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Integrating Publuu technology into interactive teaching materials as a strengthening of evaluation material learning in the Teacher Professional Education Program (PPG)

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ABSTRACT

Learning in the digital era requires innovative interactive media to improve educational effectiveness, including learning evaluation. The main challenge is low student engagement due to conventional evaluation methods. Publuu, an interactive digital platform, offers a solution by providing interesting teaching materials. This study developed and tested Publuu-based interactive materials for learning evaluation courses in the Teacher Professional Education (PPG) program. Using the ADDIE-based Research and Development (R&D) method, data were collected through initial trials and final trials on two groups: the experimental group (30 students using Publuu) and the control group (30 students using conventional methods). Normality and homogeneity tests ensured statistical validity, followed by paired sample t-tests. The results showed that Publuu materials significantly improved student learning outcomes, with a significance value (Sig.) <0.05. In addition, these materials increased student motivation and engagement. Thus, Publuu-based interactive learning materials are suitable for PPG programs, improving the quality of evaluation learning. This study provides practical benefits of interactive tools in improving learning effectiveness and student active participation. Future developments may include more interactive features to increase the appeal and effectiveness of the material.

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INTRODUCTION

Education in the digital era of the 21st century faces significant challenges due to technological transformations that fundamentally change the way knowledge is acquired and delivered. This technological advancement adds complexity to the evaluation of students' learning outcomes, where evaluation methods must now encompass critical, creative, and collaborative thinking skills in addition to traditional cognitive achievements. In Indonesia, this challenge is increasingly felt due to the gap in technology access between urban and rural areas, which widens the disparity in the quality of education. As expressed by Richardo et al., (2023) and Candra (Ranti et al., 2024), educators need

to ensure that evaluation methods remain relevant and capable of motivating students to learn innovatively in a rapidly evolving information environment. For example, in urban areas, teachers are beginning to utilize e-learning platforms and artificial intelligence (AI) to evaluate students dynamically and in real time. Conversely, in rural areas, limited digital infrastructure hinders the implementation of technology-based evaluations, so traditional approaches remain dominant (Supa, 2023). Therefore, as stated by Subroto et al., (2023), A refresh is needed in the learning approach, where technological innovations are adapted to local conditions in Indonesia through teacher training and improved access to technology that is more equitable. Initiatives like "Merdeka Belajar" launched by the government are expected to bridge this gap by promoting flexibility in contextual and inclusive learning and evaluation methods (Tanuwijaya et al., 2024; Wuisan & Mariyanti, 2023).

One of the main obstacles in evaluating learning outcomes today is the low level of student engagement in the learning process (Maimunah et al., 2021). Researchers Kang et al., (2023) stated that factors such as lack of interest, minimal active participation, and static evaluation methods contribute to the limited effectiveness of the learning experience. In Indonesia, this challenge often arises because the learning methods are still lecture-oriented and rely on written exams, making students passive recipients (Amien & Hidayatullah, 2023; Widaningsih, 2019). Observation studies on PPG Malang State University students still find a lot of learning using conventional teaching materials, so students now tend to get bored. To address this issue, innovation is needed to enhance student interaction and engagement in the learning process. One relevant approach is the use of interactive learning media, such as technology-based digital modules, which allow students to interact with the material directly and dynamically (Tianyi, 2024). Thus, the application of interactive media in learning evaluation can create a more dynamic and in-depth learning experience where students are actively engaged (Han, 2024). One of them is interactive media, namely Publuu.

Publuu itself is a digital platform that facilitates the conversion of PDF files into interactive publications that can be accessed through various devices. This platform is very suitable for creating interactive teaching materials due to its user-friendly and flexible interface (Rahmadani & Bungawati, 2023). In the context of educational evaluation for the PPG program, Publuu enables the presentation of interactive modules, visualizes performance assessment rubrics, and provides relevant scenario-based exercises (Agustina et al., 2022). Prospective teachers can understand the concept of evaluation more comprehensively and can apply it in teaching practice.

In the context of developing interactive learning materials based on Publuu for evaluation materials in Teacher Professional Education (PPG), this platform offers flexibility in presenting interactive and multimedia-based evaluation modules. Publuu allows educators to create teaching materials that visualize assessment rubrics and provide scenario-based exercises, which effectively help prospective teachers understand educational evaluation concepts more deeply (Kao & Lin, 2023). Li et al., (2024) note that the use of multimedia interactions in teaching materials allows students to explore complex concepts more intuitively and engagingly. This creates a more inclusive learning environment and motivates students to explore the learning material actively. Thus, the implementation of interactive learning materials based on Publuu in PPG evaluations can enhance the teaching quality of prospective teachers while also inspiring them to apply innovative evaluation methods in their teaching practices.

Integrating digital teaching materials into the learning process not only creates a more dynamic learning experience but also allows learners to interact with the learning material more deeply. Recent research shows that the use of interactive educational technology can enhance student engagement and their understanding of the material being taught (Kalyani, 2024). In addition, learners are no longer passive spectators; they are empowered to explore complex concepts through various interactive media, including videos, simulations, and educational games, which have been proven to improve learning outcomes significantly (Festiyed et al., 2023). The use of multimedia interactions in education also facilitates more personalized learning, where students can learn at their own pace and according to their individual learning styles. This encourages students to become more engaged in the learning process, which in turn enhances their intrinsic motivation to understand the material in depth (Mayer, 2019). Furthermore, a more interactive learning environment, such as that achieved through multimedia technology, enables collaborative learning experiences where learners

can share ideas, ask questions, and work together more effectively (Rahayu et al., 2022). Integrating platforms like Publuu into learning can improve interaction between educators and learners through more dynamic and interactive material delivery, which can increase student engagement and encourage better collaboration in the classroom (Aulia et al., 2024).

