

The Role of H5P-Based Interactive Media in The Mathematics Learning Process

Wandra Irvandi^{1*}, Yudi Darma¹

¹Universitas PGRI Pontianak, Pontianak, Kalimantan Barat, Indonesia ²Mathematics Education, wandrairvandi@gmail.com

*Corresponding author

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Abstract:

Educational transformation in the digital era utilizes various technologies to improve the quality of learning and provide innovative learning experiences. This use of technology not only changes the way we learn and teach but also creates a more adaptive and responsive educational environment in the digital era. This study focuses on the integration of interactive media based on H5P to improve mathematical problem-solving skills. The research method used a literature review to examine the relationship between technology and mathematical problem-solving skills. The results show that interactive media based on H5P can be utilized to make learning more innovative. The media meets the criteria of validity, practicality, and effectiveness, making it suitable for use in the learning process.

Keywords: Technology, H5P-based interactive media; Mathematical problem-solving skills

Introduction

The presentation of materials, concepts, propositions, theorems, and even axioms provides access that has a close relationship between mathematics and human life in mathematics learning scenarios. Although in fact, there are still many ideas, concepts in a study that express that mathematics is something abstract and has not become a primary activity in learning as a science that is familiar with life values and has "closeness to culture" (Hardiarti: 2017).

The education sector is experiencing a new phase in its learning process. The recovery of learning requires all parties to innovate and utilize technology as a complementary tool to improve the quality of education. Appropriate learning approaches and media utilization are key to direct, optimal, and ideal engagement between lecturers and students in the learning process. In this regard, innovative learning media is essential as a current learning solution. as the right choice in order to integrate learning, character and technology (Hilliard, 2015; Uğur, et.all, 2011) .

Utilizing the surrounding environment as an effort to transfer knowledge and transfer of values is an important concern to facilitate students to understand and connect the material to the facts of everyday life. Culture that is a habit for most people is a condition that is often forgotten by educators as one of the important resources



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that can be utilized in the implementation of local wisdom-based learning through ethnomathematics, which underlies the urgency of this research. In Indonesia, between 2015-2020, based on 11 journals containing the publication of 30 articles related to ethnomathematics, as many as 97% of the articles related to the topics of geometry, algebra, number value, numbers and operations, while the remaining 3% contained other materials, including statistics (Hidayati and Prahmana, 2022; Risdiyanti and Prahmana, 2019).

The needs of today's global society require a balance between hard skills and soft skills. "Problem-solving skills (De Lange, 2006; O'Shea and Leavy, 2013) and character are an inseparable whole as a manifestation of the achievement of educational goals (Cunnigham, 2007; Lapsley, 2008; Shem, 2016; Sickafus, 2004), in order to be able to produce intelligent generations and be able to act wisely as an inseparable part of community life" (Darma and Sujadi, 2014; Darma, et al., 2018; Darma, et al., 2019; 2020).

The problem-solving approach in research refers to heuristic steps, namely:

1. Conducting development research with the ADDIE model integrated with technology (AR) and ethnomathematical values to develop students' numeracy literacy.
2. Carrying out implementation and evaluation of the use of media developed from the aspects of validity, practicality and effectiveness.
3. Understanding the problem: mapping the problem of numeracy literacy as a dependent variable of the product developed as a development variable.
4. Planning the solution: arranging the roles (duties and functions) of the research team related to the aspects that will be developed and accommodated in the proposed research innovation, namely planning the development of augmented reality-based media, ethnomathematic designs that will be scenario-based in the material content and aspects of the domain of mathematical problem-solving abilities.
5. Action: core implementation of media development, measuring the validation and practicality of the developed textbook.
6. Re-checking: implementing and/or testing the product and measuring the level of effectiveness of the implementation carried out.
7. Finalization: preparation and completion of reports and research outputs.

The research idea developed is focused on the aspects of "development of learning media" and "character education and competitiveness", in addition, the research proposal has harmony and novelty from research conducted by researchers in research related to numeracy literacy aspects of problem-solving abilities with several approaches to media development and character values.

