

Development of Interactive Multimedia Integrated with PBL (Problem Based Learning) in the Subject of Economics for Grade X High School

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Abstract : This study developed interactive multimedia integrated with Problem-Based Learning (PBL) for Grade X Economics on demand and supply and evaluated its validity, practicality, and effectiveness. A Research and Development approach using the 4-D model—define, design, develop, and disseminate—was employed. Participants included expert validators, an Economics teacher, and Grade X students at SMA Pertiwi 1 Padang. Data were collected through validation sheets, practicality questionnaires, and pre-test–post-test learning outcome tests, then analysed descriptively and quantitatively using percentages and the Normalised Gain (N-Gain) index. The results showed that the multimedia achieved 95.47% validity, categorised as very valid, and 99.59% practicality, categorised as very practical. Its effectiveness was demonstrated by an N-Gain score of 0.84, which fell within the high category. The multimedia incorporated PBL syntax through case studies, interactive activities, and evaluations that actively engaged students in economic problem-solving. These findings indicate that PBL-integrated interactive multimedia is suitable for improving learning quality and student outcomes in demand and supply.

Keywords : Learning Outcomes; Interactive Multimedia; Economic Learning; Media Development; Problem Based Learning

Abstrak : Penelitian ini mengembangkan multimedia interaktif yang terintegrasi dengan Problem-Based Learning (PBL) untuk mata pelajaran Ekonomi kelas X pada materi permintaan dan penawaran serta mengevaluasi validitas, kepraktisan, dan efektivitasnya. Penelitian menggunakan pendekatan Research and Development dengan model 4-D, yaitu define, design, develop, dan disseminate. Partisipan penelitian meliputi validator ahli, guru Ekonomi, dan siswa kelas X SMA Pertiwi 1 Padang. Data dikumpulkan melalui lembar validasi, angket kepraktisan, serta tes hasil belajar pretest–posttest, kemudian dianalisis secara deskriptif dan kuantitatif menggunakan persentase dan indeks Normalized Gain (N-Gain). Hasil penelitian menunjukkan bahwa multimedia memperoleh validitas sebesar 95,47% dengan kategori sangat valid dan kepraktisan sebesar 99,59% dengan kategori sangat praktis. Efektivitasnya ditunjukkan oleh skor N-Gain sebesar 0,84 yang termasuk kategori tinggi. Multimedia tersebut mengintegrasikan sintaks PBL melalui studi kasus, aktivitas interaktif, dan evaluasi yang melibatkan siswa aktif dalam pemecahan masalah ekonomi. Temuan ini menunjukkan bahwa multimedia interaktif

terintegrasi PBL layak digunakan untuk meningkatkan kualitas pembelajaran dan hasil belajar siswa pada materi permintaan dan penawaran.

Kata kunci: Hasil Belajar; Multimedia Interaktif; Pembelajaran Ekonomi; Pengembangan Media; Problem-Based Learning

INTRODUCTION

The development of digital technology has transformed the educational landscape toward more flexible, interactive, and student-centered learning. The integration of technology into the learning process is no longer seen as an add-on, but rather a crucial part of creating learning experiences that develop 21st-century competencies, such as critical thinking, problem-solving, collaboration, creativity, and digital literacy (Santana-Mendes & Santos, 2022; Shobirin, 2025; Silva et al., 2025). The implementation of the Independent Curriculum further emphasizes the importance of learning that provides space for students to build knowledge through contextual and meaningful learning experiences, so that the use of technology-based learning media becomes one of the factors that determine the quality of the learning process (Adi et al., 2025; Sa'diyah, 2025; W et al., 2023).

Interactive multimedia is a learning innovation that can accommodate these needs (Khamparia & Pandey, 2017; Ngandoh et al., 2025). The integration of text, images, audio, video, animation, and interactive activities into a single medium allows abstract concepts to be visualized more concretely, making them easier for students to understand. The advantage of interactive multimedia lies not only in its ability to present information engagingly but also in its capacity to enable two-way interaction between students and the learning material. These characteristics provide opportunities for students to learn independently, obtain direct feedback, and build conceptual understanding through more active exploration (Viera Trevisan et al., 2022).

