RESEARCH ARTICLE

Multimedia Animation Based Basketball Learning Media

Benny APRIAL M[1*] , Tandiyo RAHAYU[1] , Sulaiman SULAIMAN[1] and Mugiyo HARTONO[1]

[1]Universitas Negeri Semarang, Postgraduate Department, Semarang / Indonesia
*Corresponding author: bennyaprialm@students.unnes.ac.id

Abstract
The aim of this research and development is to provide multimedia animated shooting learning content for basketball games. Research and Development (R&D) design from Borg and Gall was used in this research. The research subjects were 130 students taking part in physical education classes consisting of 50 students in small group tests, 80 students in field trials, and 50 students who were assessed for media effectiveness. Test the effectiveness of media using basketball to determine the level of proficiency in students' basketball playing techniques before and after receiving the basketball learning media treatment in question, treatment with interactive animated multimedia-based basketball learning materials. The level of basketball technique was determined from the initial test at 36.42. The findings of this research are to produce interactive multimedia animation-based basketball learning media with the resulting products in the form of interactive mobile applications, independent study guidebooks to facilitate the delivery of basketball learning material and make it easier for lecturers and students to achieve it. The findings in the research were to produce basketball teaching material products for universities. The students' ability to execute basketball movements after receiving multimedia animation-based therapy was 73.42 and p-value = 0.00 < 0.05). The results of this development research conclude that animation and multimedia-based teaching materials can be used to teach basketball techniques to students. Multimedia animation-based interactive teaching materials created for learning basketball techniques show that there are quite large differences between before and after treatment based on differences in students' pretest and posttest scores.

Keywords
Basketball, Learning Media, Multimedia, Animation

INTRODUCTION

Basketball is a sport that has an important contribution in maintaining and improving a person's body condition. Basketball is a sport that makes the body healthy and trains the elements of physical fitness, such as strength, flexibility, balance, accuracy, honing mutual cooperation, respecting opponents, self-confidence and improving social skills. In basketball, when carrying the ball, there are 3 things you have to do, dribbling, passing and shooting (Metulini & Gnecco, 2023).

Using technology to promote personalised learning processes and assessment, it is a consensus requirement that physical education learning (movement learning) in the twenty-first century include a small amount of technological engagement in both the learning process and the evaluation of learning results. In addition to employing technology in the classroom, emphasize that " The content, desired learning outcome, instructional style, and delivery are the four primary factors that determine how effective a learning experience is "(Attila, 2019). In addition to utilizing technology in the classroom, stress that "the effectiveness of a learning depends on four main elements, they are content, desired learning outcome, instructional method, and delivery" (Muhammad et al., 2022). If the newest

technology is used in conjunction with a four-component learning (content, learning outcomes, techniques, and learning media), it will be given effectively (Putranto et al., 2022). conditions or progress of the times and the use of appropriate and appropriate learning media. Learning media that is suitable for the digital era is learning media that involves the use of elements of computer information technology and the use of internet networks. Computer information technology may be used in the classroom, particularly when it is used to create multimedia lessons that incorporate animation, video, music, pictures, text, and graphics into a single topic (Han et al., 2021; Lubis et al., 2022). Regardless of the lecture schedule, multimedia is thought of as a learning medium that may support students' learning requirements and allow them to study whenever, wherever, and with whoever they choose.

It is hoped that by implementing interactive animated multimedia-based learning in learning, it will improve learning outcomes through a good process (Yan, 2021). This media will be able to be a complement and supplement (complementary and additional) to existing learning resources. In addition, this media can be a substitute or substitute for lecturers as learning when they are unable to attend class, namely learning that creates multi-directional learning interactions, not simply a one-way conversation between the teacher and the pupils, but also a two-way conversation amongst students, a student's connection with their surroundings, and so on. In the long term, it is hoped that interactive animation multimedia-based learning will be able to produce profiles of student graduates as professional and competent Physical Education teachers (Kao & Luo, 2020). Apart from that, what researchers hope for by implementing interactive multimedia-based learning is changes in students' behavior and lifestyle to become physically active individuals because of the figure of prospective Physical Education teachers, and avoid a passive lifestyle (sedentary lifestyle).

