Development of a Multimedia Learning Tool by Utilizing Artificial Intelligence (AI) Towards Basic Teaching Skills in Microteaching Courses for Physics Learning

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Abstract

This study aimed to address the challenges encountered by student-teachers during the School Field Introduction Program 2, particularly in classroom management and professional ethics—issues largely attributed to an insufficient understanding of basic teaching skills and core teacher competencies. To overcome these problems, the researchers developed a multimedia-based learning tool designed to enhance student-teachers' mastery of fundamental teaching skills. The multimedia integrates text, audio, visuals, and teaching simulation videos based on innovative instructional models such as Project-Based Learning (PjBL), and incorporates Artificial Intelligence (AI) using the D-ID platform to generate interactive teaching avatars. The study was conducted in the Physics Education Department at Universitas Negeri Medan, Indonesia, using a Research and Development (R&D) approach following the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Both internal and external evaluations were carried out to assess the tool's feasibility, practicality, and effectiveness. The results indicated that the developed multimedia was highly feasible (expert validation scores exceeding 89%), highly practical (user response score of 86.78%), and moderately effective (N-gain score of 0.57) in improving students' teaching competencies. It is recommended that microteaching lecturers adopt this multimedia tool to support pre-service teachers in developing professional classroom practices through more interactive and reflective learning.

Keywords: Multimedia, Innovative learning models, Microteaching

INTRODUCTION

Education in Indonesia continues to evolve with the changing times, including the curriculum, which has undergone numerous transformations from 1947 to the 2020 Merdeka Curriculum. The Merdeka Curriculum focuses on providing students with the freedom to learn, enabling them to explore their potential, develop critical thinking, creativity, and independence (Susilowati, 2022). Teachers' roles in this curriculum extend beyond delivering information to students; they guide and assist them in becoming more capable individuals prepared to face future challenges. By granting teachers flexibility in designing their lessons, Merdeka Curriculum promotes a more holistic and inclusive educational approach tailored to the needs and potential of each student.

Currently, Indonesia is in the era of Industry 4.0 and Society 5.0, characterized by rapid technological advancements. In Merdeka Curriculum, educational technology plays a crucial role in improving education quality and standards and shaping school culture (Widiyono, 2021; Nugroho et al., 2022; Rosmana et al., 2023). Integrating educational technology into learning fosters innovation, with various applications supporting teachers in creating innovative teaching strategies. In Society 5.0, students frequently utilize AI tools for learning. Both educators and learners leverage AI for educational purposes, with popular examples including ChatGPT, Gemini AI, and Curipod. These tools enable teachers to access teaching resources efficiently, enhancing their teaching skills (Davar et al., 2025; Jaiswal & Arun, 2021; Gunawan et al., 2021). AI not only simplifies resource retrieval but also broadens teachers' understanding of students' learning processes and provides strategies to support students effectively (Abbas et al., 2024; Polakova et al., 2024; Vincent & Van Der, 2020). Utilizing ChatGPT, for instance, enhances learning effectiveness and efficiency (Arifdharma, 2023; Diantama, 2023; Judjianto et al., 2024; Mai et al., 2024).

Despite these advancements, challenges remain in developing professional teachers, especially for student-teachers. Student-teachers preparing to teach in schools are equipped through microteaching courses, which are prerequisites for the PPL (*Praktik Pengalaman Lapangan*/-Real teaching practicum) (Lorenso et al., 2015). Microteaching, typically taught in the sixth semester, aims to equip students with competencies,

including knowledge, skills, values, and attitudes reflected in their thinking and actions as prospective teachers. This course provides practical teaching experience and prepares students for teaching practice. A central focus is on mastering teaching skills, which are comprehensive professional skills integrating various aspects of teaching expertise. Basic teaching skills are essential for teachers, encompassing more than just delivering material; they involve fostering attitudes, emotional developments, character, habits, and values (Fitri et al., 2020).