Several studies support the use of interactive teaching materials in education. Research by Utami et al., (2022) about the use of Schoology shows that interactive teaching materials are worth implementing and are very engaging for students. Similarly, the research by Sholikhah et al., (2024) regarding Edpuzzle shows the effectiveness of teaching materials and interactive videos in increasing student participation. A study by Febrianto & Puspitaningsih (2020) about the development of teaching materials for learning evaluation also obtained results that indicate feasibility for use in the learning process. Although previous studies have shown the effectiveness of various interactive teaching material platforms such as Schoology, Edpuzzle, and general evaluation teaching materials, this study offers a new approach by using Publuu in the learning evaluation course, an innovative platform that allows the presentation of teaching materials in an interactive format that resembles digital publications in the form of a website. Therefore, the researchers identified a research gap in this context, with the development of interactive learning materials based on Publuu integrated with a website for evaluation materials in PPG, in line with these findings, the research contribution brings the advancement of interactive teaching materials by integrating Publuu technology, offering an innovative approach to improving evaluation materials in the Teacher Professional Education Program (PPG) at the Postgraduate Program of State University of Malang. The research provides practical implications for improving the effectiveness of learning evaluation, equipping educators with cutting-edge tools to encourage active engagement and comprehensive understanding among PPG students.

METHOD

This research uses a Research and Development (R&D) approach with the ADDIE design to develop interactive teaching materials based on Publip on the topic of Learning Evaluation in the Teacher Professional Education program (PPG) (Agustianti et al., 2024). The researchers chose the ADDIE design because it is easy to understand, and its research procedures are systematically organized as shown in Figure 1. This approach helps in producing teaching materials that meet the needs and characteristics of the learners (Sakdiyah & Triwahyudianto, 2022).

Qualitative and quantitative data were collected directly from the research subjects. The subjects in this research and development were 60 PPG postgraduate students at Malang State University, with 30 experimental classes and 30 control classes. The research instruments used to collect data include validation questionnaires, student response questionnaires, and multiple-choice tests (see Table 1 and Table 2).

Table 1. Needs Analysis Instrument

No.	Questions	Yes	No
1	I feel that the Teaching Materials for the Learning Evaluation Course Used in the PPG Program are not Interactive Enough		
2	I feel that the Existing Teaching Materials for Learning Evaluation Courses have not Optimally Facilitated Students' Learning Needs		
3	I feel that New Teaching Materials are Needed to Improve the Quality of Learning Evaluation in the PPG Program		
4	I Feel the Need for Interactive Teaching Materials that can Help Students Better Understand the Evaluation Material		
5	Visually Appealing Teaching Materials to Increase My Interest in Learning		
6	Technology-based Interactive Teaching Materials can Help Make the Learning Process More Efficient in Learning Evaluation Courses		
7	I Often Find it Difficult to Access Learning Evaluation Materials with the Current Media		
8	Current Teaching Materials do not Provide Enough Support for Independent Learning Outside the Classroom in Learning Evaluation Courses		

No.	Questions	Yes	No
9	I Agree that Publuu-Based Learning Media is Effective Compared to Conventional Media		
10	I Prefer Technology-Based Teaching Materials to Support Learning in Learning Evaluation Courses		
11	I feel that Publuu-Based Teaching Materials will Facilitate Access to Learning Materials		
12	I feel that I Often Use Digital Learning Media in My Daily Learning Process		
13	I feel that Publuu-based Teaching Materials can Provide a More Interesting Learning Experience than Conventional Media		
14	I feel that Interactive Features such as Quizzes or Videos in Publuu-based Teaching Materials can Help understand Learning Evaluation Materials		
15	I am More in Favor Of Developing Publuu-based Teaching Materials for Independent Learning		
16	I Need More Guidance or Tutorials on How to Use Publuu-based Teaching Materials		
17	It Should be Accessible Through Various Devices, Such as Laptops or Mobile Phones, to Increase Learning Convenience		
18	Interactive Features Such as Easy Search or Navigation can Make it Easier to Find Certain Information in Publuu-based Teaching Materials		
19	The Content of Current Learning Evaluation Teaching Materials is Difficult to Understand		
20	Publuu-based Teaching Materials will Help Improve Learning Outcomes in Learning Evaluation Courses		

