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Development of Android-based digital teaching materials on Push Technique Material in Table Tennis Games

Kadek Dimas Dwipayana[1], I Putu Panca Adi[2], Ni Putu Dwi Sucita

[123] *Universitas Pendidikan Ganesha, Bali, Indonesia.*
**Korespodensi penulis: dimas.dwipayana89@gmail.com*

Abstrack

In university courses, particularly table tennis classes, this digital teaching material is essential to support the optimal execution of the learning process. This study aims to develop Android-based digital teaching materials focused on the push technique in table tennis. The research adopts a development study approach using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The developed product underwent validation by experts in content, instructional design, educational media, and field practice. The product testing included individual trials with three students, small group trials with six students, and large group trials with twenty-four students. Data were collected using questionnaires and analyzed using descriptive quantitative analysis. The results of the study showed that the content expert validation yielded a score of 98%, categorized as good, the instructional design expert validation scored 96%, categorized as very good, the educational media expert validation scored 90%, categorized as very good, the field practitioner expert validation scored 93%, categorized as very good, the individual trials scored 96%, categorized as good, the small group trials scored 98%, categorized as good, and the large group trials scored 92%, categorized as very good. Therefore, the developed product, an Android-based digital teaching material on the push technique in table tennis, serves as a learning resource that can enhance the quality of learning during the instructional process.

Keyword: *Development; Digital teaching Materials, Table Tennis, ADDIE*

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Introduction

Information and communication technology (ICT) has developed rapidly to meet various human needs. The information-rich nature of human life has created a dependency on ICT to fulfill these demands. One significant advancement is Android, a system designed to provide users with access to various features on mobile devices such as smartphones, tablets, and computers (Jazuli et al., 2017). The advent of ICT has facilitated numerous human activities, including business, healthcare services, work, daily necessities, and, notably, education.

The term "education" essentially refers to a conscious and deliberate effort to create a pleasant learning environment so that students can actively develop their potential, including spiritual and religious strength, self-control, personality, intelligence, noble character, and the skills needed by themselves and society. Learning is a conscious act by an educator to facilitate students in achieving desired goals (Trianto, 2009). There are several components in the learning system, including messages, people (educators/students), media, equipment, techniques, and context (Dwiyogo, 2013). This view is supported by Sanjaya (2013), who states that learning is a system because it has a goal: to educate students. From these

statements, it can be inferred that to facilitate the learning process, several components or tools are needed to support or assist the learning process. In other words, these tools make it easier for educators to convey information and for students to receive the information being presented.

One of the crucial components in the learning process that facilitates information delivery is the teaching material that students can use. Teaching material is defined as a set of systematically arranged content that can be used by students to create a condition that enables effective learning. Additionally, teaching materials help students understand the taught material better and increase their motivation and interest in learning. Therefore, teaching materials must be engaging and well-packaged to capture students' attention.

Based on a needs analysis conducted with students from the Physical Education, Health, and Recreation program at Universitas Pendidikan Ganesha, the current table tennis instruction mainly uses video and e-learning media. Although these teaching materials are provided in the learning process, they are not fully effective in helping students understand the learning material. This is due to several shortcomings, such as the absence of written materials that students can directly read and the lack of quizzes or questions as tools to evaluate the learning that has taken place.

The analysis results indicate that students need Android-based teaching materials, as all students have Android-based devices. The advantage of using Android is its ease of operation, making it popular among users. Additionally, using Android in university settings is deemed suitable because most students already own smartphones to access teaching materials. Several studies have shown that Android-based teaching materials are beneficial for students. For instance, research conducted by Kharisma (2020) found that Android-based learning positively impacts students' ability to identify the structure and language features of procedural texts (Kharisma, 2020). Based on this, the researcher is interested in conducting a study titled "Development of Android-Based Digital Teaching Materials for the Push Technique in Table Tennis Games."

Research Methode

In this study, the method used is Research and Development (R&D), which is designed to produce a specific product, test its effectiveness, and ensure it can function widely in society through needs analysis research (Rahmat et al., 2019). The ADDIE development model, a systematic and interactive instructional design approach, is applied for its effectiveness and efficiency. This model comprises five steps: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation.

In the analysis phase, activities include needs analysis, environmental analysis, and learning analysis. During the design phase, the focus is on selecting the software to create the design and development of the product or media in a storyboard. Since the teaching materials include video content, supporting applications such as Adobe Premiere Pro and other software like Adobe After Effects are used. The development phase involves creating Android-based teaching materials. This phase includes compiling the prepared lecture materials and gathering essential course content and media resources, such as text, images, animations, audio, and video.

Following this, validation tests are conducted by three experts: a content expert, an educational media expert, and an instructional design expert. Each expert is provided with assessment instruments relevant to their field of expertise. In the implementation phase, the developed product or media is implemented and tested in the learning process. This phase aims to gather feedback from students and to assess the feasibility of the developed media. The evaluation phase is carried out to determine how well the developed product or media achieves the set goals and objectives.

