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Digitalization of volleyball match system material: Learning innovation at the faculty of sports science, university of Medan

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Abstract: The use of digital technology has been proven to help implement sports practices more effective and efficient. However, no digital system in Indonesia has been developed specifically for volleyball matches. Therefore, this study aims to develop a digital volleyball match system. This research was conducted at the Faculty of Sport Science, State University of Medan, in the Physical Education, Health and Recreation Study Program. The research was conducted using the ADDIE development model, which includes the analysis, Design, Development, Implementation, and Evaluation stages. The data collection techniques used in this study were questionnaires and documentation. This study's development data collection instruments consisted of questionnaires for students, questionnaires for implementing media and material expert validation, and cameras for documentation. The data obtained from the questionnaire were analyzed quantitatively. Based on the data collected and analyzed, it was found that the digital volleyball match system developed was categorized as good from the material and media expert test. Furthermore, after being revised according to input from experts, from the implementation carried out at the small group trial stage, it was found that the digital media developed was categorized as good. After being revised again, based on the results of the large group trial, it was found that the developed digital media was categorized as very good. From these results, it can be concluded that the media is ready to be used in learning the volleyball administration system.

Keywords: *Digital flipbook, Match system, Volleyball.*

1. Introduction

In simple terms, digitalization can be interpreted as a process of change that occurs from analog to digital technology. Technological developments greatly influence the process that occurs then; until now, the industry has become more modern and relies on this technology to continue to support its operations. Digitalization itself is carried out in order to increase the efficiency and effectiveness of the performance of each part of the industry so that time and all available resources can be processed as optimally as possible to obtain maximum benefits (Xu et al., 2024; Yang et al., 2024).

This transition process is also intended to facilitate all matters required by users or users of services and products. With the various conveniences available thanks to this process, user loyalty is hoped to increase and the transactions that occur will be of greater value (Chao et al., 2024; Cuesta-Valiño et al., 2023). The basic description that can be given is the transition from the use of physical files to digital files in every part of the operating industry. Education in the digital era is education that must integrate Information and Communication Technology into all subjects. With the development of digital-era education, students can gain abundant knowledge quickly and easily (Chen et al., 2024; Haleem et al., 2022). Answering the challenges of education in this digital era, educators in the 21st century must be able to communicate and adapt to the development of the times (Hennessy et al., 2022), in this case, the development of technology, in addition to the continued development of the era, it is directly

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proportional to the development of problems that require solutions with high-level thinking (Huang et al., 2024).

Furthermore, integrating technology in the learning process has been empirically proven to improve the quality of learning (Abbey et al., 2024; Souza & Debs, 2024). The use of technology in the learning process has been proven to increase students' focus and motivation to learn (Prasetya et al., 2024; Yuan & Liu, 2025). This is because the use of technology that is able to provide learning media in the form of multimedia makes learning more interesting (Chiou et al., 2015; Zin et al., 2013). Technology also allows learning to occur anywhere and anytime (Aparicio et al., 2017; Milićević et al., 2021). Thus, it is easier for students to access learning materials and make it easier for them to learn. When teachers implement the right technology to support learning, these benefits improve students' learning achievements. In addition, the application of technology, especially multimedia-based learning media and games that are available online, is following the characteristics of today's learners who are dominated by Generation Z and Generation Alpha who cannot be separated from technology and learn better when using technology (Santosa, 2017; Shorey et al., 2021; Szymkowiak et al., 2021).

In the context of sports education learning, several studies have also been conducted to develop digital learning media for the sports learning process. Such as research conducted by Khaidir et al. (2021), who developed interactive learning media for athletics material in physical education, sports, and health subjects. Similar research was also conducted by Triandi and Hariyadi (2021), who developed interactive multimedia-based learning media for basic volleyball techniques; the learning media was declared ready for use. Furthermore, Nugraha (2024) developed interactive learning media for physical education, sports, and health subjects until it was found that the developed media could be used well to support the teaching and learning process. For the sport of soccer, Ali et al. (2022) developed HOTS-based interactive media to improve soccer learning; from the study conducted, it was found that the media they developed was ready for use.