In this study, interviews were conducted with supervising teachers and lecturers during the School Field Introduction Program 2 program at a public university in Medan, Indonesia to identify challenges faced by student-teachers. The interviews revealed several key issues: Interviews with supervising teachers and lecturers during School Field Introduction Program 2 revealed several issues: many student-teachers struggled with classroom management, lacked proficiency in preparing teaching materials such as teaching modules, and exhibited insufficient professional ethics as prospective educators. These issues often stemmed from inadequate mastery of basic teaching skills and a lack of understanding of teacher competencies. Some students participating in the teaching practicum (PPL) were unable to demonstrate and apply teaching skills effectively (Baharuddin et al., 2020). Some students participating in the teaching practicum (PPL) were unable to demonstrate and apply teaching skills effectively, as noted by Baharuddin et al. (2020). Moreover, some student-teachers lacked discipline, arriving late to discussions with supervisors and mentors, and displayed insufficient politeness. To address these challenges, Student-teachers must be guided and trained systematically to attain mastery in teaching competenciesstudent-teachers must master teaching competencies, develop professional ethics, and improve their classroom management skills through video practice. While many microteaching videos exist, few focus on multimedia-based learning tools for teaching skills grounded in innovative learning models.

The authors propose the development of a multimedia learning tool to support student-teachers in mastering basic teaching skills and teacher competencies, aligning with the findings of Pusparini et al. (2024). To overcome these issues, it is necessary to

develop a multimedia learning tool that helps student-teachers understand basic teaching skills and teacher competencies. Learning media include all resources that can effectively and efficiently convey information during the learning process. The use of engaging learning media is essential to attract learners' attention and enhance their understanding of the material (Dong et al., 2024; Handayani & Rahayu, 2020). The proposed multimedia will incorporate materials on basic teaching skills (Ratnawati et al., 2021), along with teaching videos showcasing innovative learning models optimized for teaching skills. These videos will demonstrate how teaching skills are applied and how innovative learning models are implemented in teaching activities. Presenting material in an interactive multimedia format with audio, visuals, and video aids students in understanding the material more effectively, adding variety and making the learning process more engaging (Fadieny et al., 2021; Normadina et al., 2022).

Innovative learning adopts enjoyable models under the concept of "Learning is Fun." (Johnston et al., 2022). The purpose of these models is to maximize learners' potential through active, creative, and innovative engagement during the learning process, fostering positive behavioral changes in various aspects of life, both individually and collectively. The multimedia is designed based on an innovative learning model and will utilize PjBL principles, integrated with Artificial Intelligence (AI)The multimedia will utilize a project-based learning (PjBL) model, which focuses on creating a product over a long-term process that involves students in designing, developing, and presenting the product (Amini, 2019; Patton, 2012). PjBL, especially when integrated with STEM, is a 21st-century learning model that promotes active and creative problem-solving among students (Megawati et al., 2023; Sihombing et al., 2024).

Multimedia integrates text, graphics, animation, audio, and video, offering diverse formats of information delivery. It can also be developed into a mobile application platform, enabling access anytime and anywhere (Girwidz et al., 2019; Sihombing et al., 2023, 2024; Untung et al., 2020). The multimedia for this project will be created using Canva for designing engaging presentations and CapCut for editing teaching videos. Canva offers various features, including themes, templates, and fonts, making it

accessible to both novice and experienced editors (Sobandi et al., 2023). Similarly, CapCut provides advanced video editing features and effects (Ispratiwi & Mellisa, 2023). The multimedia, designed using a Project-Based Learning (PjBL) model, will also incorporate Artificial Intelligence (AI) through the use of D-ID. The multimedia will also incorporate Artificial Intelligence (AI) through the D-ID application AI video platform, which integrates material and voice features, enhancing its interactive capabilities (Azfar & Sutiah, 2024).

METHOD

Research Methodology

This research was conducted in the Department of Physics, a public university in Medan, Indonesia. The research subjects were students of the Physics Department from the 2021 cohort who were enrolled in the microteaching course. Effectiveness testing of the multimedia was conducted with Class A students of the Microteaching course in the Physics Education Department at a public university in Medan, Indonesia to assess its impact on basic teaching skills. Practicality testing involved students from Classes A, B, and D to evaluate usability, content clarity, and overall user experience. Data were collected through a Likert-scale practicality questionnaire and pretest-posttest instruments administered to Class A. All instruments were based on validated course indicators, and student participation was entirely voluntary.