The research subjects in this study include content experts, instructional design experts, educational media experts, field practitioners, individual trial participants, small-group trial participants, and large-group trial participants. The developed product or media is initially reviewed and assessed by content experts with a background in table tennis, instructional design experts with a background in educational technology, educational media experts with a background in learning technology, and a field practitioner who is a table tennis coach with ten years of experience. Feedback, suggestions, and recommendations from these experts are used to improve the developed product or media.

After incorporating the improvements based on the experts' feedback, the product is tested with students. Individual trials involve 3 students, small group trials involve 6 students, and large group trials involve 24 students from the Physical Education, Health, and Recreation program. The students selected for the trials are fourth-semester students.

The data collection method used in this study is the questionnaire method. Questionnaires are employed to gather data from reviews and evaluations conducted by content experts, instructional design experts, educational media experts, field practitioners, as well as individual, small-group, and large-group trials.

The data analysis techniques used in this study include both qualitative and quantitative descriptive analysis. Qualitative descriptive analysis provides comments, feedback, and suggestions from the validity tests and product trials, which are used to make product improvements. Quantitative descriptive analysis is employed to process data from the product validity tests.

To determine the level of feasibility or validity of the product, the scores obtained from the questionnaires are converted into percentages. The percentage for each subject is calculated using the following formula:

Percentage = (responses × weight of each option)n x highest weight x 100%

((& K. I. M. Tegeh, I. M., 2010)

Where:

Σ = sum

n = total number of questionnaire items

To calculate the overall percentage for all subjects, use the following formula:

Percentage = (F : N) x 100%

To provide meaning and make decisions, the following criteria are used:

Table 1. Conversion of Achievement Levels on a Scale of 5 (Arikunto, 2003)

No	Achievement Level	Value	Qualification	Description
1	85– 100%	5	Very good	No need for revision
2	75 – 84 %	4	Good	No need for revision
3	65 – 74%	2	Good enough	Revised
4	55 – 64%	1	Less good	Revised
5	0 – 54%	0	Very poorly	Revised

Result and Discussion

This study aims to develop Android-based digital teaching materials for the push technique in table tennis. The subjects of this research are faculty members from the Faculty of Sports and Health and students from the Physical Education, Health, and Recreation

program at Universitas Pendidikan Ganesha. The object of the research is the application, which includes teaching materials, instructional videos, and quizzes. The instructional videos feature three levels of difficulty: easy, medium, and hard movement tasks. This study employs the ADDIE development model, which consists of five stages: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation.

The initial stage before developing the product/media in the ADDIE development model is the analysis phase. During this phase, needs analysis and identification are carried out to support the development of teaching materials for students in the Physical Education, Health, and Recreation program at the Faculty of Sports and Health, Universitas Pendidikan Ganesha. Based on the needs analysis conducted through observation, it was found that there is a lack of Android-based teaching materials for the push technique in table tennis. Further material analysis through observations with students revealed that they had insufficient understanding of how to perform the push technique in table tennis. The goal is for students to comprehensively understand the push technique by studying the material through the application provided by the researcher.

After analyzing the developed product/media, the next step is planning and design. In the design phase, the focus is on selecting the hardware and software required to create the teaching materials. The software chosen for developing Android-based digital teaching materials includes PowerPoint, Website APK 2 Builder Pro for app creation, Adobe Premiere Pro for video editing, and hardware such as smartphones and laptops. Following this, a storyboard is created to outline the basic framework and layout of the teaching materials. After establishing the basic framework, the design of the teaching materials is finalized, including the cover design, page backgrounds, fonts, and other elements. The final task in the design phase is to prepare the material and assessment instruments for the teaching materials in the form of questionnaires.

The third stage is the development phase. During this phase, the focus is on producing the product according to the predetermined design and plan. The initial step involves creating digital teaching materials, which include images, audio, and video. These materials are produced using PowerPoint and Website 2 APK Builder Pro, and videos are recorded and edited using Adobe Premiere Pro.

Once the product or educational media is complete, it is ready for evaluation and review by validators using prepared questionnaires. The experts or validators involved include Dr. Gede Doddy Tisna M.S, S.Pd., M.Or., as the content expert, Adrianus I Wayan Ilia Yuda Sukmana, S. Kom., M.Pd., as the instructional design expert, Ketut Andika Pradnyana, S.Pd., M.Pd., as the educational media expert, and Ni Komang Sri Wianawati, S.Pd., a table tennis coach from PTM Badung, as the field practitioner.

In addition to assessing the developed product or media, these experts provide feedback and suggestions for improvement to enhance the quality of the product or media. The Android-based digital teaching materials for the push technique in table tennis can be downloaded from the following link:

https://drive.google.com/drive/folders/1QtXTDRzxrF9FCEK0har1S3WKoZgOAryI

In the fourth stage, the Android-based digital teaching materials, which have been revised based on expert suggestions, undergo implementation. This involves testing the product with students and integrating it into the classroom learning process. The purpose of the implementation and product testing is to assess the feasibility and student response to the digital teaching materials, specifically the application, when used as a teaching resource or educational media to support the learning process. The product testing is carried out using questionnaires, including individual trials with 3 Physical Education students, small group trials with 6 students, and large group trials involving 24 students from the Physical

Education, Health, and Recreation program. The selected students are in their fourth semester.