The need for interactive multimedia is increasingly important in Economics subjects (Dewi, 2015; Mohd Hattar & Halabi Azahar, 2024). The material on supply and demand, for example, involves complex relationships among concepts, requiring students to understand the relationships among prices, quantities of goods, consumer behavior, producer behavior, and market mechanisms as a whole (Jägerskog, 2021; Pande et al., 2021; Park, 2022). The delivery of material is still dominated by lecture methods and conventional media, which often result in a partial understanding of concepts, leading students to experience difficulties when faced with contextual economic problems.

This situation is still found in Economics lessons at SMA Pertiwi 1 Padang. The results of the needs analysis indicate that textbooks, PowerPoint presentations, and student worksheets still dominate the learning process. The use of digital technology has not been fully implemented, even though 96.1% of students already have smartphones that can be used as learning media. This situation indicates a gap between students' readiness to access technology and the availability of digital learning media that facilitate interactive learning activities. The impact is evident in students' poor understanding of the material on supply and demand, as reflected in learning outcomes that do not meet the Learning Objective Achievement Criteria.

The characteristics of economic material require a learning approach that not only conveys concepts but also engages students in investigating real problems (VanSickle, 1992; Dean Craig & Raisanen, 2013). Problem-Based Learning (PBL) is a relevant learning model because it places authentic problems as the starting point for learning. The learning process, through problem identification, information search, discussion, solution development, and reflection, enables students to build conceptual understanding while developing critical thinking, communication, collaboration, and decision-making skills (Singh et al., 2023). However, the implementation of PBL in economics education still faces obstacles, namely limited learning media that can systematically and interestingly facilitate all stages of problem-based learning for students (Artantri et al., 2022; Khasanah et al., 2023).

Several previous studies have reported the effectiveness of interactive multimedia in improving students' motivation to learn, conceptual understanding, and learning outcomes. Other

research shows that implementing Problem-Based Learning improves critical thinking and problem-solving skills. However, these two approaches are generally still developed separately. Interactive multimedia functions more as a medium for delivering material. At the same time, PBL implementation often relies on conventional learning tools that are not yet supported by digital media capable of integrating the entire learning syntax (Aditya & Hakim, 2025; Ahmatika et al., 2025). Research on the development of interactive multimedia integrated with PBL to address the supply and demand of 10th-grade high school students remains relatively limited. Hence, there is still room to develop learning media that integrate both approaches.

This research offers interactive multimedia specifically designed by integrating Problem-Based Learning syntax into a single digital learning platform. The product was developed using Canva and published through Heyzine Flipbook, combining various multimedia elements, such as text, images, video, audio, animation, interactive quizzes, and case studies structured according to the PBL process. This integration creates a novel value for the research because multimedia functions not only as a medium for presenting information but also as a facilitator for problem-based learning, enabling students to learn actively, independently, and contextually through various digital devices. This research aims to develop interactive multimedia integrated with Problem-Based Learning for 10th-grade high school Economics and to test the validity, practicality, and effectiveness of the product as an alternative learning medium to improve the quality of the learning process and student learning outcomes in the supply and demand unit.

METHOD

This research is a research and development (R&D) that aims to produce interactive multimedia integrated with Problem-Based Learning (PBL) in Economics for grade 10 high school students. The development model used is the 4-D model consisting of four stages: define, design, develop, and disseminate. The define stage is carried out to analyze learning needs, student characteristics, materials, and learning objectives (Thiagarajan et al., 1974). The design phase includes multimedia design and the development of research instruments. The development phase includes expert validation, product revision, and testing for practicality and effectiveness. The dissemination phase involves implementing the product in the learning process.

The research was conducted at SMA Pertiwi 1 Padang, involving expert validators, Economics teachers, and 10th-grade students as research subjects. The instruments used included a validation sheet, a practicality questionnaire, and a learning outcome test (pretest–posttest) (Baig, 2021). The validation sheet is used to assess the product's feasibility in terms of materials, media, and language, while the practicality questionnaire is used to determine the ease and usefulness of the multimedia based on teacher and student responses (Premkumar et al., 1998; Azmi et al., 2022). Product effectiveness was measured by improvements in student learning outcomes following the use of interactive multimedia. Data were analyzed descriptively and quantitatively. Validity and practicality scores were calculated as percentages, while product effectiveness was analyzed using the Normalized Gain (N-Gain) index based on pretest and posttest results. Multimedia was deemed suitable if it met the criteria of validity, practicality, and effectiveness.