Table 2. Instrument Pretest dan Posttest

No.	Pretest Questions	Posttest Questions
1	Formative Assessments are often Conducted to Monitor Student Progress During the Learning Process. Explain the main Purpose of Formative Assessments and how Teachers can Use the Results of these Assessments to Improve Learning.	After Conducting a Formative Assessment, the Teacher Realizes that most Students have Difficulty Understanding Certain Material. As a Follow-up Step, What should the Teacher do to Ensure All Students can Achieve the Learning Objectives?
2	Validity is an Important Principle in Assessment. When an Assessment has High Validity, what are the Implications for Measuring Student Ability?	When Using Rubrics as Assessment Instruments, what are their main Benefits in Ensuring Fair and Objective Assessment?
3	The Principle of Fairness Demands that all Students have Equal Opportunities to Demonstrate their Competence. How can Teachers Ensure that the Principle of Fairness is Applied in Classroom Assessments?	Diagnostic Evaluation is Conducted at the Beginning of Learning to Identify Students' Abilities and Needs. How can the Results of this Diagnostic Evaluation be used to Design more Effective Learning Strategies?
4	What Distinguishes Authentic Assessment from Traditional Assessment? Explain by giving Examples of the Application of Authentic Assessment in Learning.	The Holistic Assessment Paradigm Asks Teachers to Assess Students as a whole, Including Aspects of Attitude, Knowledge, and Skills. How can the Implementation of Holistic Assessment Support Students' Competency Development?
5	Feedback is an Important Part of Formative Assessment. Why should Feedback be Specific, Timely, and Actionable?	Teacher Technology-based Assessment uses an Online App to give Short Quizzes Every Week. What are the Advantages of this Approach Compared to Conventional Methods?
6	Feedback given to Students should Use a Constructive Approach to Help them Improve their Learning Outcomes. How can a Teacher Provide Feedback that Supports a Growth Mindset?	Teachers Often Use Different Types of Instruments Such as Projects, Exams, and Portfolios. What is the Best Way to Integrate the Results from these Different Types of Instruments?
7	One of the Key Principles in Assessment is Transparency. How can this Principle be Applied in Classroom Assessment Practices?	One of the Main Purposes of Diagnostic Evaluation is to Help Teachers Understand Students' needs Before Learning Begins. What is a Concrete

No.	Pretest Questions	Posttest Questions
		Example of Implementing a Diagnostic Evaluation in the Classroom?
8	In Authentic Evaluation, Students are Asked to Complete a Project that is Relevant to Real Life. What are the main Benefits of Authentic Evaluation Compared to Traditional Evaluation?	The Principle of Inclusivity in Assessment Emphasizes the Importance of Considering the Different needs of Students. What can Teachers do to Ensure that the Assessments they use are Inclusive?
9	The Principle of Relevance in Assessment Emphasizes that Assessments should be in line with the Learning Objectives. How to Ensure that the Assessments Used are Relevant?	When Developing Assessment Questions, Teachers must Ensure that the Questions have Varying Levels of Difficulty. Why is this Variation in Difficulty Important?
10	Teachers can use a Variety of Methods to Gather Information on Student Progress. Which of the Following is most Suitable for Formative Assessment?	Project-based Assessments often Require Students to Work in Groups. What are the main Benefits of this Approach?

These instruments consist of open-ended questionnaires that yield qualitative data in the form of critiques and suggestions from validators and students, as well as closed-ended questionnaires that produce quantitative data regarding the assessment of the developed product (Yu et al., 2021). Data analysis in the research is conducted through validity analysis and statistical analysis. Validity analysis uses Formula 1.

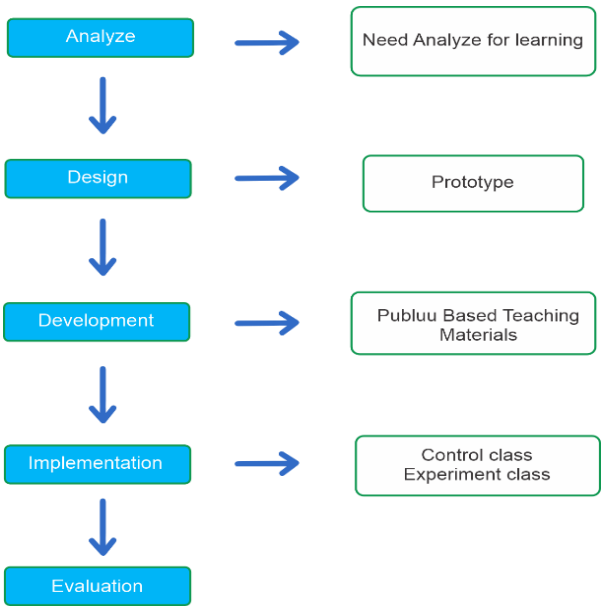

Figure 1. Methods ADDIE

$$Average\ Score = \frac{Total\ Score}{Number\ of\ questions} \quad (1)$$

The scores obtained from the respondents' assessments are quantitative data that will subsequently be interpreted into qualitative data by referring to the qualification range (Sumartini et al., 2020) in Table 3 below.

Table 3. Criteria and Content Eligibility

No.	Explanation	Class
1	0%-20%	Very Unqualified (STL)
2	21%-40%	Unqualified (KL)
3	41%-60%	Doubtful (R)
4	61%-80%	Qualified (L)
5	81%-100%	Very Qualified (SL)

Data analysis in this study uses pretest and posttest scores from postgraduate PPG students at Malang State University as research subjects. Before conducting the paired sample t-test, normality and homogeneity tests were performed to ensure the data met the necessary statistical assumptions. The pretest and posttest results were then analyzed using the paired sample t-test to test the research hypothesis. Next, the results of this t-test are compared with the predetermined significance level.