The needs and relevance of today's learning are inseparable from the need for media, and the utilization and optimization of technology are certainly imperative. Optimizing the use of interactive media that can combine the virtual world with the real world and then present or project it in real time, thus fostering critical thinking

skills and responsibility (character aspects), is a crucial focus in learning. The novelty in this research is:

1. Combining technology-based learning scenarios and the objectives of numeracy literacy in mathematical problem-solving aspects.
2. H5P -based interactive media to increase digital literacy and numeracy aspects of problem solving abilities as a fun learning solution as well as strengthening literacy improvement.
3. augmented reality- based textbook product that is developed further can be constructed and applied to multi-disciplinary sciences which is also one of the leading topics available in national research and has digital economy value packaged in innovative media (Kemendikbudristek, 2017).
4. Integration of learning and assessment as well as real-time data will be a solution to the effectiveness of the time dimension for lecturers.

H5P is an open-source interactive learning platform that contains interactive content that is shared and used for online learning in educational contexts. According to Wibowo (2023: 1), HTML is one of the most popular technologies for modern web pages. HTML5 is the fifth revision of HTML. The main goal of HTML development is to improve the latest multimedia technology, making it easy for humans to read and easy for machines to understand (Setiawan, 2017: 25).

Based on this, the following questions are raised: what is the role of H5P-based interactive media in the learning process? And what is the validity of H5P-based interactive media in terms of students' mathematical problem-solving skills, including their numeracy literacy skills, in terms of validity, practicality, and effectiveness.

Research Methods

Data collection techniques are the most strategic step in research, as the primary goal of research is to obtain data. Without understanding data collection techniques, researchers will not obtain data that meets the applicable data standards (Sugiyono, 2014).

In this development research, data collection techniques used observation, interviews, and questionnaires. Observations were conducted to assess mathematical values within the West Kalimantan community during the mathematics learning process. Interviews were conducted to identify difficulties and knowledge needs regarding the material.

There are three techniques for collecting data in this study, namely using observation, documentation and questionnaire methods.

a. Observation

The observation used in this study was structured observation. Structured observation is systematically prepared observation of what will be observed. The

observation aims to obtain an overview of the learning process and observations of mathematical values in the community in West Kalimantan.

b. Interview

An interview is a verbal question-and-answer process between researchers and respondents. This study used unstructured interviews. Unstructured interviews are free-form interviews in which researchers do not use a systematic interview guide. Interviews were conducted with students and lecturers using the learning media.

The developed product is declared valid/feasible if it meets the requirements of validity, practicality, and effectiveness. Data collection and analysis techniques are in accordance with the research objectives in Table 1:

Table 1. Research Achievement Indicators and Analysis Techniques

| No. | Criteria | Data collection technique | Analysis Techniques |
|-----|---------------|---|---|
| 1 | Validity | The media is validated by experts/specialists using validation instruments with a feasibility review by material experts and media experts, (Tests and Questionnaires) via quizziz. | Validity analysis by 3 (three) validators, each a material expert and a media expert, with a minimum criterion of 80% declare valid . |
| 2 | Practicality | The practicality of textbooks and media is seen from: Product user lecturer assessment | Practicality test: The validator provides an assessment that the learning device can be used by lecturers and students in lectures. |
| | | Student responses after the implementation of learning devices. | Students gave a positive response to the learning tools used in lectures with the category GOOD (80%) . |
| 3 | Effectiveness | The effectiveness of learning devices is seen from: Learning management skills | Effectiveness test: Learning management by lecturers is said to be good if at least 80% of the learning stages in SAP are implemented. |
| | | Activities during learning | Student activities are said to be good if irrelevant behavior is less than 20% of the total activity. |
| | | Test of problem solving ability and character values development. | The effectiveness of problem solving is said to be achieved if students complete 80% of their learning both individually and as a class with a minimum score of 70, then the character aspect is based on the character activity questionnaire. |

The research procedure follows the ADDIE stages, which include Analysis, Design, Development, Implementation, and Evaluation. Here's a description of each step in this research:

Analysis (A) Phase: identifying the needs for statistics lectures by analyzing course objectives and materials according to the curriculum. Activities carried out include initial-final analysis, student analysis, concept analysis, task analysis, and the specification of learning objectives that were previously implemented in the study. At this stage, the following has been implemented and produced with the schematization of the character-laden problem-solving development model: Then, the learning media developed is H5P-based interactive media integrated to improve numeracy literacy in terms of problem-solving ability.