In general, several problems that arise are encountered in the learning process, including the minimal application of learning media, the bare minimum of media in education, much alone media or learning tools that make advantage of information technology. Through a preliminary study in the form of a needs analysis for students, the researchers established this. Lecturers' primary responsibility is to impart knowledge, while students' primary roles are to listen, listen, and practice. Learning interactions seem stiff even though sometimes questions and discussion sessions are opened, which in the end students who learn become passive and tend to become objects and are less able to play an active role in learning (Rosmaria. Heryani, 2022). Thus, innovation and engineering of learning media and learning media is needed. Lecturers and teachers make up only a portion of the learning resource because they are not the sole source of information. To prevent pupils from rapidly becoming bored or tired of studying, all learning tools are created to promote initiative and make the learning process more effective, efficient, and engaging. As a result, the role of lecturers and instructors shifts to that of learning managers.

Given the aforementioned circumstances, there is a gap in the advancement and development of information technology in the present digital era, which is anticipated to be valuable and aid in the achievement of learning objectives, is actually not being maximized and its usefulness is not maximized. This is in contrast to what is anticipated, namely learning materials that incorporate technological advancements and improvements in the form of multimedia, which can enhance the interaction process between students who study and lecturers who teach (Roemintoyo et al., 2022). Similar views were shared on the efficacy of learning for adults, including the use of video media and video feedback in addition to learning with direct coaching (Li & Li, 2021). These findings indicate that students are adult beings with a variety of obligations, particularly those connected to job, and that strong self-management is required. Due to time constraints, learning through direct coaching or with a trainer can occasionally be difficult. The circumstances and needs of adults and students make learning through the application of media in the form of video media, video feedback, and interactive multimedia highly acceptable and appropriate (Budiarto et al., 2021).

The media that will be developed by the researcher is a multimedia animation of a basketball game which has advantages over previous research, namely that previous research has been analyzed to only develop animation in the form of a basketball game without first studying the techniques of the basketball game (Ningrat & Yasa, 2022). Here the researcher will develop a

basketball game in the form of passing, dribbling and shooting which will be packaged attractively with creative and innovative forms of animated movements will automatically attract students' interest in learning them, the media content which includes modules in the form of text, images, audio, animation and video. Development of the quality of basketball games refers to the initial level of mastery of the game. which includes dribbling passing and basketball shooting.

From the results of the preliminary study, several problems were found, namely: 1. The basketball game learning paradigm focuses more on providing learning media which is currently developing towards innovation and creativity to further activate students packaged in interactive animated multimedia, this is the main aim of good sports learning, 2. So that students are able to innovate and recognize the importance of learning media in a teaching and learning process, 3. In essence, the current learning process places more emphasis on how students learn independently and there is reciprocity from teachers and students.

Multimedia Interaction-Based Character Design Research in 3D Animation In a comparison experiment, it is demonstrated that the model developed in this research is more appropriate for a 3D animation role agent in a multimedia interactive environment (Hu & Wen, 2019). This article creates a multimedia scene model and a 3D animation role agent based on a multimedia interaction model. This increases the performance and effectiveness of intelligent interactive actions and makes 3D animated avatars better suited for multimedia engagement. Science education and science practices nowadays heavily rely on animation (Unsworth, 2020). Science animators are employed by science research institutions to provide context for cutting-edge scientific findings. Animations have been utilized for many years in scientific education as instructional tools to enhance science teaching and learning, and interest in this area of study appears to be increasing. explains how to employ material-appropriate animation to create engaging static animations that look and sound like videos, as well as interactive animations that let students select variables to create variations in the visual arrangement and/or physical action. The main purpose of interactive animations is to evaluate procedural knowledge about the nature and methods of scientific research.