RESULTS AND DISCUSSION

Development of Integrated Interactive Multimedia with Problem-Based Learning (PBL)

This research resulted in an interactive multimedia product designed to support Economics learning on the supply and demand topic for 10th-grade high school students. The multimedia was developed in Canva and published on the Heyzine Flipbook platform, making it accessible online on computers and mobile devices. The product was designed by integrating Problem-Based Learning (PBL) syntax into each learning stage, so that students not only learn the material but also engage in problem identification, information gathering, analysis, solution development, and evaluation of learning outcomes.

The development process followed the 4-D model (define, design, develop, and disseminate). The define stage resulted in a needs analysis demonstrating the need for digital learning media that can visualize economic concepts and facilitate problem-based learning. The design stage resulted

in a multimedia design that included the material structure, navigation, user interface, learning videos, animations, interactive quizzes, and case-study-based exercises. The development stage produced a revised product based on validator input until it met the eligibility criteria. The dissemination stage was carried out by implementing multimedia in Economics instruction for 10th-grade high school students. The following are important components of interactive multimedia.



Figure 1. Interactive Multimedia Display

The developed multimedia consists of several main components: an opening page, user instructions, learning outcomes, learning objectives, supply-and-demand materials, learning videos, case studies, interactive exercises, evaluations, and feedback on student learning outcomes. Each component is structured according to the stages of Problem-Based Learning so that learning activities proceed systematically, from problem orientation to solution presentation (Liu & Liu, 2026).

Validity of Interactive Multimedia

The feasibility of interactive multimedia was assessed by three validators: media experts, material experts, and linguists. The validation results showed that the multimedia achieved a score of 95.47%, which was categorized as very valid. The media expert's assessment was 94.11%, the material expert's 92.30%, and the linguist's 100%. These results indicate that the developed multimedia has met the feasibility criteria for content, media display, navigation, interactivity, and language use, making it suitable for the trial stage.

Table 1. Interactive Multimedia Validity Results

Validation Aspects	Percentage (%)	Category
Media Expert	94,11	Very Valid
Material Expert	92,30	Very Valid
Language Expert	100,00	Very Valid
Average	95,47	Very Valid

Interactive Multimedia Practicalities

The practicality of the multimedia was evaluated through a questionnaire administered to teachers and students after the product was used in learning. The analysis showed that the multimedia received very positive responses. Teachers rated the multimedia as easy to use, helpful in delivering material, and supportive of problem-based learning. Students also responded very favorably to the display, ease of navigation, clarity of the material, the interactive activities available, and the overall practicality of the multimedia.

Table 2. Practicality of Interactive Multimedia

Variabel	Percentage (%)	Category
Convenience	100,00	Very Practical
Presentation of Material	99,66	Very Practical
Appearance	99,54	Very Practical

Effects of Problem Based Learning (PBL)	99,14	Very Practical
Average	99,59	Ver y Practical

Based on the results of the student practicality test on interactive multimedia based on Problem-Based Learning (PBL), the percentages obtained were 100.00% for the ease aspect, 99.66% for the material presentation aspect, 99.54% for the display aspect, and 99.14% for the learning strategy effect aspect (PBL). The average student practicality percentage was 99.59% in the Very Practical category. These results indicate that the developed interactive multimedia is very easy to use, has excellent material presentation and display, and can support the implementation of the Problem-Based Learning strategy in the learning process.

Effectiveness of Interactive Multimedia

The effectiveness of the developed interactive multimedia can be seen in students' learning outcomes. Learning outcomes are assessed through a knowledge test administered via pretests and posttests consisting of objective questions. The purpose of implementing the pretest and posttest is to determine the effectiveness of interactive multimedia in improving student learning outcomes after participating in the learning process using the developed interactive multimedia. The pretest and posttest were administered to 30 students in class X, Phase E.

