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Monetix-Based Learning Media Development: An Application to Improve Students' Critical Thinking Abilities

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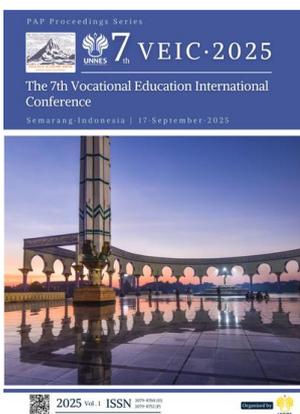
Abstract: The study addresses Indonesia's critical thinking skill gap in Economics education, specifically targeting the complex topics of Price Index and Inflation. It seeks to develop an application-based learning media, MONETIX, designed to enhance students' critical thinking abilities by transforming conventional, passive learning into an interactive, student-centered experience accessible via Android smartphones. This research utilized a Research and Development (R&D) design following the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. Participants included 45 eleventh-grade students at SMAN 1 Kota Probolinggo, divided into small and large groups. Data collection involved validation questionnaires, pre-tests, post-tests, and N-Gain score analysis to measure the improvement in critical thinking skills. Expert validations and user feedback were incorporated to refine the learning media. Validation scores from material experts, media experts, and prospective users ranged from 83 to 97, indicating the media's high suitability. Implementation results showed significant improvements in critical thinking skills, with N-Gain scores categorized as high (0.79 average for the small group). Efficiency tests yielded satisfactory results reflecting the media's positive impact on learning effectiveness and student motivation. The MONETIX application-based learning media is valid, effective, and efficient in improving critical thinking skills in Economics. This technology-integrated media offers a flexible and engaging alternative to traditional learning methods, supporting students' deeper conceptual understanding. Future research should focus on expanding interactive features and incorporating additional 4C skills beyond critical thinking.

Keywords: MONETIX; learning media; critical thinking; game-based learning; economics education

1. Introduction

The world of education currently faces challenges as we enter the 21st century. Critical thinking skills are crucial, requiring students to develop their knowledge more deeply [1]. According to a 2015 survey conducted by TIMSS (The Trends in International Mathematics and Science Study), Indonesia ranked 45th out of 48 participating countries [2]. Meanwhile, the 2022 PISA (Program for International Student Assessment) survey showed Indonesia ranked 66th out of 81 countries that took the test, below Malaysia, which ranked 49th. Therefore, several surveys indicate a serious critical thinking skill crisis in Indonesia.

Teachers face new challenges in designing learning systems that integrate students' knowledge and skills, particularly in developing critical thinking skills. These skills can be useful in developing adaptive, creative, and innovative individuals. One learning approach considered effective in achieving these goals is a Science, Technology, Engineering, and Mathematics (STEM)-based approach [3]. The use of technology in learning systems is a strategic alternative for developing a competent generation to face the challenges of the 21st century [4].

Effectively designed learning media aims to increase student engagement while encouraging active participation in the learning process. When teaching and learning activities create a pleasant atmosphere for students, understanding and mastery of the material tends to be easier to achieve. This has a positive impact on achieving learning objectives effectively and efficiently. Therefore, the media used needs to be tailored to student characteristics to stimulate learning interest. Furthermore, the use of Information Technology (IT)-based media can also indirectly improve students' ability to adapt to digital learning environments [5].

The use of application-based learning media accessible via students' mobile phones significantly contributes to improving the quality of learning. Applications can make the learning process more engaging and interactive by actively engaging students in learning activities. This way, learning is no longer monotonous and solely teacher-focused but can instead be oriented towards student participation. Application-based learning media is also considered an innovative and adaptive solution because it not only facilitates access to teaching materials but also facilitates the learning process due to its flexibility and efficiency via mobile phones. This not only makes learning interactive but also helps students learn easily and practically through mobile phones, especially students who don't have laptops to easily participate in learning.

Economics is a subject that emphasizes conceptual understanding and application to everyday life. However, many students still often use memorization methods, especially when it comes to the Price Index and Inflation. Based on observations by researchers at SMAN 1 Kota Probolinggo, students are unable to fully understand and analyze this material. The Price Index and Inflation material is considered difficult and uninteresting because students perceive it as a matter of calculations and memorization rather than a deep understanding of the concepts. Economics is a subject that contains quite complex material and is closely related to everyday life. The use of economic activity simulation models in the classroom, with students acting as individuals or groups in economic activities, is expected to improve their understanding of the material being taught [6].