In further research (He, 2020) Research on how well animation helps people understand science concepts frequently use a cognitive approach to learning without giving enough attention to the semiotic aspects of animation. Interpersonal Meaning examines how an animation engages students to study two cartoons on how they investigate how they develop science knowledge, complementing the cognitive methodologies that are common in animation research. This functional viewpoint on animation makes it easier to comprehend the various meanings that it generates, which has theoretical and practical ramifications for animation studies, education, and researchers (Falloon, 2020). There is evidence to support the use of technology-based animated simulations in education for knowledge development. However, teachers using these simulations with students must be aware of their role in conceptual construction in order to ensure accurate and robust knowledge construction.

The goal of this research is to analyze the development of animation-based basketball learning media, analyze the feasibility of the results of developing animation-based basketball learning media, and analyze the effectiveness of developing animation-based basketball learning media for students. Based on the conclusions drawn in previous research, gaps and novelties were found to develop animation-based learning media in basketball for students. Because the creation of animation-based basketball learning materials was intended to pique students' attention and facilitate their memorization of basketball motions, researchers developed this approach to offer fresh content and facilitate learning for students. A game of basketball (Bing, 2016).

MATERIALS AND METHODS

Participants and process
Table 1. Means and standard deviations (SD) for height, weight and BMI of physical education students aged 20 to 22

Characteristic	Gender	Height (cm)	Weight (kg)	BMI (kg/m2)
20 Year	Man	170	65-73	24,2
21 Year	Man	172	67-75	25,4
22 Year	Man	171	66-74	23,6
20 Year	Women	160	58-61	22,7
21 Year	Women	165	60-68	23,9
22 Year	Women	166	61-66	24,0

This development research followed ethical standards and received approval from Semarang State University in Indonesia with reference number [20889/UN37.2/EP/2023]. Participants provided informed consent, with a volunteer form including details of the study, risks, benefits, confidentiality, and participants' rights. This research adhered strictly to the ethical principles of the Declaration, which prioritizes the rights and well-being of participants in the design, procedures, and confidentiality measures.

The research was carried out at Sekolah Tinggi Olahraga dan Kesehatan Bina Guna, Universitas Negeri Medan, Universitas Pembinaan Masyarakat Indonesia and Universtias Quality Berastagi. According to Borg and Gall's research and development research, it took more than three months to complete, with the following details:
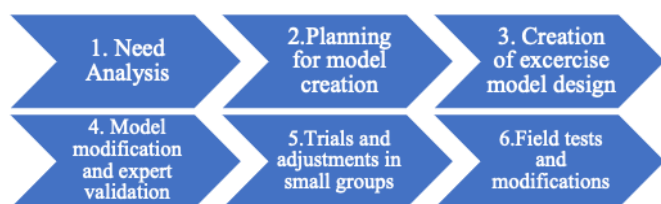

Figure 1. Characteristics of the Developed Model

The basketball shooting learning model that will be compiled and developed is a new and modified model consisting of 30 training models. Research subject Saturated/census sampling, or using the entire population as research subjects, was the method of subject selection utilized in this study.

Table 1. Research Subjects

No	Research Stage	Number of Subjects	Criteria	Instrument
1	Preliminary Research	3	3 Lecturer Basketball	Interview
2	Expert Evaluation	3	Learning Media	Interview
3	Produc Trials Small group try-out	50	Student P.E	Learning Media
	Field try group	80	Student P.E	Learning Media revised
4.	Product Effectiveness Test	50	Student P.E	Learning Media

The population in this study was all male and female students with an average age of 19-22 years with a height range of 160-175 centimeters.

