounting process.

Preliminary observations conducted through interviews with accounting teachers at SMK Negeri 1 Patumbak revealed that Trading Company Accounting learning is still dominated by lecturing and assignment methods. Students tend to be passive, less enthusiastic, and not actively involved in discussions and problem-solving activities. This condition directly hampers the development of critical thinking skills and contributes to low learning outcomes. These findings are reinforced by the results of an initial measurement of critical thinking skills using questionnaires administered to Grade XI Accounting students. The recapitulation results show that more than half of the students fall into the low critical thinking category, with percentages of 54% in Class XI AK 1 and 53% in Class XI AK 2. These data indicate that the majority of students have not yet developed adequate critical thinking abilities to support accounting learning that requires high-level analysis and reasoning.

Critical thinking skills and learning outcomes are fundamentally interconnected. Students with strong critical thinking abilities tend to be better at analyzing information, evaluating alternative solutions, and making appropriate decisions, which in turn leads to improved academic achievement. This aligns with the findings of Bhuttah et al. (2024), who state that critical thinking skills have a significant effect on student learning outcomes. The higher the students' critical thinking ability, the better their academic performance. Based on initial learning outcome data, the average scores of Grade XI Accounting students at SMK Negeri 1 Patumbak on Trading Company Accounting material are still below the Minimum Learning Achievement Criteria (KKTP) of 75. Most students have not achieved mastery, with 63% of students in Class XI AK 1 and 59% in Class XI AK 2 scoring below the KKTP. This condition indicates that students still experience difficulties in understanding basic trading company accounting concepts and applying them systematically, particularly in recording and posting transactions to the general ledger, which requires accuracy, analysis, and comprehensive understanding. Ideally, accounting learning should not only emphasize procedural mastery but also

foster critical thinking skills and simultaneously improve student learning outcomes. Students are expected to think logically, analytically, and reflectively about financial data and problems presented in learning activities. Therefore, digital learning media are needed that are not merely informative but are pedagogically designed to support the implementation of Problem-Based Learning, facilitate active student engagement, and sustain learning motivation. Previous studies have examined Problem-Based Learning, e-modules, and gamification separately. Widiansyah et al. (2024) found that the application of Problem-Based Learning in the Merdeka Curriculum significantly improves conceptual understanding as well as students' critical thinking and collaborative skills compared to conventional learning. Syahri et al. (2024) reported that the use of interactive e-modules contributes significantly to the improvement of critical thinking skills and the effectiveness of students' independent learning. Consequently, integrating gamification elements into e-modules represents a promising strategy. Gamification refers to the application of game elements such as points, badges, levels, and leaderboards within learning contexts. Febriansah et al. (2024) reported that gamification significantly increases students' intrinsic motivation, particularly in digital-based learning. This finding aligns with the characteristics of Generation Z, who are familiar with technology and digital gaming environments. Furthermore, Acosta-Gonzaga and Ruiz-Ledesma (2022) found that gamification in digital learning positively impacts learning outcomes and student mastery.

However, most existing studies still focus on a single approach or learning medium in isolation either Problem-Based Learning, gamification, or digital modules without comprehensive integration. Thus, a research gap remains regarding the development of learning media that simultaneously integrate Problem-Based Learning, gamification, and digital e-modules, particularly in accounting subjects at vocational high schools. Based on the above discussion, the novelty of this study lies in the development of a Problem-Based Learning–based digital e-module integrated with gamification elements and implemented through the Moodle Learning Management System (LMS) in accounting subjects. This integration positions Problem-Based Learning as a cognitive framework for developing critical thinking skills while utilizing gamification as a motivational enhancer to maintain student engagement throughout the learning process. In addition, Moodle enables systematic learning management through features such as discussion forums, automated quizzes, assessment rubrics, and student learning progress tracking.

Problem-Based Learning serves as a cognitive framework that promotes higher-order thinking skill development, while gamification functions as a motivational reinforcement that sustains student engagement. The combination creates a learning environment that is intellectually challenging and affectively engaging, thereby supporting more holistic learning. This integration becomes even more effective when implemented through an LMS such as Moodle, which provides various supporting features, including discussion forums, automated quizzes, assessment rubrics, and learning analytics, enabling systematic and continuous learning management. Theoretically, this study is expected to enrich the literature on technology-based accounting education. Practically, it is anticipated to serve as a reference for teachers in developing innovative, contextual digital learning media aligned with the implementation of the Merdeka Curriculum.

LITERATURE REVIEW

E-Modules in Digital Learning

An e-module is a learning medium presented through electronic media that contains instructional materials (Ricu Sidiq & Najuah, 2020). E-modules are self-instructional, flexible, and accessible through digital devices anytime and anywhere. Their main characteristics include being self-contained, stand-alone, adaptive to technological developments, and user-friendly. Ramadhan and Jalinus (2021) explain that e-modules developed based on self-directed learning principles can assist students in understanding learning materials independently without continuous teacher supervision. Beyond serving as digital teaching materials, e-modules are an essential component of the digital learning ecosystem, which emphasizes flexibility, interactivity, and technology-based independent learning. In digital learning environments, e-modules function not only as sources of information but also as platforms that systematically integrate content, learning activities, and assessment within a single system. Sung et al. (2016), in Computers & Education, state that digital learning utilizing interactive electronic modules enhances students' cognitive engagement and supports more effective independent learning compared to conventional printed materials. This indicates that e-modules play a strategic role in facilitating student-centered learning.

