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Development of Interactive Context-Based Learning Multimedia to Improve Students' Understanding of Payment Systems and Instruments

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Abstract

Students' limited understanding of payment systems and payment instruments is associated with the complex and abstract nature of the material and the limited capacity of existing instructional media to visualize concepts and promote active engagement. This study aimed to develop feasible context-based interactive learning multimedia for payment systems and payment instruments and evaluate its effectiveness in improving students' conceptual understanding. The study employed a Research and Development approach using the 4D model—Define, Design, Develop, and Disseminate—implemented through the Development stage. A limited trial involving 25 students from Class X-7 at SMA Negeri Bareng was conducted using a one-group pretest–posttest design. The developed multimedia was rated highly feasible, receiving validation scores of 81.17% from the media expert, 83.07% from the subject-matter expert, and 82.22% from the language expert. The Wilcoxon signed-rank test indicated a significant difference between students' pretest and posttest scores ($p < .001$). The N-gain analysis yielded an average score of 0.7560, equivalent to 75.60%, which was categorized as high. These findings demonstrate that context-based interactive multimedia

is highly feasible and effective in improving students' understanding of payment systems and payment instruments within the limited trial. The study contributes a pedagogically relevant digital learning resource that integrates contextual visualization and interactive activities to support conceptual understanding and active learning in economics education.

Keywords: Context-Based Learning; Economics Education; Interactive Learning Multimedia; Payment Systems; Students' Conceptual Understanding

INTRODUCTION

Effective education requires conceptual understanding so students can relate the material to real life (Anderson et al., 2001). In economics, this ability is crucial, particularly in the area of payment systems and payment instruments, to build financial literacy in the digital era (Engels et al., 2020; Ratnasari et al., 2025). Unfortunately, this material is complex, theoretical, and abstract (Malik & Fürstenau, 2024; Ratnasari et al., 2025; Wijayanti & Ghofur, 2021). Empirical evidence at Bareng State Senior High School shows that 67.9% of students find it difficult, 53% have not achieved the Learning Objective Achievement Criteria (KKTP), and the level of learning participation is very low. This problem is exacerbated by the use of learning media, which is still limited to textbooks and PowerPoint presentations, which tend to be one-way and passive. (Jones, 2003; Laurillard, 2002)

To overcome these obstacles, researchers argue for the need to implement multimedia learning that combines visuals, audio, and interactivity. Multimedia has been shown to be more effective in processing information deeply and stimulating participation (Dong et al., 2024; Surjono, 2017; Teng, 2023). This approach aligns well with the characteristics of Generation Z as digital natives (Onjewu et al., 2025; Turner, 2015).Furthermore, to make abstract economic concepts concrete, multimedia must be combined with a contextual approach (Contextual Teaching and Learning), which has been shown to significantly improve conceptual understanding by linking material to real-life experiences (Mahmuti et al., 2025; Selvianiresa & Prabawanto, 2017; Yudha et al., 2019).

Various previous studies have shown that the use of multimedia is generally very effective in improving learning outcomes, motivation, and student understanding in various subjects (Abadi et al., 2024; Kareem, 2018; Kassa et al., 2024; Plodkaew et al., 2025; Safitri & Susanti, 2023; Untari et al., 2020). More specifically, multimedia that integrates interactive

visual elements has been shown to simplify abstract content, optimize audio-visual processing, and improve memory and literacy (Dong et al., 2024; Pratiwi et al., 2025; Teng, 2023). In the context of learning approaches, the use of interactive multimedia framed with a contextual approach has been shown to significantly bridge students' understanding of abstract concepts (Etyarisky & Marsigit, 2022; Pradnyawati & Rati, 2023). On the other hand, in terms of development platforms, Genially has been recognized for its reliability as an interactive media that is very feasible, practical, and effective in increasing interest and learning outcomes (Arum et al., 2025; Mutiara et al., 2024; Romualdi et al., 2023).

However, a review of the fifteen literatures reveals a clear research gap. The majority of previous studies have focused on elementary and junior high school education, or on non-economic subjects such as mathematics, biology, English, history, and civics. Furthermore, some studies have focused solely on product feasibility testing without in-depth measurement of conceptual understanding improvements through effectiveness testing (Sartono et al., 2022). This gap underscores the need to develop contextually-based interactive multimedia specifically for high school economics, with measurable impacts on conceptual understanding.

The novelty of this research lies in the specific integration of Genially multimedia with the Padlet platform (as a means of collaboration and reflection) and Quizizz (for interactive assessment), which is framed by a contextual approach to high school economics material. Theoretically, this design is based on Vygotsky's Constructivism Learning Theory, where knowledge is actively constructed through collaboration and social experiences (Chand, 2023; Schcolnik et al., 2006; Setiawan, 2024). The visual design of the media is also strictly based on Richard E. Mayer's Cognitive Theory of Multimedia Learning (CTML), to optimize cognitive information processing through a combination of relevant words and images (Mayer, 2024).