Data Collection Tools

The measuring tool is the Basketball Learning and Performance Assessment Instrument, a protocol for obtaining the variables to be analyzed, including with and without the ball (dribbling, shooting, passing, receive, passing) the game. All these actions included in the taxonomy for the basketball training category are not included, because The instrument has been designed to evaluate learning and basic performance. The inclusion of complex tactical actions, with multiple solutions, requires special instruments, such as instruments designed to analyze pick and rolls or inside passes. These instruments assess three different components of playing actions decision making, technical execution, and final efficacy. Each of these three components of play action is codified according to its adequacy. Thus, each action is codified as: (i) Inadequate, (ii) Neutral, or (iii) Adequate. Proposed codification This is different from most existing instruments, because it is the development of two levels of assessment (appropriate /inappropriate, adequate/inadequate, successful/ unsuccessful) into three levels (Ibáñez et al., 2019).

The research and development model (Research and Development) from Borg and Gall is used in the study of the development of the agility training model (Aka, 2019) This comprises of 10 research phases, including : (1) Data collection and analysis (2) Scheduling (3) Product prototype development (4) Field testing of the prototype (5) Revision of the main product 6) The first field trial. (7) The operational product is revised. (8) Field testing in use (9) the completed product (10) application and promotion.

The instrument used in this research was the basketball test from a book (Sepdanius et al., 2019) and This research uses item/item validity calculations, because this research wants to know whether the instrument is valid or not based on the validity of each question item so that the instrument can be used effectively in the form of learning tests that measure cognitive aspects related to student learning outcomes.

In this research and development, of course, it is hoped that it will produce a product that can be used for shooting practice models for students

with new model designs or complete existing ones so that they can be used as other learning resources in the training process. To simplify the research systematics, it will be described using a chart regarding the development research steps used by researchers based on the research steps by Borg and Gall.

The following research steps are based on the preceding chart: a) Research and data gathering to discover issues in the field (doing preliminary research, literature reviews, and field observations). b) Planning (doing planning in the form of skill identification, skill definition, goal formulation, test sequencing, expert testing, small-scale trials, and large-group trials) b) Creation of the original product form (creating the initial product types/forms, such as : a) Preparation of materials, including the creation of books, modules, videos, and evaluation tools; b) Preliminary field testing; c) Preparation of materials; d) Preparation of materials, including the creation of books, modules, videos, and evaluation tools; e) Main product revision; and f) Preparation of materials, including the creation of books, modules, videos, and evaluation tools; f) Main field testing, which entails carrying out primary research field tests on 30–100 people, Operational product revision (conducting operational product revision, based on input and suggestions from the main field trial results), operational field testing (conducting main product tests with up to 40–200 subjects or 10–30 research sites), final product revision (making revisions to the final product, based on suggestions in field trials), and dissemination and implementation (dissemination and implementation of products, reporting and dissemina.

Statistical analysis

Static analysis the data obtained in the study were analyzed using the Statistical Package for the Social Sciences (SPSS) Program version 25.0. The variables used in research are expressed using percentages, means, standard deviations and numbers. The normal distribution of the obtained numerical variables was determined visually and by the analysis method of the Kolmogorov-Smirnov/Shapiro-Wilk test and Coefficient of Variation analysis. Numerical variables are displayed as medians and categorical variables are displayed as frequencies and percentages. The results were accepted within the 95% confidence

interval and significance was accepted as $p<0.05$.

RESULTS

Effectiveness test

There is a need to collect data, especially data on basketball shooting techniques based on multimedia animation, to determine the efficacy of the product in the form of a basketball shooting learning model based on game modification, which was tested on 50 research subjects from junior high school students. Following the second field trial and big group test, data collecting was done. data gathering for efficacy tests.

Table 2. Multimedia Animation Based Basketball Pretest and Posttest Data

Class	Cases					
	Valid		Missing		Total	
	n	Percent	n	Percent	n	Percent
Pretest	50	100,0%	0	0,0%	50	100,0%
Postest	50	100,0%	0	0,0%	50	100,0%

The results of the students' pre and post-tests are shown in the above table. The big group test is followed by the pre-test. Before introducing 30 different animated multimedia-based basketball instructional materials, a pre-test was conducted. According to the preceding definition, It is regarded as successful when the average outcomes of the pretest and posttest vary.