Schindler et al. (2017), in the International Journal of Educational Technology in Higher Education, emphasize that systematically designed, interactive, and accessible digital learning media can improve students' motivation, autonomy, and conceptual understanding. In accounting education, digital-based e-modules enable the integration of text, visuals, simulations, and interactive exercises aligned with the analytical and accuracy-oriented nature of accounting content. Thus, e-modules in digital learning serve not merely as content delivery tools but also as pedagogical instruments that support the development of critical thinking skills and the continuous improvement of student learning outcomes. In accounting instruction specifically, e-modules allow structured content presentation, transaction simulations, interactive exercises, and instant feedback to strengthen both conceptual understanding and practical skills.

Problem-Based Learning (PBL)

According to Bagay et al. (2023), Problem-Based Learning (PBL) is an instructional approach that utilizes real-world problems as contexts for students to develop critical thinking and problem-solving skills while acquiring essential knowledge and key subject concepts. PBL is grounded in constructivist principles and emphasizes the development of critical thinking, problem-solving, collaboration, and reflection skills. The stages of PBL include problem presentation, student organization, independent investigation, solution development, and reflection and evaluation. In accounting education, PBL is highly relevant because students are required to analyze transactions, determine appropriate journal entries, and evaluate the impact of recording decisions on financial statements. Problem-based learning positions authentic problems as the starting point of instruction, ensuring that students do not passively receive information but actively construct understanding through analytical and problem-solving processes. The problems presented are contextual, open-ended, and challenging, encouraging students to identify relevant information, formulate hypotheses, explore alternative solutions, and present logical and systematic arguments. Through this process, students connect theoretical concepts with real-life situations and develop higher-order thinking skills. In accounting contexts, PBL enables students to learn through real-life cases resembling workplace practices, such as analyzing transaction evidence, selecting appropriate recording methods, and making accounting decisions based on financial data. Therefore, PBL is oriented not only toward procedural mastery but also toward deep conceptual understanding and analytical competence.

Gamification in Moodle-Based Learning

According to Ružic and Dumancic (2015), gamification refers to the application of game design elements, mechanics, and principles in non-game contexts to enhance students' motivation, engagement, and learning experiences through digital media or learning platforms. Gamification elements include points, badges, levels, challenges, and instant feedback. Moodle, as an open-source Learning Management System (LMS), provides various features and plugins that support systematic gamification integration. The integration of gamification into Moodle-based e-modules can be implemented through structured learning pathways, reward systems, and case-based challenges. This strategy aims to maintain student engagement and enhance the meaningfulness of learning experiences.

Learning Special Journals and Posting to the General Ledger

Journaling is the initial stage of the accounting cycle, functioning to record transactions chronologically. In trading companies, the use of special journals increases efficiency in recording repetitive transactions. The posting process to the general ledger serves to classify transactions into relevant accounts as the basis for preparing financial statements. The application of PBL in learning journal entries and posting activities encourages students to critically analyze transactions, identify recording errors, and systematically reflect on accounting decisions.

Learning Theories Underlying the Development of a Problem-Based Learning E-Module Integrated with Gamification

The development of a Problem-Based Learning e-module integrated with gamification requires a strong theoretical foundation to ensure that learning is not only visually engaging but also pedagogically effective. Constructivist theory emphasizes that knowledge is actively constructed through experience and reflection (Nugroho & Kurniawan, 2023). This principle aligns with PBL, which presents authentic problems as a means of knowledge construction.

Experiential Learning Theory asserts that learning occurs through a cycle of experience, reflection, conceptualization, and experimentation (Fitriani & Suryadi, 2022). In a PBL-based e-module, students directly engage in analyzing and recording transactions, receive feedback, and refine their understanding through repeated practice. Behaviorist theory contributes through mechanisms of positive reinforcement manifested in gamification elements such as points, badges, and leaderboards (Putra & Rahman, 2022). Meanwhile, humanistic theory emphasizes the importance of student motivation, individual needs, and self-actualization in the learning process (Safitri & Ananda, 2023). Self-Determination Theory further strengthens gamification integration by highlighting the psychological needs for autonomy, competence, and social relatedness (Pratama, 2022). The integration of these theories positions the Problem-Based Learning e-module integrated with gamification as a holistic, adaptive, and relevant instructional approach aligned with the demands of modern accounting education.