Design Stage (D): This contains the design of the H5P-based interactive media that will be used in lectures. At this stage, a draft of the textbook, media, and instrument development is created, integrated with Quizizz according to the learning scenario, which will be validated and tested for product practicality overall. As for the textbook design and internalization of content and context, as shown in Table 2:

Table 2. Internalization of Innovative Textbooks

| H5P-Based Interactive Media | Numeracy Literacy: Elements (Data and Data Processing) |
|---|--|
| H5P-based KPM-laden content and context packaging. | Aware of the process & results of thinking, in developing planning, |
| | Aware of the process & results of thinking, in monitoring implementation |
| | Aware of the process & results of thinking, in evaluating actions. |
| | Aware of the process and results of one's thinking, in developing planning, |
| | Be aware of the process and results of thinking, in monitoring implementation. |
| | Aware of the process & results of thinking, in evaluating actions. |
| | Solve problems according to plan |
| | Aware of the process & results of thinking in monitoring implementation |
| | Aware of the process & results of thinking, in evaluating actions. |
| | Share results with colleagues |
| Evaluate your friends' and your own work against appropriate results. | |

Develop Stage (D): 1) developing a draft of the design for developing an augmented reality-based textbook containing ethnomathematics that has been planned (to be developed); 2) validation by a team of experts on models, media and materials, then revised according to the content, context and domain developed based on the heuristic steps of problem solving: identification, planning for resolution, problem solving, and re-checking; 3) Next, a practicality test is carried out and is included in the preparation of a publication draft in a journal, completeness of substance and publication in an international journal as a mandatory output.

Implementation Stage (I): Initial testing and application of the developed media on a wider scale (will be implemented). Another objective is to test the effectiveness of its use in teaching and learning activities and observation of character activities and

problem-solving abilities. At this stage, complete implementation data will be obtained which will obtain important information on the impact of the benefits of the product developed from the observation and practicality aspects of using the textbooks and media produced. In this stage, the implementing partner will facilitate the facilities and infrastructure for the implementation of research sample treatment and provide contributions to product evaluation implemented through student involvement in the MBKM program and is valued in credits for the Statistical Data Analysis and/or Statistics and Mathematics Education Research courses with a total of 5-7 credits.

Evaluation Stage (E): Evaluation of the results of the implementation carried out at the treatment stage, a mathematical problem-solving ability test is given and a student character assessment questionnaire is distributed to measure the effectiveness of learning by using the product developed as well as proof that the device developed is very convincing in its results and can really be used according to the aim of improving problem-solving ability and character.

Results and Discussions

H5P -based interactive video learning media is a learning tool that can be used by teachers to motivate participants in the learning process and determine student understanding. H5P -based interactive video learning media is interactive content that can be used as a learning medium. When using this learning media, a teacher must create a learning video that is posted on the YouTube application then add the YouTube video link that has been posted , then the link is pasted into the Lumi application, using the H5P feature and pasted on the Interactive Video. After that, as a presenter, you will create interactive video content based on H5P and the application can help teachers in delivering. Students play a role in responding to the interactive video so that the learning is more interesting and keeps students focused on watching the interactive video.

Media is a tool in the learning process consisting of various combinations of images, writing, photos, videos, and audio (Budiyani, 2023: 19). Learning media is an instrument used to show facts, concepts, principles, and procedures to make them more real or concrete (Moreira, Pereira, and Gusmao, 2018: 105). The right learning media will enable students to understand abstract material more easily (Khoiri et al., 2022: 256). This is as according to Kustandi and Shipto (2011) as quoted in Batubara, H. H (2020: 3), that learning media is a tool that helps the teaching and learning process so that it can achieve learning objectives well and perfectly.