Based on the identification of urgency and research gaps, the focus of this study is the design and implementation of learning technology innovation for economics education. The main objective is to produce contextual-based interactive learning multimedia on the material of payment systems and payment instruments that are feasible based on validation by media experts, material experts, and language experts, and to determine the level of improvement in students' understanding of the material after using the developed multimedia. This research is expected to provide theoretical benefits in strengthening

Constructivism Learning Theory and Cognitive Theory of Multimedia Learning, as well as provide practical benefits as an alternative innovative learning media for teachers and an attractive independent learning tool for students. The limitations in this study include the scope of the material focused specifically on payment systems and payment instruments Phase E, multimedia that is designed to be accessible only online, and the research stages that are limited to the development stage with limited trials.

METHODS

This study employed a Research and Development (R&D) approach designed to engineer, develop, and test the effectiveness of contextually-based interactive multimedia learning products. This approach was selected because it provided a systematic process for validating educational products, ensuring they met empirical standards of validity, practicality, and effectiveness (Slamet, 2022). The research framework adapted the 4D development model proposed by (Thiagarajan et al., 1974), which structured the process into four stages: Define (needs analysis, student characteristics, and goal formulation), Design (media selection, format specification, and initial storyboard design), Develop (expert validation and pilot testing), and Disseminate (broader implementation). Due to time and budget constraints, this study was executed only up to the Development stage. To evaluate the impact of the media intervention, a One-Group Pretest-Posttest design was applied to measure differences in the subjects' cognitive abilities before and after the treatment (Sugiyono, 2013).

The subjects in this study included a validation team comprising one media expert, one content expert, and one language expert. Furthermore, the effectiveness trial phase was conducted on a limited scale involving 25 tenth-grade students (Class X-7) at SMA Negeri Bareng. This sample size aligned with the rationale that 10 to 20 participants were sufficient to represent the target population during a limited trial phase (Sugiyono, 2022).

Data collection was conducted using interviews and observational instruments during the preliminary phase; a 5-point Likert-scale questionnaire for the expert feasibility validation; and an objective multiple-choice test (comprising 20 pre-test and 20 post-test items) to evaluate student comprehension. To maintain measurement integrity and accuracy, the test instrument underwent an empirical trial using SPSS software to verify its validity, reliability (Cronbach's Alpha), difficulty index, and discrimination power prior to its

administration to the research sample. Data analysis techniques were divided into qualitative and quantitative methods. Qualitative data, derived from the validators' feedback and critiques, were analyzed descriptively to guide product revisions. Quantitative data from the expert validation were processed using average percentages to determine the product's feasibility category (Sagita & Rafida, 2022). For the students' test results, the analysis commenced with the Shapiro-Wilk normality test (Sianturi, 2025). Because the data were asymmetrically (non-normally) distributed, hypothesis testing proceeded using the non-parametric Wilcoxon Signed Rank Test (Peres, 2026). Finally, a Normalized Gain (N-Gain) calculation was performed to measure the magnitude of improvement in student comprehension (Hake, 1998).

RESULTS

The product development process begins with the formulation of learning objectives and the design of a contextually based interactive multimedia storyboard on the payment system and payment instrument material. The learning objectives are formulated based on Phase E Learning Outcomes, which are specifically detailed in Figure 1. Based on these objectives, an initial interface design (storyboard) was prepared consisting of eight main sections. The first section is the Homepage containing the material title, a greeting sentence, and the initial navigation buttons. Next, the User Guide Page presents the activity procedures and the functions of the navigation buttons, which then directs the user to the Main Menu Page containing character animations and six central menu options. These menus include Learning Objectives, Learning Materials (which are broken down into payment system and payment instrument sub-materials with the support of text, images, contextual videos, and interactive buttons), and Learning Collaboration which integrates links to the Padlet platform to facilitate three activity columns: case studies, questions and answers, and reflections. In addition, a Practice Questions menu is provided containing instructions and links to Quizizz, and closes with a Developer Profile menu that displays the identity of the media creator. The concept map of the material underlying the flow of media information is illustrated in Figure 1.