The study employed the Research and Development (R&D) method using the ADDIE model, consisting of five phases: Analyze, Design, Development, Implementation, and Evaluation. The phases carried out during the study were as follows:

Analysis Phase

This phase included three types of analyses:

- Needs analysis: Conducted to understand the requirements and objectives of the microteaching course.
- Curriculum analysis: Evaluated the curriculum used in the Department of Physics, FMIPA.
- Learner analysis: Examined the characteristics of students in the 2021 cohort, particularly concerning their learning process in microteaching.

Design Phase

In this phase, a multimedia-based learning medium was designed based on the analysis results. The activities included:

a. Determining the content focus to enhance teacher competencies, particularly in basic teaching skills, for inclusion in the multimedia learning material, ,
b. Drafting the initial design of the multimedia product by creating a storyboard,
c. Developing multimedia applications,
d. Preparing instruments, including those for feasibility, practicality, and learning outcome tests.

Development Phase

This phase involved creating a multimedia product according to the planned design. Validation was conducted by media and material experts from the Physics Department at Unimed. Validation results included ratings and suggestions for improvement, which served as the basis for revising the developed multimedia and preparing it for testing on students.

Implementation Phase

During this phase, the multimedia product was tested on the 2021 cohort students. The implementation involved using the multimedia in the learning process, distributing instruments to measure student responses, and gathering feedback. Revisions were made based on suggestions from participants, while ensuring alignment with prior validator recommendations to maintain consistency in improvements.

Evaluation Phase

The final phase evaluated the developed multimedia. This was achieved by analyzing data from expert validators, student responses, and the pre-test and post-test results. The evaluation aimed to determine the effectiveness of the multimedia and finalize it as an effective learning tool.

Data Collection Techniques

Needs Analysis

A needs analysis was carried out in the Physics Department at a public university in Medan, Indonesia to evaluate the learning facilities and identify students' needs regarding knowledge, attitudes, and skills.

Interviews

Interviews were carried out with lecturers responsible for the microteaching course to analyze the needs of both students and faculty, focusing on students' levels of conceptual understanding of physics.

Questionnaires

a) For expert validators: Two experts were involved to assess the feasibility of the developed multimedia.

b) For students: To evaluate the practicality of the multimedia after it was used by students, feedback was collected through questionnaires and

observations.

Tests

Pretest and posttest instruments were designed according to the indicators of conceptual understanding that students were expected to achieve during the learning process. Pretests were administered before the learning activity, followed using multimedia, and concluded with posttests to determine the effectiveness of the learning media in improving students' conceptual understanding.

Data Analysis Techniques

Quantitative data analysis was employed in this study. Percentage calculations were performed using Microsoft Excel to draw conclusions and categorize the feasibility of the multimedia based on specific aspects of the study. The feasibility was classified using a 5-category Likert scale, following the guidelines suggested by Arikunto (2010).

RESULTS AND DISCUSSION

This study produced a multimedia tool to optimize basic teaching skills, which was deemed highly feasible, highly practical, and effective:

a) The percentage score from material experts was 92.08%, and the score from media experts was 89.55%. Thus, the multimedia was categorized as "highly feasible" based on expert evaluations.

b) The practicality score of the multimedia was 86.78%, categorized as "highly practical."

c) The effectiveness was indicated by an N-gain score of 0.57, classified as "moderate effectiveness."