Product Validity in Educational Development

Product validation in educational development is a systematic evaluation process conducted to ensure that the developed product meets standards of content feasibility, instructional design quality, and media suitability before implementation in real learning contexts. The primary objective of validation is to ensure content quality, instructional design consistency, and user acceptability (Yilmaz, 2020). In development research, product validation is generally conducted through expert judgment, including validation by subject matter experts, instructional design experts, and media experts. Subject matter validation focuses on conceptual accuracy and content depth, instructional design validation evaluates pedagogical alignment and learning activities, and media validation assesses visual aspects, navigation, and usability of digital products. According to Yilmaz (2020), "expert validation is a critical phase in educational design research that ensures the instructional materials are aligned with learning objectives and pedagogical standards before implementation." Therefore, validation by subject matter experts, instructional design experts, and media experts is essential in this e-module development study to ensure the product's feasibility and appropriateness for use.

METHOD

This study employed a Research and Development (R&D) approach aimed at producing a gamification-integrated, Problem-Based Learning (PBL) e-module for accounting subjects, as well as assessing the feasibility of the developed product. The research participants were Grade XI students of Accounting Competency Concentration 1 at SMK Negeri 1 Patumbak in the 2025/2026 academic year. Product development followed the ADDIE model, consisting of analysis, design, development, implementation, and evaluation stages, as this model provides a systematic yet flexible framework for developing technology-based instructional materials. The analysis stage was conducted through teacher interviews and classroom observations to identify learning needs, student characteristics, and content scope. The findings revealed that students experienced difficulties in distinguishing between general journals and special journals and in posting transactions to the general ledger, indicating the need for interactive and contextual learning media. Based on these results, the design stage formulated learning objectives, the Problem-Based Learning flow, e-module content, and evaluation instruments. The e-module was structured according to PBL syntax and enriched with gamification elements including points, badges, levels, and leaderboards implemented via the Moodle platform to enhance student motivation and engagement.

The design stage aims to develop the e-module structure based on the results of the needs analysis. Activities at this stage include formulating learning objectives, designing a problem-based learning flow, developing e-module content, and constructing evaluation instruments. The e-module was designed following the syntax of problem-based learning, which consists of problem orientation, identification of learning needs, information gathering, solution development, and reflection. Gamification elements such as points, badges, levels, and leaderboards were integrated through the Moodle platform to enhance students' motivation and engagement. The development stage involved transforming the design into a digital e-module equipped with interactive materials, case studies, practice exercises, and gamification features, which was subsequently validated by subject-matter experts and media experts. The revised product was then subjected to limited trials with students to obtain user feedback. A formative evaluation approach was applied by analyzing expert validation results and student trial responses to determine product feasibility. Data were collected using a five-point Likert scale questionnaire and analyzed descriptively using quantitative methods by

converting scores into percentages. The e-module was considered feasible if it fell within the valid or highly valid categories. The implementation stage was conducted in the form of group trials involving eleventh-grade students of the Accounting Skill Concentration at SMK Negeri 1 Patumbak. This trial aimed to obtain an initial overview of the feasibility of the e-module from the users' perspective. The implementation was not intended to examine learning effectiveness, but rather to ensure that the e-module could be used properly by students within a limited learning context. The evaluation stage in this study focused on formative evaluation conducted during and after the e-module development process. The evaluation was carried out by analyzing the results of expert validation and group trial results involving students. This stage aimed to assess the level of product feasibility and to identify aspects that required improvement. The evaluation results served as the basis for concluding that the developed problem-based learning e-module integrated with gamification met the feasibility criteria for use as supplementary instructional material in accounting learning. Expert validation is a process intended to ensure that the developed product meets content, construct, and design criteria. The assessment was conducted by competent experts using an evaluation instrument based on a rating scale (Sugiyono, 2020). Expert validation was carried out to assess the feasibility of the developed product namely, the problem-based learning e-module integrated with gamification in terms of content, media, and instructional design. Meanwhile, product trials were conducted to ensure its suitability for the learning needs of eleventh-grade accounting students at SMK Negeri 1 Patumbak.

Research instruments were used as tools to obtain data related to the feasibility level of the developed problem-based learning e-module integrated with gamification. The instruments in this study consisted of expert validation questionnaires and product trial questionnaires administered to students. All instruments were systematically developed based on the product development objectives and digital teaching material feasibility indicators, and they underwent content validity testing prior to data collection. Each statement item in the questionnaire was measured using a five-point Likert scale, consisting of strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). Validation data were obtained through questionnaires using a five-point Likert scale administered to subject-matter experts and media experts, with assessment scores ranging from very inappropriate (score 1) to very appropriate (score 5). All scores from each assessment item were summed to obtain a total score, and then average scores were calculated for each assessment aspect as well as overall. The final results of validation and product trials were categorized as follows:

Table 1. Categories of E-Module Validity

Percentage (%)	Validity Category
81–100	Very Valid
61–80	Valid
41–60	Moderately Valid
≤ 40	Invalid

The developed e-module product is considered feasible for use if it falls within the valid or very valid category (Afridiani & Faridah, 2021).

RESULTS AND DISCUSSION

The e-module was developed and implemented through the Moodle platform, enabling online access for both teachers and students. The research findings were obtained through expert validation and student group trials as part of formative evaluation to assess product feasibility. The collected data were used as a basis for refining the e-module and drawing conclusions regarding its suitability as a digital instructional material.