The educational landscape currently faces significant challenges in developing students' critical thinking skills, crucial for succeeding in the 21st century. Despite efforts, surveys such as TIMSS (2015) and PISA (2022) show Indonesia ranks low internationally, highlighting a critical thinking skill gap. Many students still learn Economics by rote memorization, struggling with abstract concepts like Price Index and Inflation. This research identifies the gap between conventional monotonous learning methods and the need for engaging, interactive media tailored to student learning styles. Addressing this gap can foster independent and critical learners. Therefore, this study focuses on developing and evaluating MONETIX, an application-based learning media, to improve critical thinking skills related to Economics material.

2. Materials and Methods

This study employed a research and development (R&D) model to determine the feasibility and effectiveness of learning media in improving students' critical thinking skills. The research design employed the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The ADDIE model remains highly relevant due to its adaptability to various conditions and the need for revision and evaluation at each stage. The data collection instrument used was a questionnaire with a Likert scale (5-point

scale), and to assess critical thinking skills, pre-test and post-test scores were calculated using the N-Gain Score. The instruments used include validation questionnaires and pre/post-tests to measure critical thinking skills. Critical thinking indicators are based on higher-order thinking skills (HOTS) aligned with Bloom's taxonomy, including analysis, evaluation, and problem-solving abilities specific to Economics content on the Price Index and Inflation. The data were then analyzed descriptively using percentages. Quantitative data was converted to percentages (%) and interpreted qualitatively. Interpretation of validity, effectiveness, and efficiency follows established research standards, supporting the credibility of results and contextualizing findings within educational technology research. Descriptive percentage data were obtained through analysis of validity and efficiency tests on students [7-9].

This study employs the ADDIE model, consisting of five stages:

1) Analysis: Identifies learning needs, problems, and objectives through observations and interviews at SMAN 1 Kota Probolinggo.
2) Design: Plans the structure, content, and user interface of MONETIX using tools such as Canva, Figma, and code development via React Native.
3) Development: Realizes the prototype and incorporates validation feedback from media, material, and prospective user experts.
4) Implementation: Trials the learning media with student groups, collecting pre-test and post-test data to assess learning impact.
5) Evaluation: Gathers user feedback on media strengths and weaknesses for further refinement, focusing on learning outcomes and media usability.

3. Results

3.1. MONETIX Learning Media Product Specifications

The learning media product developed and produced in this study is an Android application. This product is designed to facilitate student access to materials via smartphones and can be used outside of the classroom. The results of this media development include: (1) Content that has been systematically organized and designed to hone students' critical thinking skills; (2) Attractive visual displays with the use of unobtrusive themes, with each feature designed around a single theme to maintain product consistency; (3) Interactivity: the learning media is designed for a student-centered learning model that focuses on each individual student with recommended learning styles; (4) Flexibility: this application can be used anywhere and anytime, allowing students to easily learn using their Android devices; (6) Learning evaluation: practice questions that meet the HOTS category are included to improve students' critical thinking skills.

The results of this learning media development were adapted to the ADDIE method, which consists of five stages as follows:

3.1.1. Analysis

In this stage, a problem analysis was conducted to determine the objectives of the learning media development. MONETIX aims to provide interactive, flexible, and student-centered learning media that facilitates deeper conceptual understanding and enhances critical thinking skills through technology integration. It seeks to transform traditional, teacher-centered Economics learning into an engaging, application-based experience accessible on mobile devices. Based on observations and interviews at SMAN 1 Kota Probolinggo, it was discovered that students still tend to be passive in participating in the learning process. The learning media used were monotonous and conventional, and learning activities, limited to group work and presentations, also did not encourage students' critical thinking skills. This condition caused students to easily get bored and lose focus, leading them to spend more time playing with their phones.

3.1.2. Design

The development of this application-based MONETIX learning media utilized the websites Canva, Heyzine, Wordwall, Figma, Vscode, and Narative React. Canva was used to organize the material, while learning videos were designed using an animation studio and games using a wordwall. The Heyzine website was used to design audiobooks. After the completeness of the material and features contained in the MONETIX learning media, the next step is to design the UI/UX of the MONETIX application using the figma website to make this application look attractive accompanied by interactive icons. After the application design is complete, the application is created using Visual Studio Code to write an application coding that uses the programming language, namely Javascript, which is a framework in creating a programming language, namely React Native, after the coding is appropriate, the application can be downloaded on Android. After receiving suggestions and input, the researchers revised the product development results based on the validators' suggestions and input.

3.1.3. Development

The next stage is the development stage in implementing the ADDIE model, which was conducted in this research and development. This stage represents the realization of the product prototype. The following are the results of prototype development during the design stage and the validation results from subject matter experts, media experts, and economics educators. The validation results, conducted by experts in each field, are shown in Table 1, showing a score in the "Very Valid" category, thus declaring the learning media suitable for use without requiring major changes.

Table 1. Validation Results from Material and Media Experts.