Table 3. Descriptive Statistics Results

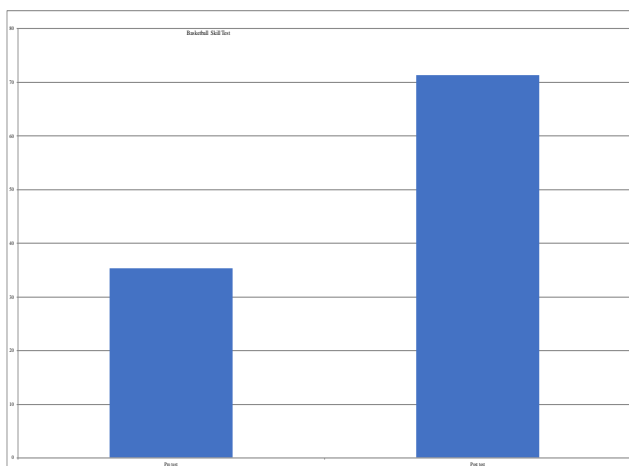| Pair 1	n	M	SD	P Value
Pre-test	50	36.4167	2.73910	0.000 < 0.05
Post-test	50	73.4167	5.95245	

Mean:M; Std. Deviation:SD

According to Athe results, the average value of the animated multimedia-based basketball learning materials before treatment was 36.4167, and after treatment with different animated multimedia learning materials, it was 73.4167, indicating an increase in the average value. basketball strategy.

Table 4. Paired Samples Test Results

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Postest	37,0	6,48879	,91765	38,84409	35,15591	40,320	49	,000

The results of the basketball approach in animation multimedia learning medium before and after treatment differed significantly, according to the findings of the significance difference test performed using SPSS 30.1 (t-count = 40.320, df = 49, and p-value = 0.00< 0.05). On the basis of this data, it can be concluded that the generated multimedia learning materials for basketball methods may significantly enhance learning. The average level of the basketball technique test before and after treatment with basketball animation multimedia learning medium is compared in the table below using the bar diagram in the following of this image:

technology-based media rapidly and effortlessly, which is also very beneficial for teaching pupils the necessary life skills (Zhao & Liu, 2021).

The learning process is a process that involves interaction between students, teachers and students (Roccetti et al., 2020). With this interaction, it is hoped that students can gain an understanding of what is obtained in teaching and learning interactions. In the process of implementing learning in schools there are several factors that influence it, namely internal and external factors, not only that, media or multimedia greatly influences the learning process in achieving maximum learning outcomes (Pedaste et al., 2021). Therefore, it is necessary to develop media innovations or other multimedia developers (Rohman et al., 2022). One of the elements that affects motivation and educational components that are beneficial for assisting students in understanding the topic is learning media. Media needs to be presented in a way that can inspire student learning. Low learning motivation will result from improper media use. The findings of researchers' observations, which show that the vast majority of teachers simply use textbooks as a learning medium, show this. Therefore, kids quickly experience boredom, pay little attention to what they are learning, lack motivation to compete with their classmates, and easily feel content with the outcomes (Chen & Wang, 2021).

The chosen media must be efficient, interesting, and capable of inspiring students to study. Of course, as technology and science advance, there is a need for new media to support instructors in their attempts to motivate their

DISCUSSION

The discussion in this research refers to previous research which is in line. The researcher creates a product concept based on students' learning needs. The resulting product can be given to students via download on a predetermined link. After the researcher creates a product concept, it is followed by expert validation. Researchers validate the product to. Learning media helps lecturers and students to achieve learning goals and increase student learning motivation (Roemintoyo & Wibawanto, 2023) . At the moment, instructors have a variety of learning media options, including electronic-based media. Learning tools including graphics, animations, and videos are thought to be able to benefit pupils who have visual perception issues (Migliorati et al., 2023). Students can get knowledge by utilizing multimedia learning resources effectively. The millennial generation utilizes digital and nondigital

students to study (Wang & Jian, 2023). His study came to the conclusion that teachers who use highly effective media in the classroom will affect their students' learning outcomes. Therefore, it may be claimed that students' learning outcomes provide evidence of the usefulness of learning media. However, in addition to the results of the learning process, the success of media is also demonstrated by the feedback provided by students.