H5P stands for HTML5 Package and aims to make it easier for everyone to create, share, and reuse interactive HTML5 content such as creating interactive videos, interactive modules, interactive quizzes, interactive presentations and many others (Utari, et al., 2022: 65). According to Azzahra and Aji (2023: 434), states "HTML5 has the ability to create a video player on a web page providing more interactive features

that not only manipulate playing videos but can add new players above the video containing interactive objects such as images, text, questions, questionnaires and many more ". According to (Wehling: 2021, in Budiyan, 2023: 23) the use of the H5P feature provides benefits by allowing easy customization of pre-existing video material into online content or more interactive videos.

There are 3 (three) features in the H5P content according to Yaas, et al. (2022: 8) as follows:

- 1) Interactive book , almost the same as multiple choice, except that there is a check button which functions as a way to find out the right and wrong answers to the questions worked on by the user.
- 2) Interactive video includes images on each video slide, maximizing the duration to just one minute.
- 3) Image hotspots , there is an explanation of the material provided and questions on several video slides at the beginning and middle of the video slide.

H5P can be combined with video to provide interactive videos, such as videos from YouTube or other sources that are then combined with questions or other activities for students to complete. H5P facilitates the learning process for both teachers and students by presenting interactive content. Interactive content makes the material more engaging and allows students to directly participate by responding to the material.

Media design interactive , especially when designed using platforms like H5P, have proven increase involvement student with give experience dynamic and in - depth learning . This in line with findings Blockland et al . (2019), who argue that that content interactive push involvement more cognitive in , especially in context solution problem .

Previous research has highlight that student best learning when they in a way active involved with content (Clements & Sarama , 2016). In studies this , students interact with tasks solution problem in gamified environment , enhancing motivation and attention sustainable (Darling-Hammond, et al., 2020).

The results also highlight importance real -world applications in exercise solution problem . With put problem mathematics in context life real , students can see relevance the skills they have learn , so that increase understanding and retention they (Polya , 2015).

As for the results the plan is followed up based on three criteria Main : validity , practicality , and effectiveness .

Validity

Table 3 presents results evaluation validity conducted by three expert material lessons . Interactive media This reach score validity of 85%, exceeding the minimum validity threshold.

Table 3. Interactive Media Validity Score H5P Based

| Expert/Specialist | Mark (%) | Criteria |
|-------------------|----------|----------|
| Expert 1 | 82% | Valid |
| Expert 2 | 88% | Valid |
| Expert 3 | 85% | Valid |
| Average | 85% | Valid |

Practicality

Input student collected through survey post implementation , and more of 82% of students report that the media interesting and easy used . The teacher also provides bait back , confirm practicality of media in space class .

Table 4. Practicality Score Based on Input Students and Teachers

| Questionnaire | Mark (%) | Criteria |
|---------------|----------|-----------|
| Student | 82% | Practical |
| Teacher | 84% | Practical |
| Average | 83% | Practical |

Effectiveness

The implementation of H5P -based media was successful , more of 85% of students reach results targeted learning . Table 3 summarizes performance solution problem student based on results before and after test .

Table 5. Pre-test Results Test and Post Test

| Test Type | N | Average value | Elementary School | t-value | p-value | Conclusion |
|-----------|----|---------------|-------------------|---------|---------|------------------------|
| Pre-Test | 90 | 52.3 | 8.5 | 8.45 | <0.01 | Significant Difference |
| Post-Test | 90 | 76.8 | 6.2 | | | |

Improvement significant post-test scores show effectiveness of H5P -based media in increase ability solution problem mathematics . Analysis correlation show existence connection significant positive between H5P usage and skills solution problem students ($r = 0.68, p < 0.01$).

The findings of this study provide substantial evidence that H5P-based interactive media can improve students' mathematical problem-solving abilities. The media's validity, practicality, and effectiveness exceed established benchmarks, thus confirming potential digital innovation in education .