1 Analysis Stage

The analysis stage aimed to identify learning needs as a foundation for developing a gamification-integrated, Problem-Based Learning (PBL) e-module. This stage consisted of initial needs analysis, learner analysis, and content analysis.

a. Initial Needs Analysis

The initial needs analysis was conducted through classroom observations and interviews with accounting teachers and Grade XI Accounting students at SMK Negeri 1 Patumbak. The results indicated that

accounting instruction was still dominated by conventional, teacher-centered methods, resulting in limited student engagement and underdeveloped critical thinking skills. Although digital learning media had been introduced, they remained primarily informative and linear, without systematically integrating Problem-Based Learning approaches or gamification elements. From the learning outcomes perspective, several students had not yet achieved the Minimum Learning Mastery Criteria (KKTP), particularly in topics requiring analytical and problem-solving skills. Despite the availability of supporting facilities such as computer laboratories and internet access, their utilization had not been optimally directed toward interactive and challenge-based digital learning. Students expressed greater interest in learning activities that present real-world cases, transaction simulations, material visualizations, and reward systems such as points and badges. These findings indicate an urgent need for the development of a gamification-integrated PBL e-module to support more active, contextual, and meaningful learning.

b. Learner Analysis

Learner analysis was conducted to obtain insights into students' characteristics, learning needs, and technological readiness. Observations and interviews revealed that students tended to be passive during lessons, showed limited participation in discussions and problem-solving activities, and experienced boredom when learning was delivered in a purely textual and verbal manner. Students reported that they understood accounting concepts more easily when materials were presented through case examples, systematic procedural steps, problem-based exercises, and visual and interactive media. This indicates that students predominantly exhibit visual and experiential learning styles. In terms of technological readiness, students were accustomed to using digital devices and were supported by adequate school facilities. Based on these findings, the development of a gamification-integrated PBL e-module was considered relevant for enhancing student engagement, motivation, and learning autonomy.

c. Content Analysis

Content analysis referred to the Merdeka Curriculum for Vocational High Schools in the Accounting Competency Concentration, focusing on trade company transaction recording materials, including the preparation of general and special journals as well as the posting process to the general ledger.

2 Design Stage

The design stage aimed to formulate the initial framework of the gamification-integrated PBL e-module implemented via Moodle. This stage covered content structure, problem-based learning flow, learning activity design, and gamification mechanisms to enhance student motivation, participation, and interaction. The e-module was designed to provide an interactive, contextual learning experience oriented toward authentic problem solving. Overall, the design stage comprised three main components: the PBL-based e-module structure, Moodle learning activity design, and gamification system design.

a. PBL-Based E-Module Structure Design

The e-module structure followed the Problem-Based Learning syntax, including problem orientation, identification of learning needs, information gathering, analysis and evaluation, and presentation of results and reflection. This structure was intended to foster active learner engagement and critical thinking skills. The e-module content was organized into three learning activities: recording transactions in general and special journals, presenting and evaluating transaction records, and posting transactions to the general ledger.

b. Learning Activity Design in Moodle

Learning activities began with contextual problem presentation, followed by content exploration, case-based exercises, and reflection and evaluation, organized into Learning Activity Units (KBM) 1, 2, and 3. This design enabled structured learning, emphasized analytical thinking processes, and encouraged students to construct understanding through problem solving.

c. Gamification System Design

The implemented gamification elements included completion conditions, badges, levels, leaderboards, and progress bars. This system was designed to enhance motivation, engagement, and independent learning. The restrict access mechanism regulated tiered learning, allowing students to access subsequent materials only after

completing prior activities. Gamification integration was expected to foster positive competition, increase engagement, and support gradual competency mastery.

3. Development Stage

The development stage aimed to transform the design into an initial product in the form of a gamification-integrated PBL e-module developed via Moodle. At this stage, the prepared design was implemented into a digital product containing transaction recording materials in general and special journals as well as the posting process to the general ledger in the Accounting for Service, Trading, and Manufacturing Companies course. The e-module development considered the results of needs analysis, learner characteristics, and accounting content structure. The e-module content was presented through illustrations, authentic transaction case studies, problem-based exercises, and interactive quizzes. To enhance motivation and learning engagement, the e-module incorporated gamification elements such as unlockable content, levels, badges, leaderboards, and progress bars. The e-module was accessed online through Moodle accounts, enabling flexible learning both inside and outside the classroom. At this stage, validity testing was conducted by subject-matter experts, instructional design experts, and media experts to assess feasibility in terms of content quality, PBL flow, and gamification integration. The developed product was then finalized as a prototype ready for group trials to obtain initial feedback regarding usability, navigation, and student responses to gamification-integrated problem-based learning.

a. Initial Product Review

The initial product represented the output of the e-module development process using Moodle. This media constituted the first-stage design prepared for trial implementation. A description of the initial product is presented as follows:

- Login Page

The login page serves as the initial interface when teachers and students access Moodle. On this page, users enter their username and password to access the Accounting for Service, Trading, and Manufacturing Companies course and its associated e-module.