RESULTS AND DISCUSSION

Results

Analysis

The previous analysis was used as a guideline and consideration in developing interactive learning materials based on Publip for the Learning Evaluation material in the Teacher Professional Education (PPG) program. The analysis conducted includes complexity analysis and user needs analysis. The complexity analysis aims to identify and categorize the issues faced in the PPG program related to the material and types of learning materials. This analysis includes the review of core competencies and basic competencies, as well as the analysis of material concepts.

An interview with a PPG lecturer revealed that traditional teaching methods, such as lectures using textbooks or handouts, are still predominantly used, emphasizing teacher-centered learning. Lecturers also highlighted that the choice of teaching materials has a significant impact on students' interest and motivation to learn. The interview results also indicate that there are materials that are difficult for students to conceptualize, particularly in the learning outcome evaluation module. Additionally, students tend to get bored quickly if the learning process relies solely on PowerPoint presentations or text materials. To increase enthusiasm and motivation for learning and reduce boredom, innovative teaching materials that effectively support the learning process are needed.

User needs analysis is conducted to determine the types of learning materials required by students to improve the quality of education. The needs analysis questionnaire was distributed online using Google Forms, chosen for its efficiency and wide reach. The questionnaire was distributed to postgraduate PPG students at Malang State University. Based on the results displayed in Figure 2 as a follow-up to the analysis of student needs, it can be interpreted that although lecturers have utilized teaching materials, they are generally still in the form of textbooks or handouts. This indicates the need for the use of other more innovative teaching materials that can enhance student motivation and interest in learning, as well as improve learning outcomes during lecture sessions.

Previous research by Anggela et al., (2021) explains that critical thinking skills and student learning outcomes improve with the use of creative and innovative media. Therefore, the development of interactive learning materials based on Publuu can be tailored to the needs of the students. Research supporting this has been conducted by Sagala (2024), who developed a Website-Based E-Module for the Choir Course with Publuu.

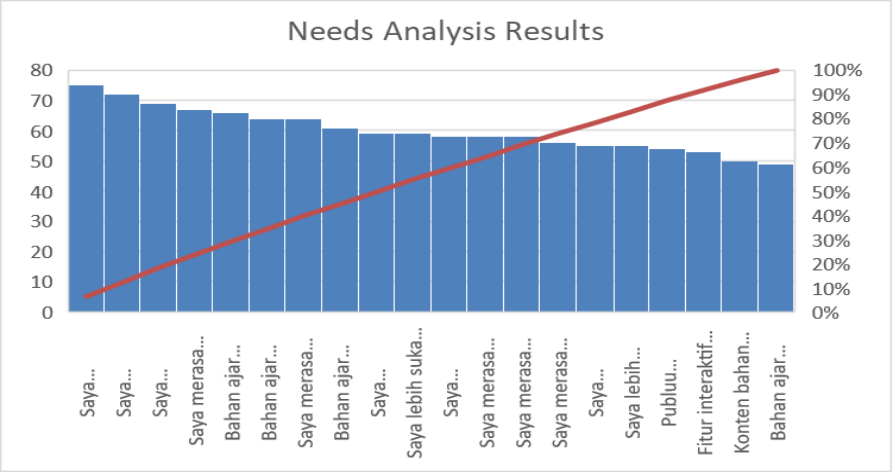

Figure 2. Needs Analysis Result

Design

Based on the needs identified in the analysis stage, interactive learning materials based on Publuu were developed to meet the needs of students. The design process begins with selecting appropriate media to be transformed into effective learning resources that enhance the learning experience. A storyboard was then created as the initial blueprint and design framework for this interactive learning material. The storyboard played an important role in designing the interface, from the initial page to the evaluation section. Content is organized by identifying core and basic competencies, determining the types of learning materials to be used, and selecting learning resources as references. The final product is developed in the form of a Publuu-based website.

Development

This development stage involves the creation of products and the feasibility testing of interactive teaching materials based on Publuu for Learning Evaluation materials in the Teacher Professional Education (PPG) program. The development process begins with formulating learning objectives, preparing materials according to the syllabus, developing interactive teaching materials based on the designed storyboard, and conducting evaluations that include practice questions. This interactive learning material based on Publuu has several display menus, including the initial page, as shown in Figure 3, the material menu in Figure 4, and the quiz page in Figure 5. This stage produces a structured interactive learning material product by the established competencies, along with a questionnaire sheet to measure the validity of the media, material, and user responses.