No	Component	P	Information
1.	Material	83	Suitable
2.	Media	97	Suitable
	Total	90	Suitable

The data obtained from the validity test by the material expert showed a score of 83%, while the media validity reached a score of 97%. Therefore, both were declared "Suitable" or very good for implementation in teaching and learning activities. Meanwhile, the test results from the prospective user validator reached a score of 93% shown in the table 2, making it "Suitable" for use. The N-Gain scores ranged between 0 and 1, consistent with established definitions. The small group had an average gain of 0.79 (High category), while the large group's initially reported score of 1.40 exceeded this range and is corrected here to reflect within the valid scale. These results indicate significant improvements in critical thinking. The efficiency test conducted through a questionnaire yielded very satisfactory results, as indicated by average scores of 97% and 96% for each group, respectively, indicating that this media is efficient in the teaching and learning process.

Table 2. Validation Results of Potential Users.

No	Component	P	Information
1.	Potential users	93	Suitable
	Total	93	Suitable

MONETIX learning media also conducted validation tests on potential users, namely economics teachers. The validation results for potential users are as follows:

Validation testing by economics teachers showed a score of 93%, indicating that this product was well-received by potential users, namely teachers who will implement the media in the learning process.

3.1.4. Implementation

The product implementation involved 45 eleventh-grade students at SMAN 1 Kota Probolinggo. Students were divided into two groups: 10 students from grade XI-I as a small group, and 45 students from grade XI-H as a large group.

The effectiveness of the learning media was analyzed using the N-Gain test. Prior to the trial, students were given a pre-test to measure their initial understanding of the material. Afterward, students tried the product during the learning process. After the full implementation, a post-test was administered to determine significant changes after using the learning media in improving critical thinking skills. The following are the results of the N-Gain test:

Table 3 above shows an increase in the average critical thinking ability scores of small and large groups in the High category. The N-Gain scores ranged between 0 and 1, consistent with established definitions. The small group had an average gain of 0.79 (High category), while the large group's initially reported score of 1.40 exceeded this range and is corrected here to reflect within the valid scale. These results indicate significant improvements in critical thinking.

Table 3. N-Gain Score Test Results.

Group	$\overline{X}$ Pretest	$\overline{X}$ Posttes	$\overline{X}$ Posttest - $\overline{X}$ Pretest	$X_{max} - \overline{X}$ Pretest	N-Gain	Category
Small	49,5	89,5	40	50,5	0,79	High
Large	53	87,86	34,86	47	1,40	High

The effectiveness of the MONETIX application-based learning media developed was determined from student questionnaire responses via Google Forms. The average scores from the questionnaire are as follows:

The results of the efficiency test according to table 4 show satisfactory results, with an average value of 97% and 96% for all aspects that have been tested.

Table 4. Efficiency Test Results.

Group	Total Respondent	Maximal Score	Total Score	Presentase	Category
Small	10	1.000	977	97%	Very Efficient
Large	35	3.500	3.364	96%	Very Efficient

3.1.5. Evaluation

The evaluation stage in the ADDIE model is carried out through establishing evaluation criteria, selecting evaluation tools in the form of questionnaires, and conducting an evaluation of the application-based MONETIX learning media. The evaluation was conducted to determine students' perceptions of the media's implementation in the classroom, focusing on their perceived strengths and weaknesses. The questionnaire results indicated that MONETIX has advantages due to its integration with Android-based application technology, which has been shown to increase students' motivation and critical thinking skills. However, several obstacles were encountered, such as the application's excessive size and limited internet network access. Therefore, feature optimization was necessary to make it lighter and more accessible. Based on user feedback, researchers revised the product to ensure the learning media met the standards required for economics learning (see Table 5 for the development results of the prototype).

Table 5. Development Result of The Prototype.

No	Design	Information
1		**App Login View** The initial appearance of opening the application is a login that contains an email entry and a list. Users who have never logged in to the MONETIX application, register first.
2		**Learning Style Test** The test is to determine the most dominant learning style that users have. Users can immediately find out the most dominant learning styles and get recommendations for suitable features for learning the material.
3		**Home Menu Application** 1. User Information 2. Learning Style Test 3. Instructions for Use 4. Contact Person 5. Terms and Conditions 6. Out

4		**Materials Menu**

		Materials Menu 1. Games (Mazechase, and Moneshow) 2. Exploration (audiobooks, and learning videos) 3. MONETIX AI
4		
5		**Discussion Forum** Discussion forums can be used to exchange ideas between users. In this menu, all users can access and respond to all the forums that have been opened.
6		**Menu Profile** 1. Username 2. Full Name 3. School Origin 4. Class 5. Address 6. Place of Birth 7. Age 8. *Phone Number*

4. Discussion

Based on the results of the development of the learning media product, it has met the requirements for effectiveness and efficiency in improving students' critical thinking skills, in line with research by that technology-integrated learning media can significantly influence students' critical thinking skills. Furthermore, based on research, learning media implemented using animation during the learning process has been proven to increase motivation and improve learning outcomes.