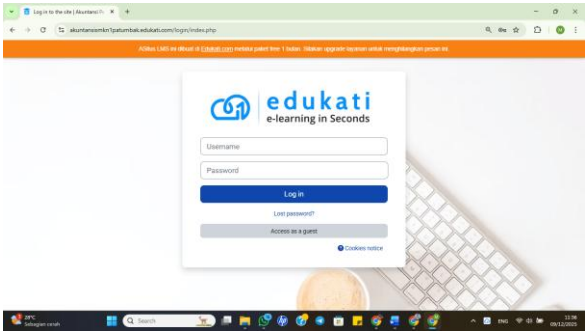

Figure 1. Login Page Interface of the Moodle System

- Site Home

The opening page, or Site Home, displays the list of subjects, menu navigation, class information, and access to the e-modules. This section also presents the e-module cover, a brief description of each subject, and the learning navigation system to be followed by students based on the problem-based learning flow and gamification structure implemented in the Moodle system. The appearance of the opening page is shown in the following figure..

Figure 2. Opening Page Interface of the E-Module on the Moodle Platform

- Learning Activities

The structure of learning activities in the e-module is designed hierarchically and sequentially in accordance with the problem-based learning flow and the principles of a gamified learning pathway. Students are not allowed to access all materials simultaneously; instead, they must complete activities progressively based on a predetermined sequence. This mechanism is managed through the restrict access and completion tracking features, which enable students to proceed to subsequent activities only after fulfilling the completion requirements of previous tasks.

Accordingly, students are required to complete a series of activities, starting from the pretest, triggering questions, material exploration, instructional videos, problem-based exercises, to assignments and reflection. Each activity is designed to serve as a prerequisite for the next learning stage, ensuring that knowledge construction occurs gradually and systematically. The integration of gamification elements such as points, badges, access levels, progress bars, and leaderboards functions as motivational drivers that enhance students' adherence to the learning pathway. For example, badges are awarded for specific tasks as recognition of achievement, while leaderboards display student rankings, thereby fostering a learning experience that is competitive yet collaborative.

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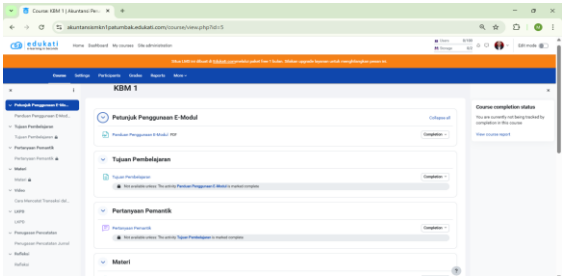

Figure 3. Learning Activities in the Moodle System

The e-module content on the Moodle platform was organized in the form of a course structured progressively and systematically. Based on the previously designed learning structure, learning activities within the e-module were divided into three main components: Independent Learning Activity (KBM) 1, KBM 2, and KBM 3.

The types of materials studied by students in each course are presented in the following table

Table 2. Learning Activities / Courses Studied by Students

Course Title	Learning Activities
KBM 1: Recording Transactions in General and Special Journals	1. Module usage guide 2. Learning objectives 3. Problem-based guiding questions 4. General and special journal materials and learning videos 5. Transaction analysis worksheets (LKPD) 6. Journal recording assignments 7. Reflection forum
KBM 2: Presentation and Evaluation of Journal Recording Results	1. Introduction 2. Group presentations 3. Accounting terminology glossary activities 4. Comprehension quiz 5. Enrichment activities 6. Reflective forum
KBM 3: Posting Journals to the General Ledger	1. Introduction 2. Contextual guiding questions 3. General ledger materials 4. Posting tutorial videos 5. Advanced worksheets and ledger posting tasks 6. Group presentations 7. Quiz 8. Reflection forum 9. Enrichment

b. Validation Results

- Learning Content Validation Results

The results of learning content validation conducted by the subject-matter expert, Andri Zainal, S.E., M.Si., Ph.D., are presented in the following table.

Table 3. Learning Content Expert Validation Results

No	Aspect	Score
1	Content Feasibility	4.00
2	Material Quality	3.40
3	Content Presentation Feasibility	4.00
4	Self-Evaluation Presentation	4.00
5	Language Feasibility	4.00
6	Overall Presentation Feasibility	3.50
	Average	**3.90**
	Percentage	**78%**

Based on the subject-matter expert validation of the developed gamification-integrated Problem-Based Learning e-module, the results showed an average score of 3.90, equivalent to 78%, which falls within the "valid" category. This indicates that the developed learning materials are feasible for use. Nevertheless, the subject-matter expert provided recommendations for improvement, as outlined below.

Table 4. Subject-Matter Expert Feedback

No	Feedback	Revision
1	The addition of real examples of transaction documents and the provision of answer keys for exercises are necessary.	The researcher added authentic trade company transaction documents, such as invoices, cash receipts, memos, cash-in vouchers, and cash-out vouchers, which were directly integrated into the Student Worksheets (LKPD) within the e-module. In addition, answer keys for all exercises were uploaded to the Moodle platform with restricted access, allowing only teachers to view them for evaluation and instructional control purposes.