The research employed a development research method with the following steps:

1. Analysis Phase

a) Needs Analysis for Students and Educators:

Based on observations and interviews, challenges were identified in the School Field Introduction Program 2 course. Students reported difficulties in mastering classroom management and appeared stiff during class activities. Questionnaires revealed that students struggled with basic teaching skills, including introducing a lesson effectively and maintaining professional behavior, such as punctuality and approachability. Interviews with lecturers and mentor teachers confirmed these findings, emphasizing that students lacked optimal implementation of basic teaching skills and exhibited insufficient professional ethics.

b) Curriculum Analysis:

The curriculum adheres to the Indonesian National Qualification Framework (KKNI), which requires

lecturers to exhibit creativity in delivering course materials. Creative efforts include the development of innovative teaching materials and learning media. According to Situmorang (2014), innovative teaching materials enhance student engagement and facilitate competency acquisition, ultimately improving learning outcomes.

c) Learner Analysis:

While students demonstrated interest and motivation, they experienced nervousness and lack of content mastery during guided teaching practice. Additionally, many students (73.5%) lacked the professional ethics expected of future educators, such as demonstrating friendliness and punctuality. Although books and journals discuss basic teaching skills and teacher competencies, a multimedia tool offering direct simulations of basic teaching skills was deemed necessary.

To address these issues and align with curriculum requirements and learner needs, a multimedia tool was designed. This tool covers basic teaching skills and teacher competencies, featuring teaching simulation videos using an innovative model—Project-Based Learning (PjBL). The PjBL was selected due to its alignment with the current curriculum.

2. Design Phase

The researchers developed a multimedia tool to enhance mastery of basic teaching skills. This multimedia comprises images, audio, text, and teaching simulation videos. Its content includes: Explanations of basic teaching skills supported by teaching simulation videos using the PjBL model, Discussions on teacher competencies, and Interactive features leveraging artificial intelligence (AI). The multimedia was created using applications such as Canva, Microsoft PowerPoint, and CapCut, and it incorporated AI tools like D-ID. AI-enabled elements included animated representations of the teaching team to explain concepts like basic teaching skills, teacher competencies, and the eight fundamental teaching skills.

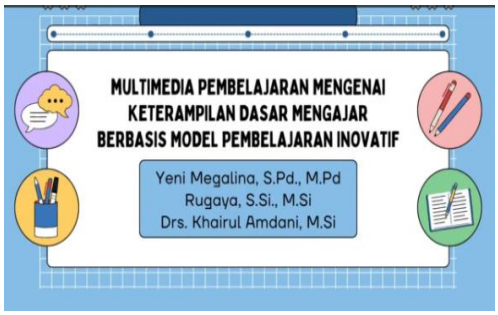

Figure 1. Cover of Learning Multimedia and Basic Teaching Skills Materials Utilizing AI with the D-ID Application

Figure 1 shows the cover of the multimedia learning tool on basic teaching skills, which was developed by the faculty team based on an innovative

learning model.. The explanation of basic teaching skills is supported by AI. The cover depicts an image of a faculty member speaking to explain the concept of basic teaching skills and elaborating on the eight fundamental teaching skills.

Figure 2. Video of a Teacher Teaching Using the Project-Based Learning Model While Implementing Basic Teaching Skills

The simulation in Figure 2 demonstrates a lecturer teaching to implement basic teaching skills using the innovative the PjBL model. In the video, the teacher applies the PjBL model by presenting a fundamental concept about dynamic fluids, specifically the Archimedes' principle, as the foundation. The teacher then guides students in designing a project to answer the fundamental question. This project utilizes the "Rumah Belajar" platform available at (https://belajar.kemdikbud.go.id/), where students select the high school level and access the virtual lab focused on buoyant force, as illustrated in Figure 3.

Figure 3. Virtual Laboratory Featuring the Topic of Buoyant Force

The next syntax includes:

c) Scheduling, where the lecturer and students agree on the timeline for creating the Archimedes' principle project, which spans two sessions;

Figure 4. Scheduling Stage

Based on Figure 4, the lecturer and students have reached an agreement to hold two scheduled meetings to complete the project on Archimedes' Principle. The final submission of the project is set to take place at 11:00 AM in the classroom.

d) Monitoring project progress, where students work on the project collaboratively in groups;