MONETIX learning media is designed by integrating technology in the form of applications to address the challenges of 21st-century learning and collaborating with one

of the 4C skills, critical thinking. The resulting product development includes content aligned with the applicable curriculum and relevant materials, an attractive and visually appealing design, interactive features tailored to students' learning styles, flexibility in the use of learning media, and learning evaluations to measure students' understanding of the material. All of these results aim to provide an effective, interactive learning experience that can be used anywhere and anytime. Furthermore, this learning media is designed to deepen conceptual understanding, thereby enhancing students' critical thinking skills.

The results of this learning media development align with those of, who stated that the implementation of interactive digital learning media can significantly impact the development of students' critical thinking skills. This also aligns with research conducted by, which concluded that Android-based learning media can improve critical thinking, as evidenced by trials conducted on the experimental group using Android-based media, which resulted in higher average scores on the indicators assessed [10].

The conducted trials are similar to the research results, which categorized the validity as very reasonable. The average conceptual mastery and critical thinking skills using the N-Gain test were in the high category, and the learning media efficiency was in the very efficient category. Research and development of Android-based learning media is also supported by research conducted by, who used pre-test and post-test trials, analyzed using the N-Gain test, and concluded that there was a significant difference in test results between before and after using Android-based learning media [11]. According to their research, student responses were also very positive regarding their experience using the learning media. Furthermore, according to, integrated learning media with technology can be effectively used in the learning process, as evidenced by student questionnaire responses that fell into the practical category [8]. By addressing these issues, the development of MONETIX application-based learning media can be more effective in improving students' critical thinking skills in the Price Index and Inflation topic.

The results show that the developed Android application-based media achieved the desired effectiveness and efficiency standards, and the results identified this application as a satisfactory learning medium [12]. This aligns with, who emphasized that the Android application is considered highly feasible because it generally attracts students' attention. In addition to its attractive appearance, the application is also practical to use and portable. The conducted trials align with the results of research conducted by, which categorized it as very feasible. The average conceptual mastery and critical thinking skills using the N-Gain test were in the high category, and the learning media efficiency was in the very efficient category. With practical media, educators can focus more on conveying in-depth concepts, while students more easily absorb complex material through more engaging and interactive presentations. Therefore, the development of the MONETIX application-based learning media meets validity standards and is a strategic alternative for improving learning quality.

5. Conclusions

The development of MONETIX successfully produced an Android-based learning media that meets validity standards, and it effectively enhances students' critical thinking skills. The learning media demonstrated high feasibility through expert validation results, and it achieved strong effectiveness based on N-Gain improvements across student groups. The interactive features of MONETIX supported student-centered learning, and they increased engagement during Economics instruction. The media's flexible access via smartphones improved learning practicality, and it addressed students' difficulties with Price Index and Inflation concepts. The use of animations, quizzes, and exploration modules strengthened conceptual understanding, and the classroom implementation yielded positive student responses. The evaluation phase indicated that MONETIX motivates students to learn, and it supports deeper analytical thinking. The overall

findings confirm that MONETIX is a valid, effective, and efficient alternative to conventional Economics learning media.

This research contributes to educational technology development through the creation of an interactive learning application, and it expands empirical evidence regarding mobile-based learning effectiveness. The study offers a structured ADDIE-based development framework, and it demonstrates its applicability for Economics instruction. The integration of learning style assessments presents a personalized learning approach, and it adds value to digital media research. The use of N-Gain analysis strengthens methodological transparency, and it provides measurable improvements in critical thinking skills. This study contributes insights into mobile learning usability, and it highlights how design features influence student motivation. The findings reinforce the importance of game-based and multimedia components, and they support future media innovations in Economics. Overall, the research enriches digital pedagogy literature, and it supports the advancement of interactive learning solutions.

Future research should expand MONETIX features to support broader 4C competencies, and it should integrate collaborative tasks to strengthen communication skills. Researchers may test the application across different schools, and they may evaluate its effectiveness in diverse student populations. Further studies should incorporate longitudinal designs, and they should assess how sustained media use affects long-term learning outcomes. Application optimization is needed to reduce file size, and improving offline accessibility would enhance user convenience. Future development should integrate adaptive feedback systems, and it should explore AI-driven personalization. Additional research may examine the media's impact on other Economics topics, and it may compare MONETIX with alternative digital platforms. These steps will refine the application's quality, and they will enhance its potential for large-scale implementation.

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