Departing from the success of previously developed digital media developments and the benefits of digital media in learning, this research was conducted to develop a digital volleyball match system. Thus, this research complements previous research. In line with previous research results, this digital volleyball match system has great potential to improve the efficiency and effectiveness of volleyball team management and provide significant benefits in the world of sports.

2. Method

Following the purpose of this study, namely to develop a product in the form of a digital volleyball match system, this study was carried out by following the Research and Development research method. The research and development model used is the ADDIE development model, which includes the analysis, Design, Development, Implementation, and Evaluation stages (Branch, 2009). This research was conducted at the Faculty of Sport Science, State University of Medan, in the Physical Education, Health and Recreation Study Program. This study involved 25 students in the small group test stage and 94 people in the large group. Those involved in this study were students who took volleyball courses.

Data collection in this study was conducted using questionnaires and documentation. The development data collection instruments compiled in this study were Questionnaires for Students and media and Material Expert Validation. The data analysis technique used in this study was a quantitative descriptive analysis technique, namely presenting the results of product development, testing its validation level, and determining product feasibility. The measurement range in determining the feasibility category is using 4 Likert scales.

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Table 1.
Conversion of questionnaire results.

Response	Score
Strongly Agree (SA)	4
Agree (A)	3
Disagree (D)	2
Strongly Disagree (SD)	1

From the collected data, we calculate the average using the formula:
Notes:

$$\overline{X} = \frac{\Sigma X}{n}$$

$\overline{X}$ = Mean Score
$\sum X$ = Total Score
n = Number of raters

3. Findings

This study aims to develop a product in the form of learning media for volleyball match administration learning. The ADDIE development model is used to create this teaching media, and the results of each stage are listed below.

3.1. Analyze

The analysis stage begins by searching for empirical field study data regarding the potential and problems that exist in learning the volleyball match system course at the Faculty of Sports Sciences at the State University of Medan regarding the use of digitalization of match systems and match charts in utilizing Android as one of the technologies in the modern era. Currently, the administration of the volleyball match system has great potential to increase the efficiency and effectiveness of volleyball team management and provide significant benefits in the world of sports. Then, the author tries to analyze the needs and design learning media based on the application of digitalization of the match system and match charts in the volleyball match administration course at the student level at the Faculty of Sports Sciences at the State University of Medan in the process of implementing learning the volleyball match system and match charts.

3.2. Design

After collecting information and problems in the field, researchers design a product that follows the existing problems. Determining the main material of the volleyball match media product in the volleyball match administration course based on the Android application. Determining the purpose of creating learning media according to the curriculum. In product design, another activity carried out is creating a flowchart. A flowchart is a development flow diagram that provides a final picture of a display that is poured into a media script. A digital platform called Lectora is used to develop application-based learning media. Lectora is a software and e-learning development tool. Lectora can be used for various learning needs, especially for making presentations, quizzes, and even flash-based learning games. You can also easily insert videos, images, games, evaluation questions, test sheets, etc.

3.3. Develop

The development stage consists of two steps, namely (1) development of learning media for the volleyball match system and match chart and (2) product validation. The results of the development stage of the volleyball match system teaching media are as follows:

3.4. Development of Learning Media for Android-based Volleyball Match Systems

The teaching media was developed using the Canva application to compile the material, create

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background and cover designs using the Adobe Photoshop CS6 application, create and edit videos and audio using the Capcut application, and combine covers, material files, add components in the form of video, audio, and images into one file in the form of volleyball teaching media with exe or app using the Heyzine Flipp Book website. The results of the development of the match system teaching media are as follows:

3.4.1. Cover

The cover menu of this teaching media contains a welcome sentence to users of the volleyball match system teaching media, the title of the material, and the "Enter" navigation button to enter the main menu.

3.4.2. Instructions for Using the Android-based Volleyball Match Application

The main menu is a page containing all the menus in the volleyball match system teaching media, including introduction, competency, material, operational, glossary, profile, and exit.

3.4.3. Core Competencies and Basic Competencies

This core competency and basic competency menu is a page that contains core competencies and basic competencies that users must achieve in the Android-based volleyball match system learning media according to the RPP.