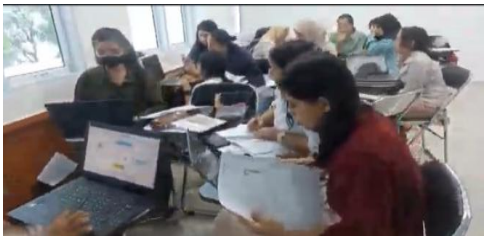

Figure 5. Monitoring Project Progress Stage

Based on Figure 5, the teacher monitors each student group's activities while experimenting in the virtual laboratory. Students complete the provided worksheet, and the teacher offers guidance to help them understand and analyze Archimedes' Law.

e) Testing results by discussing the completed projects;

Figure 6. Testing Results Stage

Based on Figure 6, students present their projects in front of the class in groups. Afterwards, other groups provide questions or feedback on the presented projects.

f) Evaluating the learning experience, where each group presents their project outcomes, other groups provide feedback, and the lecturer responds to the results and summarizes the project findings.

Figure 7. Evaluating the Learning Experience Stage

Based on Figure 7, students reflect on the projects they have completed. The teacher provides feedback on both the learning process and the outcomes of the project. Furthermore, the teacher guides the reflection and gives appreciation for the students' efforts and achievements.

3. Development Stage

In this stage, the multimedia is developed to optimize basic teaching skills and is evaluated for its feasibility by two expert lecturers in Physics Education.

Feasibility Test Analysis:

The purpose of the feasibility test is to determine the criteria for feasibility and obtain suggestions for improvements before implementation.

a) Validation Results by Subject Matter Expert.

The feasibility test results by the subject matter expert showed a percentage of 92.08%, which falls under the "very feasible" category. The percentage for each evaluation aspect can be seen in the Figure 8.

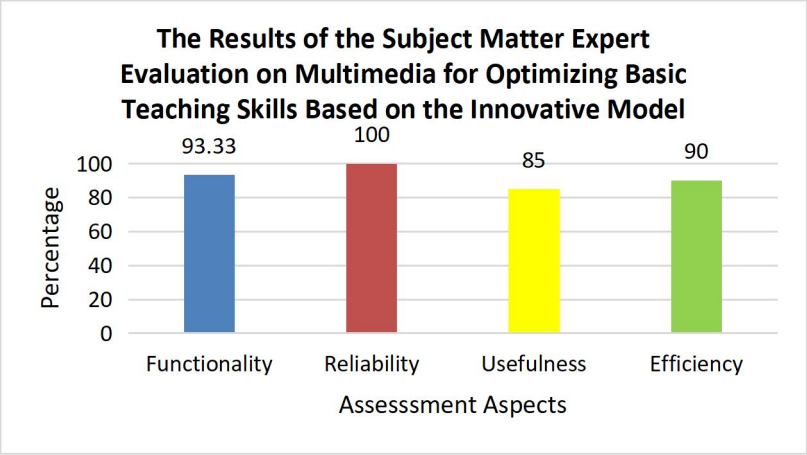

Figure 8. Diagram of the Subject Matter Expert's Evaluation Results for The Multimedia

b) Results of Validation by Media Expert:

The feasibility test results by the media expert showed a percentage of 89.55%, categorized as highly feasible. The percentage for each assessment aspect can be seen in the Figure 9.