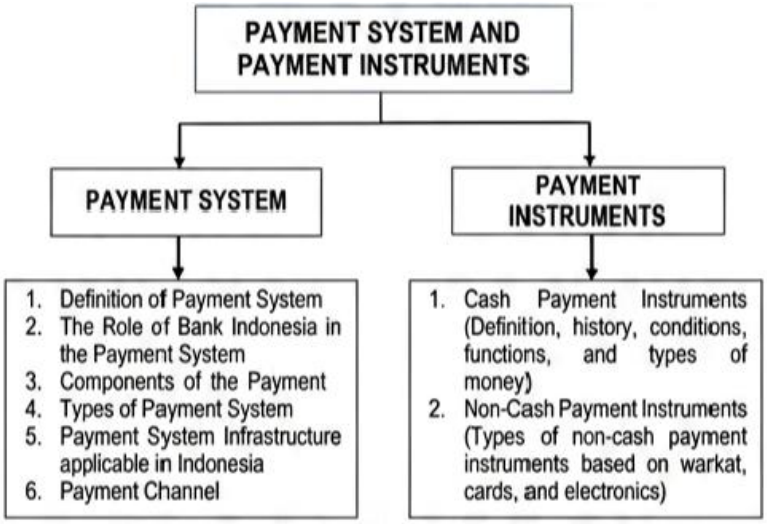

Figure 1 Concept Map of Payment Systems and Payment Instruments Material

Source: Processed by researchers (2026)

Entering the second stage, namely Design, researchers developed test instruments and designed multimedia prototypes (storyboards) using the Genially platform with a landscape ratio (16:9) for responsiveness across devices. The product interface narratively consists of several main segments. When students access the link, they are greeted by a Home page containing the material title and an initial navigation button, which directs them to the User Guide Page. Next, students enter the Main Menu Page designed with animated characters and six central menus. The Learning Objectives Menu details the competencies to be achieved, while the Learning Materials Menu is divided into two main segments (payment systems and payment instruments) integrated with contextual components through text, infographics, videos (such as the BI-RTGS and SKNBI mechanisms), and interactive pop-up buttons. To stimulate participation, the Learning Collaboration Menu is directly embedded into the Padlet platform, which contains three activity boards: an inquiry board for group case study completion (LKPD), a question board for interactive discussions, and a learning reflection board. Finally, formative evaluation is facilitated through the Practice Questions Menu integrated with Quizizz, and closed by the Developer Profile Menu. To learn more detailed information about the results of the research, please visit the link below:

The third stage is Development, which begins with expert appraisal (expert review and validation). During the qualitative review process, experts provided essential input, such as rearranging the material sequence by placing "Bank Indonesia's Role" before "Payment System Components," adding annotations to the BI-RTGS working diagram, adjusting the definition of GPN (National Payment Gateway), and requiring the use of italics for all foreign

terms. Post-revision, the product's feasibility was measured quantitatively. The final validation results, as presented in Table 1, confirm that this learning multimedia consistently achieved the "Very Feasible" category from all validators.

Table 1. Expert Feasibility Validation Result

Validator	Key Assessment Aspects	Persentage	Criteria
Members of Media	Visual design, usability, compatibility, navigation, interactivity	81,17%	Very Feasible
Materials Expert	Curriculum suitability, completeness, accuracy, presentation	83,07%	Very Feasible
Linguist	Language proficiecy, communicative value, spelling suitability (PUEBI)	82,22%	Very Feasible

In parallel with product validation, the quality of the pre-test and post-test instruments was also evaluated through empirical testing before being used in developmental testing. Question difficulty was evaluated to determine the proportion of students who answered each item correctly, a process calculated using computerized SPSS software.

Of the total 30 items tested per instrument, anomalies were found in the form of empirical invalidity (r-count < r-table) in 5 pre-test items and 9 post-test items, which were then immediately eliminated. The 20 best items that passed the selection showed a very high level of reliability, as evidenced by the Cronbach's Alpha value of 0.969 for the pre-test and 0.964 for the post-test.

Media effectiveness testing was then conducted on 25 students in grade X-7. The data normality assumption test (Shapiro-Wilk) produced probability values (Sig.) of 0.005 and 0.021 (both <0.05), which means the data is not normally distributed. Therefore, hypothesis testing was diverted to using the non-parametric Wilcoxon Signed Rank Test statistic. The results of the Wilcoxon test statistics calculation and the effect size of the increase (N-Gain) are comprehensively summarized in Table 2,

Table 2. Result of Wilcoxon Statistical Test and N-Gain

Statistical Indicators	Calculated Value	Interpretation of Result
Asymp. Sig. (2-tailed)	0,000	There are significant differences in understanding
Z Score	-4,379	Based on the absence of negative ranks

Statistical Indicators	Calculated Value	Interpretation of Result
Negative Ranks	0	No students experienced a decrease in scores
Positive Ranks	25	All students (100%) experienced an increase in scores
N-Gain Score (Mean)	0,7560 (75,60%)	Increased understanding is in the high category

The data in Table 2 absolutely demonstrates that none of the participants experienced a post-media use score degradation (Negative Ranks = 0). Furthermore, the asymptotic significance value, which is well below 0.05, proves the success of the intervention. The impact of this cognitive escalation is classified as high, with an average net increase (N-Gain) reaching 75.60%.