3.4.4. Material

The material page contains the title of the learning activity and the topics to be studied, namely: Half competition match system, knockout system, full system

3.4.5. Video

The video menu contains videos of learning activities and the topics to be studied, namely a series of match implementations according to the match system chart that is adjusted to the needs of the match to be held.

3.4.6. Profile

The profile contains information about the identity of the volleyball teaching media developer, consisting of developer 1 and developer 2, such as name, NIP, department, faculty, agency, student ID, and email.

3.5. Learning Media Assessment

Volleyball teaching media that has been consulted with experts and improved is then improved using the volleyball match system teaching media assessment sheet that has been previously created. Volleyball match system experts validate the material to determine whether the teaching media created is suitable for use by users and to receive criticism and suggestions so that the media becomes better. The validation results are as follows.

3.6. Design Validation

This study uses three expert validations: volleyball game experts, volleyball game material experts, and validation media experts/programmers based on Android applications. After the product is produced, validation from material experts and media experts is needed. Design validation is a process of activities to assess whether the product design, in this case, a new work system, will be rationally more effective than the old one (Sugiyono, 2015).

The development of digitalization of the match system and match charts in the volleyball match administration course aims to improve learning outcomes for students during the new normal conditions. Information collection is carried out by analyzing problems and materials, followed by collecting materials and their supporters. Sample analysis was carried out in April 2024.

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From the results obtained in the needs analysis test from experts, it can be concluded that researchers must improve/revise each expert input. From the picture above, it is concluded that the percentage of volleyball game lecturer experts is 44% in a less good category, of material experts who teach volleyball courses is 43% in a less good category, and of media, experts are 38% in a less good category. The needs analysis results on experts have an average value of the needs analysis conducted by researchers on material experts and media experts have a total result of 125 percentages 35% with a less good category and meaningfully improved. Based on the information in the image of the expert validation percentage assessment Sudjana (2005) then the average validation value is in the range of 25% - 42%, it can be concluded that the analysis of the needs for developing learning media for match systems and match charts based on applications in the course of football match administration for students of the Faculty of Sports Sciences at the State University of Medan is categorized as less good and not valid for use in the trial stage after improvement. The percentage results obtained in carrying out expert validation of the trial stage of needs were 40% with a less than good category; these results were obtained from distributing questionnaires to 3 experts where there were still many shortcomings that needed to be fixed according to what was written from expert comments in building and touching on the field of application used, one of which is the completeness of volleyball game learning materials, instructions for using the application and video tutorials included in the application are still not good. Therefore, the researcher will make a design revision according to the comments and input given by the expert to the researcher, which has been written in the trial questionnaire of needs.

3.7. Design Revision

After the design validation is done, the next stage is the design revision according to the expert's revision. Table 2 shows the input from the experts used as the basis for the design revision.

Table 2.
Expert input as a basis for design revisions.

Expert	Expert input
Volleyball Game Expert	• The completeness of the material in the application is still not suitable for the student-level • How to use the developed Android application is still too complicated. It needs to be simplified. • Application instructions are still difficult to understand, and they must be made easier so that lecturers and students can understand how to select features in the application. • The application size is too large. • The appearance of the application is not attractive
Subject Matter Expert (Lecturer for Volleyball Course)	• The completeness of the material is still lacking; the material must be following the level of students in the match system and equipped with volleyball match charts, videos on how to do basic techniques, and practice questions. • Application instructions can still not help users properly understand how to use the application. • The application design is not attractive. • The videos available on this application are of poor quality, blurry, and broken.
Media Expert	• The design is still not attractive • The letters, colors, and font types are still not appropriate

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	• The application is difficult to use • The application size is still too large

3.8. Implementation

3.8.1. Small Group Trial

After conducting the needs test, the researcher can proceed to the next stage, namely the small group trial. The small group trial was conducted on experts first and then on 25 students who had been determined. From the results obtained in the product trial test (small group trial) from experts, it can be concluded that researchers must improve/revise each input from the experts. From the picture above, it is concluded that the percentage of volleyball game lecturer experts is 72% with a good category, from material experts, volleyball lecturers are 70% with a good category, and media experts are 71% with a good category. The product trial test (small group test) conducted by researchers on experts obtained a score of 255 with a percentage of 71% having a good category and meaningfully can be used with conditions. Based on the description in the expert validation percentage assessment image Sudjana (2005), the average validation value is in the range of 50% - 83% then it can be concluded that the small group trial of the development of learning media for the match system and match chart in the volleyball match administration course for students of the Faculty of Sports Sciences at the State University of Medan based on the android application is categorized as good and valid for use in the trial stage after improvement.