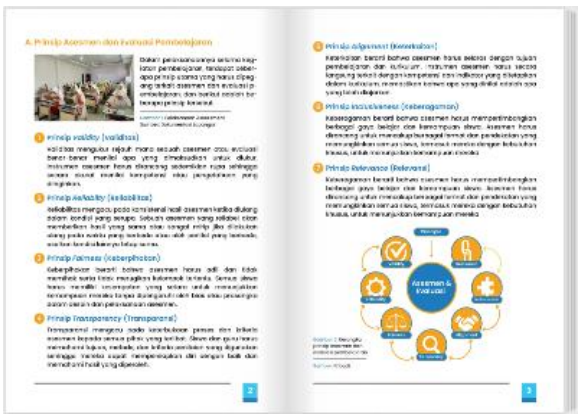

Figure 3. The Front Display of Publuu

Figure 4. Teaching Material Evaluation

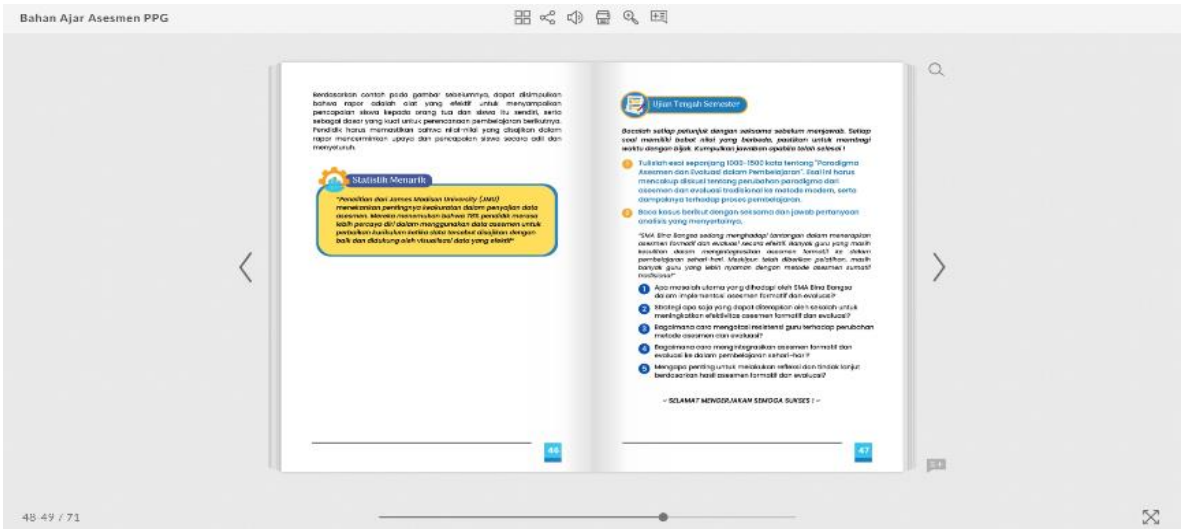

Figure 5. Quiz Page for Evaluation-Based Learning Materials on Publuu

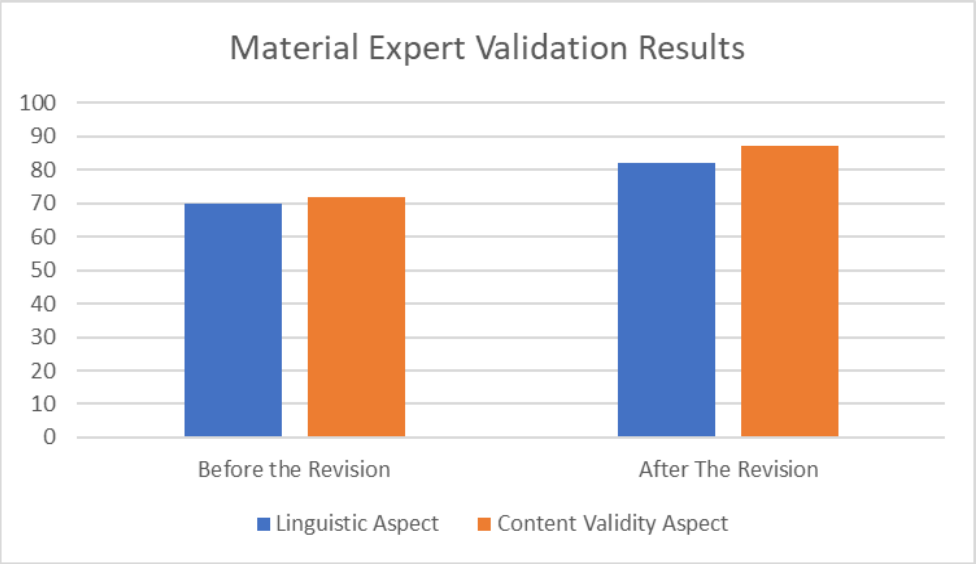

Figure 6. Material Expert Validation

Based on the data presented in Figure 6, the material aspect received a percentage of 90% after revision. This percentage indicates that the material in the interactive learning resources based on Publuu meets the feasibility criteria with the designation "very feasible." This signifies that the material has been compiled in detail, clearly, and by the needs of the students. Thus, the presentation of material through interactive learning materials based on Publuu can help students understand the material more optimally. As a medium of delivery in the classroom learning process, the presence of effective teaching materials is essential. Without the use of appropriate teaching materials, the delivery of the material will be abstract, and students' understanding of the material will decrease because they cannot visualize what is being taught (Setiawan et al., 2023). These findings indicate that the material is suitable for use in interactive teaching materials based on Publuu and is ready to be tested with educational practitioners and students. However, several improvements need to be made to the material before the trial implementation.

The media validation process was carried out using a questionnaire consisting of 20 statements, along with a comments and suggestions section. The assessment includes several important aspects, such as visual design, language use, learning strategies, and software engineering.