Students are drawn to multimedia because it incorporates a variety of text, image, video, audio, and animation components because it allows them to experience learning in an individual manner (Aryanti et al., 2020). Learning outcomes can be improved via the use of multimedia by encouraging student learning motivation and independent learning processes. Interactive learning tools can increase students' motivation to study and aid in their comprehension of the subject matter (Madinabeitia-Cabrera et al., 2023). The learning outcomes of pupils who are taught utilizing interactive learning media vs those who are not differ significantly. Interactive multimedia instruction is created using issues that arise in daily life. Interest, self-confidence, and other psychological characteristics are among those that are believed to have an uncontrollable impact on study outcomes.

In general, the characteristics of animated multimedia that are developed are self-instructional where students are able to learn independently without other parties, animated multimedia that is developed without depending on other media or does not need to be used in conjunction with other media, users. friendly, meaning that the animated multimedia used meets the aspect of ease of use. In use, the animated multimedia developed has consistency in terms of font, spacing and margins, the entire learning material of one unit of competency or sub-competency being studied is present in its entirety. interactive multimedia. The interactive multimedia specs created are: (1) animation multimedia may inspire kids to learn physical education in a more creative and energetic way; (2) the material presented is in the form of questions presented in an interesting way; (3) this animated multimedia has been validated by media, material and practice experts; (4) this animated multimedia is simple and does not require various complicated media or tools for students to learn; (5) complete if equipped with a guidebook on how to use it, how to solve the questions, answer key, and assessment indicators obtained by the child; (6) The level of student response, the completeness of children's learning outcomes, and the activities shown by children reflect that students are very enthusiastic in solving problems and studying the material provided. Compared to other media, the advantage of this multimedia is that it can contain various media such as audio, text, images and animation. It is hoped that this multimedia can help students provide visual stimulation in understanding basic basketball technique learning.

The novelty of this research is producing learning media for basketball courses based on animated multimedia, with the resulting products in the form of mobile applications, interactive VCDs, printed books and indexed international journals which will later be used well in learning activities. and in independent learning to facilitate the delivery of learning material for physical education measurement tests and make it easier for lecturers and students to achieve the expected goals and produce teaching material products for basketball courses.

Overall, the results of this research support existing research regarding animation-based basketball learning media. The findings and recommendations from this research, namely animated learning media, prove that the results are feasible and effective for use in student learning. Therefore, it is also prioritized to be able to improve basketball technique. The right choice is to use animation learning media as one of the important things to obtain it.

Conclusion

Basketball learning media based on animation multimedia is based on the study findings. References from earlier studies, which are included in the discussion of the findings and comments, further bolster this. According to the findings, creating innovative teaching strategies is crucial. Using animation multimedia-based basketball instructional materials is one such strategy. Additionally, the results demonstrate that the product's effectiveness and efficiency in the classroom are ideal for enhancing students' basketball skill. The results of this study were also refined by expert evaluations. The dissemination and implementation of Animation Multimedia Based Basketball Learning Media will take the shape of a product that is available as an

application on Google Play and the App Store. Using animation multimedia-based basketball learning materials in advanced basketball instruction is one suggestion for further study.

Conflict of interest

The authors declare no conflict of interest. No financial support was received.

Ethics statement

This development research followed ethical standards and received approval from Semarang State University in Indonesia with reference number [20889/UN37.2/EP/2023].

Author Contributions

Study Design, TR and SS; Data Collection, BAM and TR; Statistical Analysis, BAM, TR; Data Interpretation, BAM and SS; Manuscript preparation, BAM, TR, SS and MH; Literature Search, BAM, TR and MH. All authors have read and approved the published version of the manuscript.

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