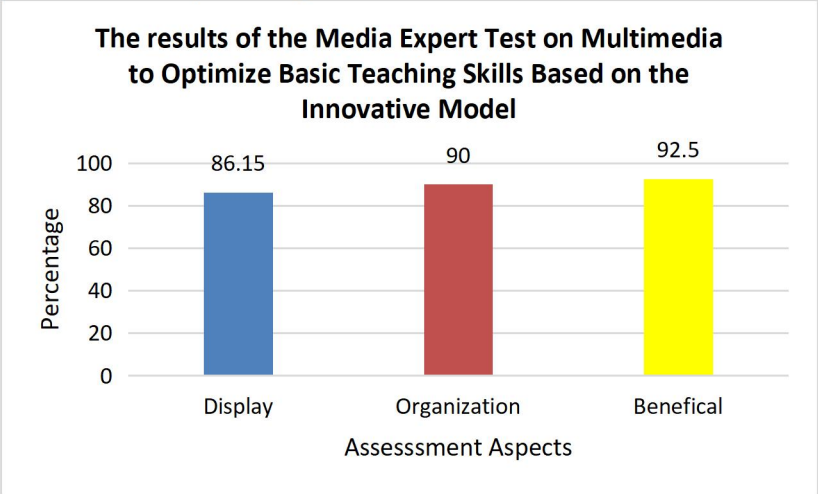

Figure 9. Diagram of Media Expert's Evaluation of Multimedia

4) Implementation Stage

The implementation was conducted with Physics students from the 2021 cohort, classes A, B, and D. To test the effectiveness of the multimedia in class A, the implementation was carried out in the classroom. The implementation process involved sending the multimedia on basic teaching skills to class's online messaging group via WhatsApp and Telegram, so that students could access the developed media anytime and anywhere.This implementation served to test and confirm the practicality of the developed multimedia for students.

5) Evaluation Stage

In the evaluation stage, the

practicality test results for the students showed 86.78%. To evaluate the effectiveness of the media used in the microteaching course for Class A students, pretests and posttests were administered. The results, with an N-gain score of 0.57, were categorized as moderate, indicating that the multimedia was effective.

The development of multimedia based on innovative learning models to optimize basic teaching skills was conducted using Research and Development (R&D) with the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The stages began with the analysis phase, which included needs analysis, curriculum analysis, and learner analysis. The researcher identified issues based on observations and interviews with several lecturers teaching the microteaching course. The problems identified were that many students during School Field Introduction Program 2 lacked classroom management skills, including insufficient mastery of Physics content. Additionally, some students exhibited poor ethics, such as being unfriendly towards lecturers and lacking discipline. One contributing factor was the lack of mastery in basic teaching skills and an understanding of teacher competencies. According to Rambe et al. (2022), students preparing for PPL should enhance their ability to understand basic teaching skills. This supports the current findings, which revealed that many pre-service teachers struggled with classroom management and lesson delivery due to inadequate preparation in these foundational competencies.

The emergence of Big Data and Artificial Intelligence (AI) is reshaping the educational sector by offering customized learning experiences, enhancing operational efficiency, and supporting data-driven decision-making. Big Data enables the collection and analysis of large amounts of educational data to gain insights into student performance and institutional effectiveness (Elam, 2024). At the same time, AI technologies, such as machine learning and natural language processing, are being used to create intelligent tutoring systems, predict student success, and automate administrative tasks. However, challenges like data privacy issues, unequal access to technology, and the need for teacher training complicate the adoption of these technologies in education. Moreover, integrating AI and Big Data into current educational systems presents both practical and logistical difficulties

(Judjianto et al., 2024; Kizilcec, 2024).

Based on these problems, multimedia was deemed necessary, leading to the development of multimedia on basic teaching skills using innovative models. The multimedia consists of text, audio, visuals, and video. The video includes simulations of teachers demonstrating basic teaching skills. In the design phase, a storyboard was created, and media, in the form of videos, was developed. The researcher gathered materials corresponding to the Course Learning Outcomes (CLOs) for the course. The storyboard was designed to include the media framework, including the introduction, content, and conclusion. The video was created using Canva, PPT, and CapCut. Canva is considered a comprehensive application as it allows the creation of various media types and is easy to use both on mobile phones and laptops. This aligns with the findings of Yuliana et al. (2023), which show that the Canva application is effective for creating video media. Furthermore, Canva is efficient because it provides a variety of free design templates and is available in web, Android, and iPhone versions. This multimedia contains explanations of the eight basic teaching skills, which include skills in opening and closing lessons, questioning, explaining, classroom management, guiding small group discussions, reinforcing, varying teaching methods, and teaching individuals and small groups. The multimedia uses AI to explain the concepts of basic teaching skills, teacher competencies, and the eight basic skills. The content created is combined with images and voice recordings from the lecturers, using the D-ID platform. D-ID is a platform that offers features for creating AI-generated talking character videos (Rachmany & Kurachman, 2024).