Table 3. Summary of N-Gain Test Results

Description	Score
Pretest Average	52,56
Posttest Average	92,33
N-Gain	0,84
N-Gain Percentage	84%
High Category	“High Category” $g \geq 0,70$

The effectiveness of multimedia was measured by improvements in student learning outcomes, assessed using pretests and posttests. The average pretest score of 52.56 increased to 92.33 in the posttest. Analysis using the Normalized Gain (N-Gain) index yielded a score of 0.84, which is considered high. These results indicate that the use of interactive multimedia integrated with Problem-Based Learning significantly improved students' understanding of the supply and demand material.

Discussion

The development of interactive multimedia in this study not only produces digital learning media but also creates a learning environment that integrates technology with a Problem-Based Learning pedagogical approach. The integration of PBL syntax into multimedia allows students to be actively involved from the problem orientation stage to the development of solutions (Sutarto et al., 2022; Loyens et al., 2023; Wang et al., 2023). These characteristics enable multimedia to function as a learning facilitator, not just a provider of information. Presenting material through a combination of text, images, video, animation, and interactive activities provides a richer learning experience, allowing students to construct knowledge independently and contextually (Mayer, 2009).

The high level of validity indicates that the multimedia has met the eligibility standards for content, learning design, media, and language (Harisah et al., 2025; Winther & Klotz, 2013). These results indicate that each multimedia component has been systematically structured to align with the learning outcomes and characteristics of the supply-and-demand material. The clarity of the material structure, consistent navigation, and the use of communicative language support the creation of learning media that is easy for students to understand and use. These findings demonstrate that the quality of the learning design is a crucial factor in producing multimedia that is not only visually appealing but also possesses high pedagogical value.

The high level of practicality of the multimedia demonstrates that the product can be easily implemented in the learning process. Easy access through various digital devices, simple navigation, and the integration of various interactive features provide a more flexible learning experience and

increase student engagement throughout the learning process. Positive responses from teachers also demonstrate that multimedia can support problem-based learning without adding complexity to classroom management. This situation reinforces multimedia's role as an adaptive medium to the needs of both teachers and students in economics learning.

The improvement in learning outcomes, demonstrated by the N-Gain value of 0.84, indicates that interactive multimedia integrated with PBL effectively helps students understand the concepts of supply and demand. This improvement was influenced not only by the more engaging presentation of the material but also by learning activities that encouraged students to identify problems, explore information, discuss alternative solutions, and reflect on learning outcomes. This process enabled students to build connections between economic concepts and phenomena they encounter in everyday life, thereby making learning more meaningful.

Overall, the research findings indicate that integrating interactive multimedia with Problem-Based Learning (PBL) can produce learning media that meet the criteria of validity, practicality, and effectiveness, while simultaneously strengthening the implementation of student-centered learning. The main contribution of this research lies not only in the development of multimedia products but also in the integration of problem-based learning models into digital learning environments, thereby bridging the need for innovative, interactive, and relevant learning media to meet the characteristics of economics learning in secondary schools.

CONCLUSIONS AND RECOMMENDATIONS

This study successfully developed interactive multimedia that integrates Problem-Based Learning (PBL) into the 10th-grade Economics curriculum, using the 4-D development model. The resulting multimedia incorporates PBL stages into content presentation, case studies, interactive activities, and assessments, thereby fostering active, contextual, student-centered learning. Testing results indicate that the product meets the criteria for being highly valid (95.47%) and highly practical (99.59%), and is effective, yielding an N-Gain score of 0.84 (high category). These findings demonstrate that the developed multimedia is not only suitable as a learning tool but also enhances student engagement and learning outcomes on the topic of supply and demand.

The study's primary contribution lies in integrating PBL stages into interactive multimedia, providing an alternative digital learning medium that supports 21st-century learning. Teachers can use the developed interactive multimedia as an alternative instructional medium for economics topics that require conceptual visualization and problem-solving. Future research is recommended to test the effectiveness of multimedia in other economics topics, at different educational levels, or through experimental designs with broader sample coverage; this would yield stronger empirical evidence regarding the impact of multimedia on students' learning outcomes, critical thinking abilities, and problem-solving skills.

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