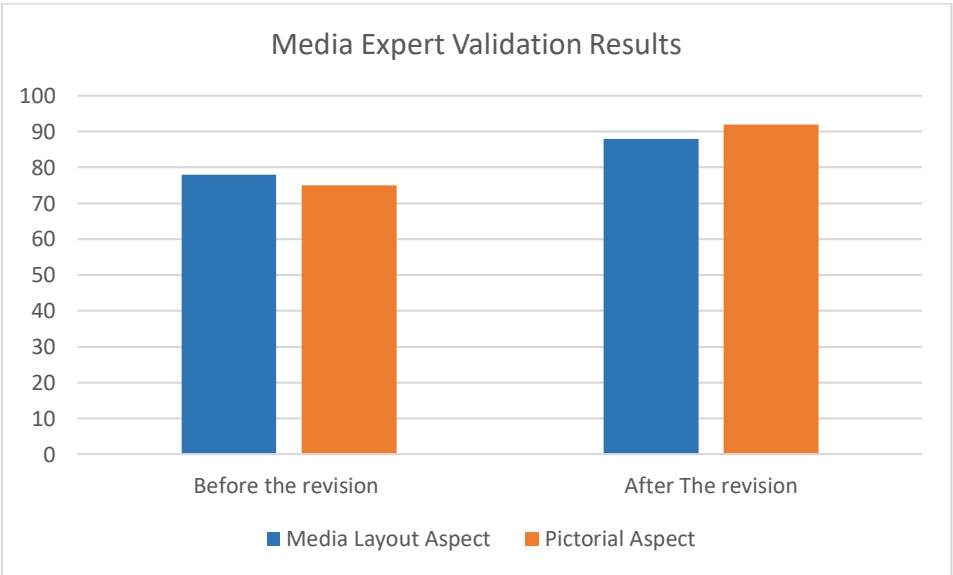

Figure 7. Media Expert Validation Result

The percentage of the suitability of the interactive learning materials based on Publuu reached 84.5%, as shown in Figure 7. This figure indicates that the learning materials have met the eligibility criteria as "very suitable," thus ready for testing. This interactive learning material offers a deeper learning experience through the visualization of symbols, allowing students to understand the learning evaluation material through relevant images. Referring to Edgar Dale's cone of experience theory, learning that involves the five senses can be effectively implemented in the teaching and learning process (Anwar et al., 2022).

The use of interactive learning materials based on Publuu will enhance the effectiveness of classroom learning and provide a more concrete experience for students. With the help of realistic visualizations, students can grasp the material better compared to just through concepts or text (Nurandari & Triatmanto, 2023). Interactive features such as quizzes in this learning material encourage students to be more active in developing their understanding and enhancing their skills and knowledge. This teaching material is designed to encourage students to learn independently, while the role of the instructor is as a facilitator who supports the learning process. In the constructivist theory, facilitators have the responsibility to help students achieve effective learning outcomes (Sayaf, 2023). Based on validation, this interactive learning material based on Publuu is ready to be tested with education practitioners and PPG students.

Implementation

Interactive learning materials based on Publuu are implemented for users after being validated by experts during the development stage. This implementation stage involves lecturers as education practitioners and 30 postgraduate PPG students as the experimental group. Education practitioners conducted the trial to evaluate educators' responses. The assessment is performed using a questionnaire consisting of 20 statements regarding the components of teaching materials, along with a comments and suggestions column. The aspects evaluated include language use, Publuu-based teaching material components, material structure, and overall presentation.

The purpose of this stage is to measure user responses to interactive learning materials based on Publuu, particularly in enhancing students' understanding of learning evaluation materials in the PPG program. The learning materials being tested also emphasize the presentation of interactive visuals relevant to students' needs, facilitating the learning process. The implementation of this teaching material not only supports a deeper understanding of students but also strengthens the role of lecturers as facilitators who help enhance students' learning independence through the constructivist approach.

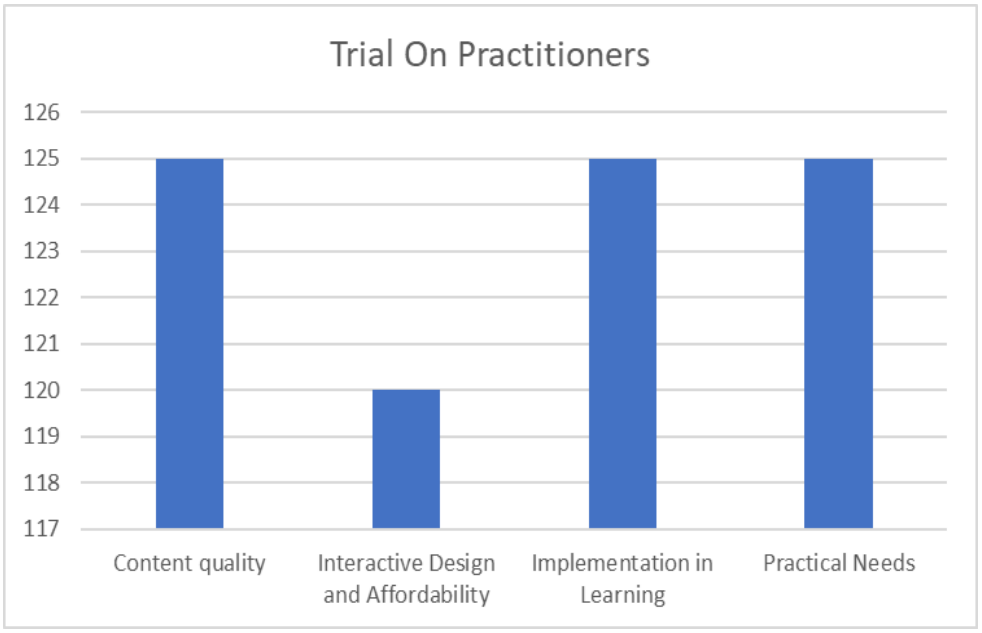

Figure 8. Graph of Test Results for Education Practitioners

The results of the trial conducted by education practitioners, as shown in Figure 8, indicate a percentage of 99%. This figure suggests that the interactive learning materials based on Publuu meet the "very feasible" criteria and can be further tested. Based on these test results, these learning materials are ready to be implemented for students.