- **Learning Media Validation Results**

The results of learning media quality validation conducted by the media expert, Dr. Hariyadi, S.Kom., M.Kom., are presented in the following table.:

Table 5. Learning Media Quality Validation Results

No	Aspect	Score
1	Effective and Efficient Use of Resources	4.00
2	Media Reliability	4.00
3	Media Compatibility	4.50
4	Media Usability	4.00
5	Communicativeness	5.00
6	Creativity	4.50
7	Visual Quality	4.00
8	Animation	4.00
9	Navigation Icons	4.00
	Average	**4.15**
	Percentage	**83%**

Based on the media expert validation of the developed gamification-integrated PBL e-module, the results indicated an average score of 4.15, equivalent to 83%, which falls into the “highly valid” category. This suggests that the developed media is feasible for implementation.

The media expert also provided feedback for refinement, as summarized below.:

Table 6. Media Expert Feedback

No	Feedback	Revision
1	The designed media is quite good and usable; however, a school profile should be added to the main page. The color combination is adequate.	The researcher revised the Moodle main page by replacing the author’s personal identity with the official school profile. This change was made to ensure that the e-module appears more institutional and can be used broadly as a school learning resource rather than as an individual product.

- **Instructional Design Validation Results**

The results of the instructional design quality validation conducted by the design expert, Dr. Zulkarnain Siregar, S.T., M.M., are presented in the following table.:

Table 7. Instructional Design Quality Validation Results

No	Aspect	Score
1	Feasibility	4.00
2	Presentation	4.09
3	Graphic Design	4.20
	Average	**4.10**
	Percentage	**82%**

Based on the instructional design expert validation of the developed gamification-integrated, Problem-Based Learning e-module, the results indicated an average score of 4.11, equivalent to 82%, which falls into the "highly valid" category. This suggests that the instructional design is feasible for implementation.

The design expert also provided constructive feedback for improvement, as summarized below.

Table 8. Instructional Design Expert Feedback

No	Feedback	Revision
1	The e-module design is good and supports learning; however, the graphical appearance still requires refinement.	The researcher enhanced the graphical presentation of the e-module by adding color-coded mapping to each content section to help students understand conceptual relationships more visually and systematically. Color usage was aligned with content functions to facilitate differentiation between learning stages and accounting concept flows. In addition, the course page layout on the Moodle platform was edited and redesigned using Canva to achieve a more attractive, organized, and consistent visual appearance.

4. Implementation Stage

After the gamification-integrated, Problem-Based Learning e-module was deemed feasible, the next stage was implementation through product trials involving students. The learning media used in this stage were accessed via Moodle at https://akuntansismkn1patumbak.edukati.com. The implementation began on October 22, 2025, and was conducted face-to-face at school, involving Grade XI Accounting students at SMK Negeri 1 Patumbak. Prior to implementation, several preparations were carried out, including coordinating the learning plan with the subject teacher, preparing Moodle accounts, and distributing usernames and passwords to all students to enable access to the e-module. Students used the e-module according to the designed learning sequence, starting from material introduction, problem-based learning activities, to task completion and reflection. During implementation, the researcher observed the execution of e-module usage and recorded any technical issues encountered. Product trials were conducted to assess comprehensibility, operational feasibility, and user responses to the e-module before its application in the main research sample. The trial phase consisted of three evaluation types: one-to-one evaluation, small-group evaluation, and large-group evaluation.

a. One-to-One Evaluation

The one-to-one evaluation involved three Grade XI Accounting students representing high, medium, and low academic ability levels. This evaluation aimed to assess individual comprehension of the e-module, including Moodle navigation, clarity of instructions, Problem-Based Learning flow, and the effectiveness of gamification features.

Table 9. Results of the One-to-One Evaluation

Respondent	Mean Score	Percentage	Interpretation
1	3.95	79%	Valid
2	4.05	81%	Highly Valid
3	4.05	81%	Highly Valid
Average	**4.00**	**80%**	**Valid**

Based on these results, the average validation score from the individual trial was 4.00, equivalent to 80%, which falls within the "valid" category. This indicates that the developed e-module is feasible for use. In addition, students provided feedback on the e-module, which served as input for further improvements, as presented in the following table.:

Table 10. Student Feedback on the E-Module during One-to-One Evaluation

No	Feedback	Revision
1	The color scheme of the e-module was less attractive.	The researcher adjusted the color appearance of the e-module to a brighter and more engaging theme using Canva.

b. Small-Group Evaluation

This stage involved six students, and the results of the trial served as the basis for the second revision phase. Based on the calculations, the average product validation score in the small-group evaluation reached 4.20, equivalent to 83%, which falls into the "highly valid" category. This indicates that the developed e-module is feasible for implementation.