The fifth and final stage of the ADDIE development model is evaluation. The evaluation phase aims to determine the extent to which the target goals have been achieved. Based on the testing results from content experts, instructional design experts, educational media experts, and field practitioners, the final evaluation shows that the Android-based digital teaching materials for the push technique in table tennis are classified as "very good" and are deemed highly suitable for use in actual learning environments without further revision. Detailed results of the data analysis, which refer to the product validity tests and the review and assessment from each research subject, are presented in Table 2 as follows:

Table 3. Percentage Results of Teaching Material Feasibility Testing

No	Research Subject	Product/Media Feasibility (%)	Description
1	Content Expert	98	Very Feasible/Very Valid
2	Instructional Design Expert	96	Very Feasible/Very Valid
3	Educational Media Experrt	90	Very Feasible/Very Valid
4	Ahli Praktisi Lapangan	93	Very Feasible/Very Valid
5	Field Practitioner	98	Very Feasible/Very Valid
6	Individual Trial	96	Very Feasible/Very Valid
7	Large Group Trial	96	Very Feasible/Very Valid

Based on the results of the validity test or product feasibility test of each research subject, it can be concluded that the product or media developed in the form of android-based digital teaching materials on push technique material in table tennis games is very feasible to be used as teaching materials to support the lecture process, especially in table tennis courses.

This development research produced a product in the form of an Android-based digital teaching material. The research has undergone a validation process, with results showing that the developed product is valid. The validity results are based on evaluations by experts, including content experts, instructional design experts, and educational media experts. The product has also been tested by a field practitioner. The evaluations and trials indicate that the Android-based digital teaching material is valid, with several factors reinforcing this conclusion.

The development of the Android-based digital teaching material followed the ADDIE development model. The ADDIE model consists of five stages: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation (Anafi et al., 2001). From these stages, the resulting product is deemed suitable for use in education. The content of the digital teaching material is highly qualified, with a product assessment percentage of 98%. The material is well-organized and clear, making it appropriate for students to master the push technique in table tennis, which is a crucial skill in the game. Good teaching material should contain comprehensive information from various learning sources. According to Sulastri (2021), learning resources are anything that can provide information in the learning process (Sdn et al., 2022).

In terms of instructional design, the Android-based digital teaching material has a very good qualification, with a product assessment percentage of 96%. However, there were suggestions from experts for improvements, such as including illustrations to clarify the content and removing some text to avoid clutter. Illustrations can help convey specific meanings visually (Maharsi, 2016). Additionally, there were recommendations to integrate quizzes into the material and to enhance the overall composition.

Regarding the media aspect, the Android-based digital teaching material is highly qualified, with a product assessment percentage of 90%. The evaluation covered the application’s interface, including the initial screen, font use, text accuracy, and color choices.

Suggestions for improving the media included refining navigation and adding supporting images to the material. Effective educational media should facilitate easy information delivery and reception (Pupung et al., 2024).

From the perspective of field practitioners, the Android-based digital teaching material has a very good qualification, with a product assessment percentage of 93%. The review focused on the ease of use, appeal, and benefits of the product. This finding is supported by research conducted by Kurniawan (2023), which states that Android-based digital teaching materials are suitable for use in the learning process (Kurniawan, 2023). The product is user-friendly for students, featuring instructional tools, appealing content, and a range of materials such as videos, images, and quizzes, which facilitate learning the push technique in table tennis.

The Android-based digital teaching material is considered effective in helping students learn the push technique in table tennis. The research encourages students to utilize the provided resources, including various features like material, images, and videos, and to test their understanding through quizzes.

However, there are some limitations to this digital teaching material, including the need for a good signal due to online video access and the fact that it cannot be accessed on non-Android phones.

Conclutions

This study concludes that the design and development of a digital teaching material in the form of an Android-based application for the push technique in table tennis was carried out according to the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The storyboard served as the foundational framework for creating the Android-based digital teaching material. Based on the completed storyboard, a digital teaching material on the push technique in table tennis was developed. According to the product validity tests conducted via questionnaires distributed to research subjects, the developed Android-based digital teaching material falls into the "very good" category with the following percentages: 98% from content experts, 96% from instructional design experts, 90% from media experts, and 93% from field practitioners. Student feedback indicates that: (a) individual trials rated it "very good" with a percentage of 96%, (b) small group trials rated it "very good" with a percentage of 98%, and (c) large group trials rated it "very good" with a percentage of 92%. Based on these results, it can be concluded that the Android-based digital teaching material on the push technique in table tennis is highly suitable for supporting the teaching process.

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