The data collection process was conducted during offline learning activities and took place in three sessions guided by PPG lecturers. Before the trial was conducted, students were asked to download and access the interactive learning materials based on Publuu through their respective devices. Next, this teaching material is used by the learning evaluation material that has been prepared in the activity plan. After the learning session is over, students fill out a questionnaire containing statements to collect data on the feasibility and effectiveness of the tested teaching materials.

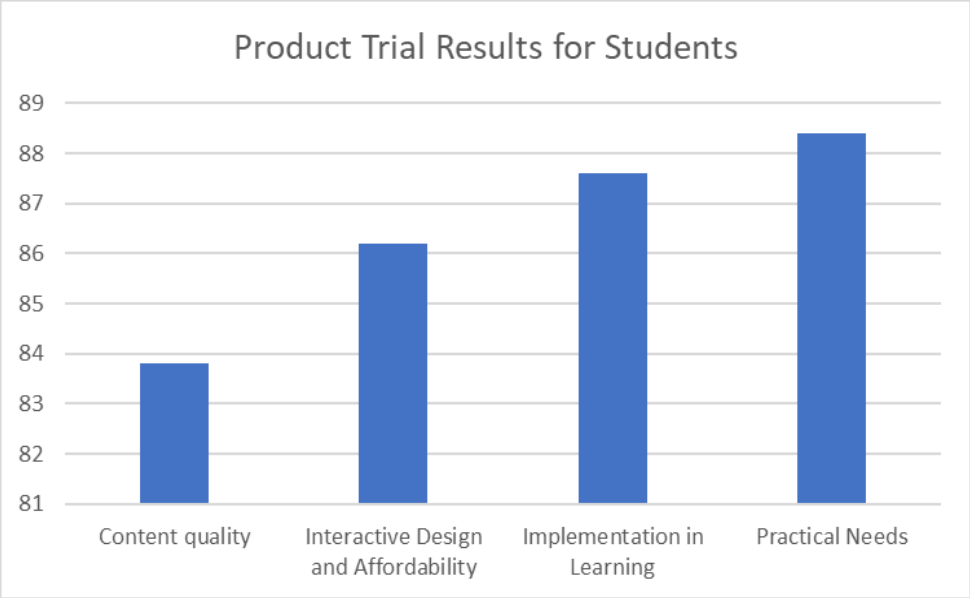

Figure 9. Graph of Student Responses to Publuu-based Teaching Materials

Based on the data displayed in Figure 9, the interactive learning materials based on Publuu show an average feasibility level of 85%. This figure indicates that the learning materials in the trial usage phase have met the "very feasible" criteria. Responses from students suggest that this teaching material is very interesting and can enhance learning motivation. Students feel that understanding the material and its application has become easier. Thus, this interactive learning material based on Publuu is very suitable for implementation in the learning process, especially in the evaluation of learning materials in the Teacher Professional Education program. (PPG).

Evaluation

Evaluation is the final stage in the ADDIE development model, which aims to assess whether the interactive learning materials based on Publuu for the Learning Evaluation subject in the Teacher Professional Education (PPG) program have achieved the desired objectives. This evaluation ensures that every step of the development process runs according to plan. At the analysis stage, after the complexity and needs analysis of the students is conducted, the supervisor evaluates the obtained results to ensure that the developed teaching materials are relevant and meet the needs of PPG students. Subsequently, the evaluation at the design stage is carried out through the review of learning objectives formulation, material development, questionnaire instrument design, tests, and the storyboard of Publuu-based teaching materials to ensure that all design elements support the effectiveness of learning. At the development stage, expert validators assess the suitability of the teaching materials using a questionnaire and identify weaknesses such as typographical errors, image mismatches, and a lack of materials that support higher-order thinking. At the implementation stage, the questionnaire is filled out by education practitioners and PPG students who have used the

teaching materials. Education practitioners provided a positive response regarding the effectiveness of the teaching materials but recommended incorporating variations in their application. Students also stated that the Publuu-based teaching materials helped their understanding of the learning evaluation material. However, there were still shortcomings, such as the absence of sound in the videos and images that could not be enlarged. This evaluation is conducted at every stage of development to ensure that the interactive learning materials based on Publuu for the Learning Evaluation material for PPG are developed according to the ADDIE model and can produce effective learning materials that meet the needs of students.

Analysis of the Effectiveness of Publuu-based Teaching Materials

This effectiveness test aims to measure the success level of developing educational evaluation teaching materials based on Publuu in improving students' learning outcomes in the Teacher Professional Education Program. (PPG). Effectiveness analysis is conducted through the implementation of pretests and posttests on two groups of students, namely, the experimental group and the control group. The pretest is performed to measure the initial abilities of the students before the treatment in the form of using Publuu-based teaching materials. Meanwhile, the post-test is used to assess the learning outcomes after the use of these teaching materials.