Table 11. Results of the Small-Group Evaluation

Respondent	Mean Score	Percentage	Interpretation
1	4.30	86%	Highly Valid
2	4.10	82%	Highly Valid
3	4.10	82%	Highly Valid
4	4.10	82%	Highly Valid
5	4.15	83%	Highly Valid
6	4.20	84%	Highly Valid
Average	**4.20**	**83%**	**Highly Valid**

In addition, students provided feedback on the e-module, which was used as input for further improvements, as presented in the following table

Table 12. Student Feedback on the E-Module during the Small-Group Evaluation

No	Feedback	Revision
1	Several words lacked proper spacing.	The researcher revised the text by adjusting word spacing to comply with Indonesian language writing conventions. These revisions were applied to the guiding questions and activity instructions in Moodle.
2	The font size in the e-module was too small.	The researcher increased the font size from 11 to 12 or larger to improve readability.

C. Large-Group Trial (Operational Field Testing)

The large-group trial involved 10 Grade XI Accounting students and did not generate any suggestions for revision. Instead, students reported that they preferred the developed gamification-integrated, Problem-Based Learning e-module because it helped them understand the material more clearly through real-world problem presentation, structured problem-solving activities, engaging gamification features, and a systematic learning flow. In addition, group-based learning activities were perceived to enhance student engagement and collaboration.

Table 13. Results of the Large-Group Trial

Respondent	Mean Score	Percentage	Interpretation
1	4.80	96%	Highly Valid
2	4.75	95%	Highly Valid
3	4.70	94%	Highly Valid
4	4.65	93%	Highly Valid
5	4.65	93%	Highly Valid
6	4.60	92%	Highly Valid
7	4.65	93%	Highly Valid
8	4.40	88%	Highly Valid
9	4.65	93%	Highly Valid
10	4.85	97%	Highly Valid
Average	**4.67**	**93.4%**	**Highly Valid**

Based on these calculations, the average product validation score in the large-group trial reached 4.67, equivalent to 93.4%, which falls into the “highly valid” category. This result indicates that the developed e-module is feasible and appropriate for implementation in accounting learning activities.

5. Evaluation Stage

The evaluation stage in this study focused on formative evaluation, which was conducted during and after the e-module development process. The evaluation was based on validation results from subject-matter experts, media experts, instructional design experts, as well as product trials involving students. The feasibility assessment results of the gamification-integrated, Problem-Based Learning e-module obtained from expert evaluations and student trials are presented in the following table.

Table 14. Results of the E-Module Feasibility Assessment

No	Category	Mean Score (%)	Interpretation
1	Subject-Matter Expert Validation	78	Valid
2	Media Expert Validation	83	Highly Valid
3	Instructional Design Expert Validation	82	Highly Valid
4	Individual Trial	80	Valid
5	Small-Group Trial	83	Highly Valid
6	Large-Group Trial	93	Highly Valid
	Overall Mean Score	**83**	**Highly Valid**

The results indicate that the developed gamification-integrated, Problem-Based Learning e-module demonstrates good feasibility for use in Grade XI accounting instruction. These findings confirm that the e-module is not only feasible based on expert judgment but also well received by students across different trial scales. Based on all validation results and trial implementations, the overall product feasibility score reached 83%, which falls into the “highly valid” category. This value exceeds the minimum feasibility criterion of 61%, indicating that the developed gamification-integrated PBL e-module is suitable for implementation in accounting learning activities.

Discussion

Based on the validation results from subject-matter experts, media experts, and instructional design experts, the problem-based learning e-module integrated with gamification demonstrated feasibility levels ranging from valid to highly valid. The subject-matter expert validation yielded a score of 78%, media expert validation reached 83%, and instructional design expert validation achieved 82%. Limited trials further indicated that the developed e-module was valid to highly valid, with individual trials scoring 80%, small-group trials 83%, and large-group trials 93%, resulting in an overall average validation score of 83%. These findings indicate that the developed e-module meets feasibility standards in terms of content, media, and instructional design as a digital teaching material supporting accounting learning. The validation scores suggest that the material content aligns well with competencies and learning characteristics in vocational accounting education, particularly in conceptual accuracy, material completeness, and systematic presentation. The highly valid media evaluation indicates that the e-module possesses effective visual design, navigation, and technological compatibility, thereby supporting usability in digital learning environments.

Meanwhile, instructional design validation confirms that the problem-based learning flow has been logically and consistently structured, facilitating student-centered learning activities. The integration of gamification elements—such as points, badges, and leaderboards was considered innovative and relevant, contributing to increased student motivation, engagement, and learning enthusiasm. These findings are consistent with the meta-analysis by Sailer and Homner (2020), which reported that gamification in digital learning enhances motivation, engagement, and perceived competence through feedback mechanisms and reward systems, thereby reinforcing the feasibility of the e-module as an effective learning medium. These results also align with constructivist theory, which posits that learning becomes more meaningful when students actively construct knowledge through problem solving and reflection on learning experiences. The implementation of problem-based learning within the e-module serves as a cognitive framework that encourages students to analyze authentic problems, connect concepts to real-world contexts, and develop logical reasoning. Furthermore, the integration of gamification elements such as points, badges, and progress tracking supports behaviorist principles through positive reinforcement mechanisms, while also aligning with Self-Determination Theory, which emphasizes motivation, competence, and learner engagement in digital learning.