The results were obtained from the distribution of questionnaires to the 3 experts where there were still many shortcomings that needed to be fixed according to what was written from the expert's comments in building and touching on the field of application used, one of which was the completeness of the volleyball game learning material was still lacking at the student level, instructions for using the application were still lacking, how to use the application was still difficult to understand, the design of the application was still less attractive and the video tutorial included in the application was still less good, therefore the researcher will make a design revision according to the comments and input gave by the expert to the researcher which had been written in the needs trial questionnaire. The results obtained in the small group trial testing on experts continued to be tested on students with a sample of 25 students from the Faculty of Sports Sciences at the State University of Medan. At this stage, 25 students conducted a small group trial of developing learning media for match systems and match charts in the volleyball match administration course for students from the Faculty of Sports Sciences at the State University of Medan based on the Android application. After conducting the trial, students were given an assessment and evaluation instrument to assess the learning application. The percentage value of the small group trial by a sample of 25 students was 81% with a good category.

After the product has been tested in small groups and validated, the next stage is to revise it according to the experts' revisions. Table 3 below shows what needs to be revised according to the experts.

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Table 3.
Expert Input as a Basis for Product Revisions.

Expert	Expert input
Expert (Volleyball game lecturer)	• The volleyball game material in the application is still incomplete, and it needs to be added and improved. • How to use the developed Android application is still too complicated, and the application instructions are still not good. • The application size is too large.
Subject matter expert (Lecturer in charge of volleyball course)	• The completeness of the match system material and match charts in volleyball learning in the application is still lacking. • The application instructions are still lacking. Create instructions on how to use the application so that all students and lecturers can understand it well. • Try to design it more attractively, and the application is less attractive
Android media expert	• The video on this application is not good because it is still blurry and broken. • The design is still lacking and needs to be redesigned to be more attractive with colors that match the application. • The letters, colors, and fonts are still not appropriate.

3.9. Large Group Usage Trial

After conducting a product trial, the researcher can proceed to the next stage, namely a large group trial. A large group trial was conducted on experts first and then on 94 students consisting of 3 classes, and it had been determined. The results of the study will be adjusted to the results of the expert assessment of the questionnaire given by the researcher. From the results obtained in the trial usage test (large group trial) from the experts, it can be concluded that the researcher can carry out the next stage without improvement. From the picture above, it is concluded that the percentage of volleyball game lecturer experts is 89% with a very good category; from material experts, volleyball lecturers are 87% in a very good category, and from media experts, 90% with a very good category. The results obtained in the large group trial test on experts continued to be tested on students with a sample of 94 students from the Faculty of Sports Sciences, State University of Medan.

The trial usage test (large group test) conducted by the researcher on experts obtained an overall score of 321 with a percentage of 89.99%, having a very good category and meaning it can be used. Based on the description in the expert validation percentage assessment image, Sudjana (2005), the average validation value is 75% - 100%. Then, it can be concluded that the large group trial of the development of learning media for the match system and match chart in the volleyball match administration course for students of the Faculty of Sports Sciences at the State University of Medan based on the android application is categorized as very good and valid for use in the trial stage after improvement. These results were obtained by distributing questionnaires to the three experts used by researchers to help and comment on what the researchers needed. At this stage, 94 students involved in a large group trial of the development of learning media for the match system and match chart in the volleyball match administration course for students of the Faculty of Sports Sciences at the State University of Medan based on the android application. After the trial, students were given an assessment and evaluation instrument to assess the learning application. The percentage value of the large group trial by a sample of 94 students was 90%, with the category obtained being very good.