The implementation of Publuu-based teaching materials was carried out in three sessions. In the first session, students were given a pretest to evaluate their understanding of educational evaluation material before using Publuu-based teaching materials. In the second session, students in the experimental group followed the learning process with Publuu-based teaching materials, while the control group used conventional methods based on printed teaching materials. In the third session, both groups of students were given a post-test to assess the improvement in learning outcomes and understanding after the learning process using Publuu-based teaching materials in the experimental group and conventional methods in the control group.

Table 4. Normality Test

No.	Treatment	Sig.
1	Pretest Experiment	0.945
	Pretest Control	0.140
2	Posttest Experiment	0.051
	Pretest Control	0.200

The results of the students' pretest and posttest were analyzed using normality (see Table 4) and homogeneity tests (see Table 5). The normality test shows that the pretest value of the experimental group has a significance (Sig.) value of 0.945, while the posttest has a (Sig.) value of 0.051. In the control group, the pretest value shows a (Sig.) of 0.140 and the posttest (Sig.) of 0.200. Based on the results of the Kolmogorov-Smirnov normality test, the pretest and posttest data in both groups show (Sig.) values > 0.05, indicating that the data are normally distributed.

Table 5. Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Publuu Effectivity	0.024	1	67	0.878

Next, the homogeneity test on the pretest and posttest data of students from both groups shows a significance value (Sig.) of 0.878. Since this value is greater than 0.05, the pretest and posttest data are considered heterogeneous, as presented in Table 2. With the normal data distribution and the existing heterogeneity, a paired sample t-test can be conducted to test the previously formulated hypothesis related to the development of this Publuu-based teaching material.

Based on the results of the paired sample t-test conducted using the SPSS application with a significance level of 0.046, a two-tailed significance (Sig) value was obtained, indicating $e \leq 0.05$. These results suggest that the null hypothesis (H0) is rejected, and the alternative hypothesis (H1) is accepted, meaning there is effectiveness in the use of Publuu-based educational evaluation teaching materials in improving the learning outcomes of PPG students. Thus, Publuu-based teaching

materials are effective for use in educational evaluation learning for students of the Teacher Professional Education Program (PPG).

Discussion

Learning media, such as interactive teaching materials based on Publuu for the Learning Evaluation material in the Teacher Professional Education (PPG) program, have proven to be an effective solution to address various issues in the learning process, including the lack of innovation and variation in media usage. This condition often makes students quickly feel bored, lose motivation, and decrease their interest in studying (Harsel et al., 2019). The use of technology-based media, as explained by Knaus (2023), can encourage active student engagement, increase enthusiasm, and improve learning outcomes. Daud et al., (2024) also revealed that public learning can significantly enhance students' motivation and academic achievement.

Research supporting interactive learning materials based on Publuu emphasizes the importance of learning materials. According to Dolasinski & Reynolds (2020), Microlearning with websites is useful for reflecting on the knowledge that has been learned and integrating it into microlearning. This approach is highly relevant in the subject of Learning Evaluation, where students must deeply understand the concept of evaluation and apply it practically. Besides that, Satriawati et al., (2023) should mention that websites with geometry materials can make learning more interactive and enjoyable, which ultimately reduces boredom and helps in understanding complex concepts.

Based on these findings, the development of interactive learning materials based on Publuu is not only effective in reducing boredom but also in significantly enhancing student motivation and learning outcomes. In addition, this teaching material is capable of creating a more interactive and engaging learning experience where students can actively participate in the learning process. Thus, the development of this teaching material is consistent with previous research that supports web-based learning as an innovative and effective teaching method.

CONCLUSION

Based on the findings of this study, the development of interactive learning materials based on Publuu for Learning Evaluation content in the Teacher Professional Education (PPG) program has aligned with the complexity analysis and user needs conducted by the researcher. The results of the statistical analysis with the paired sample t-test show a two-tailed Sig. value of $0.000 < 0.05$, which means the alternative hypothesis (Ha) is accepted, and the null hypothesis (H0) is rejected. This shows that the use of interactive learning materials based on Publuu is effective in improving the learning outcomes of PPG students. These learning materials significantly succeeded in enhancing students' learning achievements, as evidenced by the difference in pretest and posttest scores between the experimental class and the control class, where the experimental class showed a greater improvement.

Some suggestions that emerged regarding the development of this teaching material include constraints in technology access, such as students' limited ability to access the Publuu application, as well as time constraints that could affect the smoothness of the learning process. To overcome these obstacles, the researchers recommend using an LCD projector as an alternative for presenting interactive teaching materials in the classroom. In addition, the researchers also provided additional devices to students who had difficulty accessing learning materials. The limitations of this research include the scope of the material, which only covers one sub-topic, the testing of teaching materials in only one experimental class, and the lack of interactive features such as scoreboards or leaderboards. Recommendations for further development include adding more material, integrating innovative technologies such as AR (Augmented Reality), enhancing quiz features with higher difficulty levels, and adding other interactive elements to make the teaching materials more engaging and suitable for the needs of PPG students.

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