The simulation video created is based on the Project-Based Learning (PjBL) model. The PjBL model requires students to create a project based on the taught material. In practice, this model is student-centered, with the teacher acting as a motivator and facilitator (Wahyuni, 2018). This learning model was chosen because it can motivate students and foster creativity. This is in line with Rati et al.'s (2017) research, which indicates that project-based learning models can improve student creativity and learning outcomes. The stages in the video are as follows: 1) The first stage involves students observing and asking fundamental questions about the material and its practical applications in daily life, which the teacher presents via projector. 2) The second stage involves

students, together with the teacher, defining the project, which focuses on Archimedes' principle using a virtual laboratory. Students prepare laptops and create a project design. 3) The third stage involves scheduling the project, setting the time and place for submission, which is at 11:00 in the classroom. 4) The fourth stage involves the teacher monitoring group activities during the experiment in the virtual laboratory. 5) The fifth stage is testing the results, where students present their group projects to the class, followed by questions from other groups. 6) The sixth stage involves students revisiting the answers after discussion and receiving feedback from the teacher.

In the development phase, the multimedia was presented to two expert lecturers in Physics to assess its feasibility and provide suggestions for improvement to ensure the product meets the intended objectives. Based on the media expert validation results, the aspects evaluated were as follows: the appearance aspect scored 86.15%, organization 90.00%, and usability 92.50%. The overall average for media expert validation was 89.55%. These results suggest that the video for optimizing basic teaching skills is highly suitable for use. The material expert validation results showed scores of 93.33% for functionality, 100% for reliability, and 90% for efficiency. The overall average for material expert validation was 92.08%. These results are in line with the findings of Dhaifullah and Haryanto (2023), which reported that a learning video product, in the form of an Mp4 file, was deemed very feasible by material experts, scoring 90.5%, and by media experts, scoring 78.3%.

During the implementation phase, the multimedia was tested for practicality with students from the 2021 cohort in classes A, B, and D. The implementation took place in the classroom, with the multimedia distributed to students via Telegram and WhatsApp groups. In the evaluation phase, the practicality test yielded results showing 88.46% for ease of use, 84.39% for presentation appeal, and 87.8% for usefulness. The overall average practicality score was 86.78%, indicating that the multimedia was highly practical. In this phase, the effectiveness of the multimedia was tested with Microteaching students from class A, 2021 cohort. The effectiveness, as measured by the N-gain score, was 0.57, which is categorized as moderate.

The advantages of this multimedia on basic teaching skills are as follows: 1) it can be used offline, 2) it can be accessed

anytime and anywhere, allowing students to review the content repeatedly to better understand basic teaching skills, and 3) the simulation video based on the PjBL model helps students gain a better understanding of basic teaching skills. However, there are some limitations: 1) many students had difficulty downloading the video through WhatsApp due to its large file size, and 2) during video recording, there were issues with empty spaces and the classroom seating arrangement, which was less balanced due to the use of a larger classroom than usual.

CONCLUSION

This study concludes that the multimedia learning material, developed using the Research and Development (R&D) approach with the ADDIE model and based on an innovative learning framework, demonstrates strong potential for use in teacher education. Designed to be accessible via smartphones and laptops, the multimedia resource was found to be highly feasible, receiving expert validation scores of 92.08% from material experts and 89.55% from media experts. Furthermore, it was rated as very practical by users, with a practicality score of 86.78%. In terms of effectiveness, the N-gain score of 0.57 indicates a moderate improvement in students' understanding and performance after using the multimedia.

These results affirm the necessity and value of integrating interactive, model-based multimedia into microteaching courses or teacher training programs. The study contributes to the field by offering a validated digital learning tool that supports the development of basic teaching skills among pre-service teachers.

Future research is recommended to explore the long-term impact of such multimedia tools on teaching competence in real classroom settings, as well as to adapt and test the material across different educational contexts, including larger and more diverse populations.

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