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3.10. Evaluate

This research was conducted with stages that have been adjusted to expert opinions on R&D, and these stages are the author's guidelines. After carrying out these stages, the percentage of needs analysis, small and large group trials can be compared to have increased. The increase in the trial results was obtained from input from experts. Input or revisions from experts helped researchers have the suitability of the android application for developing learning media for match systems and match charts in volleyball match administration courses for students of the Faculty of Sports Sciences at the State University of Medan based on the android application developed by researchers to help lecturers in the digitalization learning process of volleyball matches and game charts. A comparison of the percentage of trial activities carried out by researchers can be seen in Table 4 below.

Table 4.
Trial Results

Expert	Trial		
	Design Validation	Small Group Trial	Large Group Trial
Volleyball Game Expert	44%	72%	89%
Subject Matter Expert	43%	70%	87%
Media Expert	38%	87%	90%

The percentage comparison of each trial increases the percentage of volleyball game lecturer experts who have 44% of trial needs, 72% of small group trials, and 89% of large group trials. Volleyball course lecturer material experts have 43% of trial needs, 70% of small group trials, and 87% of large group trials. Media experts have 38% of trial needs, 87% of small group trials, and 90% of large group trials. The results can be seen in the picture above.

4. Discussion

The results of this study indicate that the Android application-based learning media developed for the Volleyball Match Administration course received different evaluations from various parties, ranging from volleyball game lecturer experts to material experts to media experts to students. This study provides important information on developing technology-based learning media for sports education.

The validation results of volleyball game lecturers showed increased quality based on the trials. In the needs analysis trial, this media received a less good category. However, after revisions were made based on expert input, the results of the small group trial increased to good, and the large group trial reached a very good category. This increase is in line with the theory of learning media development, which emphasizes the importance of an iterative process in validation and revision to achieve optimal results (Branch, 2009).

Validation by material experts who are lecturers in charge of the Volleyball Match Administration course showed a similar pattern of increase. The initial evaluation in the needs analysis test was in the less good category. However, through a revision process based on expert input, this media obtained a good category in the small group trial and very good in the large group trial. This finding is consistent with previous research stating that collaboration with subject matter experts is very important in ensuring the accuracy of content in learning media (Dick et al., 2015).

The validation results by media experts showed that this learning media was in the fairly good category in the needs analysis test, good in the small group trial, and very good in the large group trial. This shows that the application's design and technology aspects have undergone significant improvements. According to Zarafshani et al. (2020), the quality of learning media is highly dependent on integrating visual design elements and interactivity relevant to user needs.

The evaluation by students also gave encouraging results. The application received a good category in the small group trial involving 25 students. This application received a very good category in the large group trial with 94 students. These results indicate that this learning application is academically relevant and effective in improving students' learning experiences. Constructivist learning theory

supports these findings, where well-designed learning technology can facilitate students' active involvement in learning (Haleem et al., 2022; Sailer et al., 2024; Wibowo et al., 2023).

The results of this study reinforce the importance of the iterative process in developing technology-based learning media. In addition, collaboration between developers and subject matter experts, media experts, and end users is the key to success. This study also supports the idea that using technology in sports education can improve the effectiveness and efficiency of learning (Clark & Mayer, 2016; Pârvu et al., 2023). For further research, it is recommended that this application be tested in a wider context and with various teaching methods.

5. Conclusion

After data collection, which began with empirical field study data on the potential and problems in learning the volleyball match system course, the Faculty of Sports Sciences at the State University of Medan on the use of digitalization of match systems and match charts in utilizing Android as one of the technologies in the current modern era, then data processing was carried out from the first expert test, the second expert test, small group test, large group test, it was concluded that the test from three experts concluded that the average percentage of 71% had a good category with revisions. Then, a small group test was conducted with a sample of 25 people with an average percentage value of 81% and a good category. Then, a large group Usage Trial was carried out on 94 students, with a percentage value of 90% and a very good category. The conclusion is that in learning the volleyball match system course, the Faculty of Sports Sciences at the State University of Medan on digitalization of match systems and match charts utilizing Android.

Based on the results of this study, it is expected that the learning media for the volleyball match system based on Android can be used in matches at both regional and national levels. This is because the learning media for the volleyball match system based on Android makes it easier for students and other users to compile a match system in a volleyball championship. In addition, for the next researcher, it is expected to be able to innovate again in creating a better volleyball match system learning media, in order to create more effective and efficient learning.

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