Interactive media , in particular when designed using platforms like H5P, have proven increase involvement student with give experience dynamic and in - depth learning . This in line with findings of Blokland et al . (2019), who argue that content

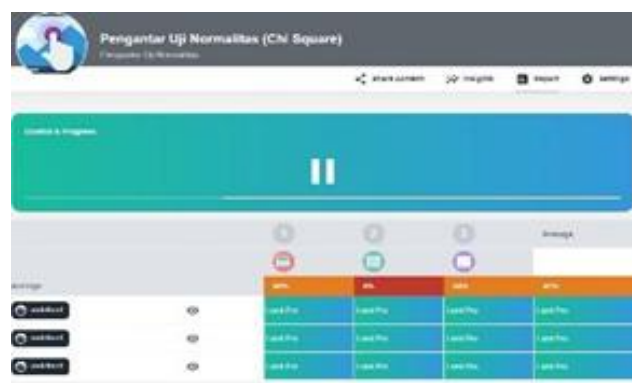
interactive push involvement more cognitive in , especially in problem-solving context.



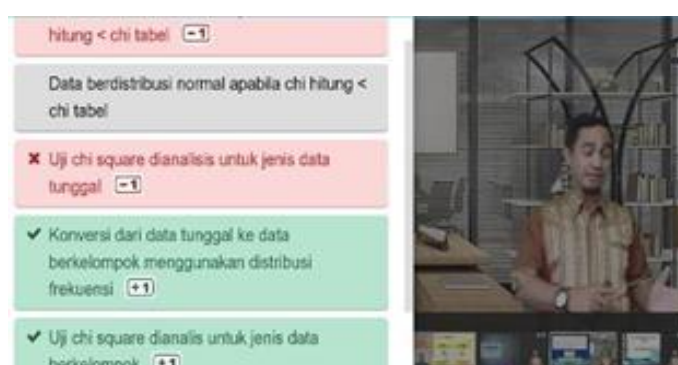
Picture 1. Interactive Design



Picture 2. Checklist Style Gamification



Picture 3. Correction Answer



Picture 4. Summary Answer

The increase in students' post-test scores demonstrates the effectiveness of interactive media in improving problem-solving skills. Previous research has highlighted that students best learn when they are actively involved with content (Clements & Sarama, 2016). In this study, students interact with task solution problems in a gamified environment, enhancing motivation and attention sustainably (Darling-Hammond, et al., 2020).

The results also highlight the importance of real-world applications in exercise solution problems. With real-life mathematics problems, students can see the relevance of the skills they have learned, so that their understanding and retention increase (Polya, 2015).

Input from the teacher shows that H5P-based media is practical and easy to integrate into the existing curriculum. This is consistent with findings by Leijen et al. (2021), which states that one of the strengths of H5P is its versatility and convenience in integration into various learning management systems (LMS). This report states that the media requires minimal preparation time, so that it can be used as a regular tool in the classroom.

The post-test results showed significant improvement, confirming H5P-based media effectiveness. The Polya heuristic model is embedded in the guiding media for students through the process of solving structured problems. Teacher and student input validate the practicality of H5P, in line with findings by Leijen et al. (2021), which emphasizes the convenience of platform integration into the classroom. This study highlights the potential of H5P in developing high-level thinking skills, in harmony with the global demand for both hard and soft skills.

Although this study yielded positive results, there are limitations that must be noted. The sample size is relatively small, and the research is focused on a specific age group of students (medium school). Future research must consider more diverse and broad samples and explore the long-term effect of interactive media on mathematical problem-solving skills. Besides that, comparative studies can explore the impact of H5P-based media on various lessons and learning environments.

This study shows that H5P-based interactive media is a valid, practical, and effective tool for increasing the mathematical problem-solving abilities of students. The ability of the media to involve students in interactive task solution problems produces

improvement results significant students . As digital innovation continues form education , tools as H5P offers promising solution For develop skills important 21st century .

Conclusions and Suggestions

Based on this study, in theory interactive media H5P based can increase ability solution problem mathematical students . However, for the validity , practicality , and effectiveness of the media, further studies are needed to develop and implement the media that has been prepared. Besides that , study comparison can explore the impact of H5P -based media on various eye lessons and environment Study.

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