DISCUSSION

The empirical evidence from this research definitively confirms that the contextual-based interactive multimedia learning application has substantially improved students' conceptual understanding, as demonstrated by the superior N-Gain score of 75.60%. This dramatic increase is due to the instrument's success in amalgamating visual-audio elements with a contextual activity taxonomy, transforming the rigidity of the theoretical material on payment systems into a dynamic conceptual manifestation that resonates with students' daily use. The interactivity architecture within the Genially ecosystem, strategically combined with Padlet as an inquiry-based discussion incubator and Quizizz as a real-time formative assessment instrument, successfully stimulated participants' cognitive resonance, leading to enhanced retention and comprehensive assimilation of information.

Doctrinally, these findings inject new justification for the validity of Richard E. Mayer's Cognitive Theory of Multimedia Learning (CTML), which states that optimal cognitive efficiency will be achieved when instructional content is distributed through verbal and visual channels without triggering a cognitive overload crisis on working memory (Mayer, 2024). The collaborative aggressiveness observed in the interactive case study solving routine also validates the pillars of Vygotsky's Constructivism Learning Theory, which dictates the urgency of social dialectics in executing the engineering of meaningful understanding (Chand, 2023). At the level of comparative literature, this conclusion strengthens a series of studies by (Arum et al., 2025; Plodkaew et al., 2025) which depict the

superiority of Genially in skyrocketing academic performance (N-Gain 85%). Diving further, this analysis expands the research paths of (Etyarisky & Marsigit, 2022; Pradnyawati & Rati, 2023) by presenting the radical proposition that contextual-multimedia hybridization is not exclusive to the exact sciences, but rather serves as a formidable antithesis to the complexity of abstract material in the realm of economics.

The residual findings bear significant implications for vocational and economic education. From a theoretical perspective, this study deepens the literature narrative regarding the synchronization of constructivist paradigms and cognitive multimedia design architecture within the orbit of digital pedagogy. Functionally, this product's validity, feasibility, and effectiveness test matrix serve as an evidence-based foundation for educators, institutional directors, and curriculum creators to adopt this interactive multimedia instrument as a progressive teaching mechanism that aligns with the cognitive anatomy of Generation Z digital natives.

Despite yielding encouraging findings, this research anatomy contains several inherent limitations or boundary conditions that reduce the possibility of absolute generalization. The research execution is frozen at the development equilibrium in the 4D cycle, relying on the One-Group Pretest-Posttest maneuver on a micro-sample cluster (25 students) that eliminates the existence of a control group compartment. The functionality of this multimedia utility is also absolutely captive to the stability of bandwidth and internet connectivity infrastructure. Consequently, the future research trajectory is challenged to push the penetration of this product to the equator of large-scale dissemination (Disseminate), while mobilizing a cross-class quasi-experimental design architecture armed with a comparison class, to extract much more robust, holistic, and comprehensive external validity parameters.

CONCLUSION

Based on the research results and discussions regarding the development of contextual-based interactive learning multimedia for payment systems and payment instruments, it can be concluded that the development of contextual-based interactive learning multimedia for payment systems and payment instruments uses a 4D development model limited to the development stage. Validation results by media experts, material experts,

and language experts indicate that the developed multimedia is highly suitable for use as a learning medium.

Students' understanding of payment systems and payment instruments improved after using contextual-based interactive learning multimedia. This improvement is demonstrated by a significant difference between pre-test and post-test results and a high N-Gain value.

Based on the research results, the development of contextual-based interactive learning multimedia provides benefits in supporting the economics learning process, particularly for payment systems and payment instruments. The implications of this research include: Contextual-based interactive learning multimedia can be used as an alternative economics learning medium to assist teachers in presenting payment systems and payment instruments. The interactive and contextual characteristics of multimedia help present abstract material in a more concrete way, making it easier for students to understand.

Contextual-based interactive learning multimedia provides a variety of learning activities that encourage active student involvement in building their understanding. These activities are integrated into a single medium that is easily accessible both inside and outside the classroom.

Based on the research findings, the researchers offer several recommendations, including the use of contextually-based interactive learning multimedia as an alternative learning medium for payment systems and payment instruments, as well as other economic topics with similar characteristics. This can support more interactive learning and enhance student understanding. Schools are also advised to support the implementation of learning media that optimize the use of available technology facilities so that the use of digital learning media can continue sustainably. Researchers are strongly advised to conduct research up to the dissemination stage and to use a research design involving a control class so that the media's effectiveness can be tested more thoroughly.

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