From a humanistic perspective, the e-module provides learners with flexibility to study at their own pace and according to their individual learning styles, thereby fostering self-actualization. The utilization of Moodle as the learning management system also supports digital learning theory by integrating content, activities, and assessment within a systematically managed learning environment. The primary strength of this e-module lies in the simultaneous integration of three essential components: problem-based learning as the pedagogical approach, gamification as motivational reinforcement, and Moodle as the learning management platform. The e-module not only presents instructional content but also delivers an interactive, contextual, and problem-oriented learning experience. The tiered learning structure, use of real transaction case studies, and reward system combined with access restrictions enable students to follow the learning pathway progressively and purposefully. This distinguishes the developed e-module from conventional digital modules, which tend to be linear and minimally interactive.

Based on expert validation and limited trials, the developed e-module is deemed feasible for implementation, having fulfilled digital teaching material indicators, including content feasibility, media feasibility, and instructional design feasibility. The valid and highly valid categories obtained indicate that the e-module can be utilized as supplementary accounting teaching material without requiring major revisions. Expert feedback was incorporated into product revisions, thereby enhancing the quality of the e-module prior to broader implementation. Consequently, this gamified problem-based learning e-module is suitable for supporting more active, contextual, and learner-centered accounting instruction, particularly within the context of the Merdeka Curriculum in vocational high schools. The feasibility results and positive responses toward this e-module are consistent with previous studies. Yuliana (2022) reported that problem-based learning accounting e-modules demonstrated high validity and effectively improved student learning outcomes and critical thinking skills. Studies by Lestari and Santoso (2021), as well as Handayani and Kusuma (2022), similarly confirmed that the application of problem-based learning significantly enhances students' critical thinking abilities and learning outcomes. Moreover, gamification integration is supported by Anggraeni and Hidayat (2021) and Rizky and Sari (2024), who found that gamification elements increase student motivation, engagement, and academic achievement.

CONCLUSION

Based on expert validation and limited trials, the developed problem-based learning e-module integrated with gamification achieved feasibility levels categorized as valid to highly valid. Subject-matter expert validation reached 78% (valid), media expert validation 83% (highly valid), and instructional design expert validation 82% (highly valid). Individual trials scored 80% (valid), small-group trials 83% (highly valid), and large-group trials 93% (highly valid), indicating that the e-module is user-friendly, engaging, and facilitates students' independent understanding of learning materials. Overall, the average feasibility percentage reached 83%, placing the e-module in the highly valid category. These results indicate that the e-module meets content, media, and instructional design standards and aligns with the characteristics and needs of vocational students. The findings support constructivist and problem-based learning theories emphasizing active, problem-centered learning, as well as behaviorist and self-determination theories underlying the motivational role of gamification. The product's strength lies in integrating problem-based learning syntax, gamification elements, and the Moodle LMS, enabling tiered, interactive, and systematically monitored learning. Supported by expert validation and positive student responses during limited trials, this e-module is deemed suitable for use as digital teaching material in vocational accounting education.

Implications

Theoretically, this study demonstrates that integrating problem-based learning with gamification in digital e-module development strengthens both constructivist and motivational learning foundations simultaneously. Problem-based learning serves as a cognitive framework that encourages learners to construct knowledge through authentic problem solving, while gamification acts as an affective reinforcement enhancing motivation, engagement, and learning persistence. The feasibility findings, categorized as valid to highly valid, support constructivist theory, experiential learning, and self-determination theory, all of which emphasize active engagement, learner autonomy, and competence development in digital learning environments. Thus, this research contributes to the theoretical discourse on digital teaching material development through integrated pedagogical approaches that foster critical thinking and meaningful learning.

Practically, the results indicate that this gamified problem-based learning e-module can serve as a viable and relevant alternative digital teaching material for vocational accounting education. The e-module assists teachers in implementing learner-centered and contextual instruction aligned with the Merdeka Curriculum. The LMS enables systematic learning management through discussion forums, automated quizzes, learning progress tracking, and immediate feedback. For students, the e-module supports self-directed learning, enhances motivation, and facilitates comprehension of analytical accounting concepts through case studies and problem-based exercises. Additionally, this study may serve as a practical reference for educators and future researchers in developing digital learning media that effectively integrate pedagogical approaches and technology.

Research Limitations

This study was limited to expert validation and restricted product trials. It did not extend to practicality or effectiveness testing. Therefore, future research is recommended to conduct large-scale effectiveness evaluations to obtain a comprehensive understanding of the product's impact on learning outcomes.

Recommendations for Future Research

Future studies are encouraged to proceed with practicality and effectiveness testing on a broader scale to obtain more comprehensive insights into usability, acceptance, and the impact of the e-module on students' critical thinking skills and learning outcomes.

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