

Development of Teaching Material for Table Tennis Game for Knockout Serve to Improve the Serve Basic Skills of Eleventh Grade Students of SMA Negeri 2 Pasarwajo, Buton Regency

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ABSTRACT: This study aims to develop, evaluate the feasibility, and measure the effectiveness of teaching materials in improving basic service skills in grade XI students at SMA Negeri 2 Pasarwajo, Buton Regency. The type of research used is research and development (R&D) with a 4-D model approach, which includes the stages of Define, Design, Develop, and Disseminate. The validation process was carried out by three expert lecturers, consisting of two material experts and one media expert. A small-scale trial involved 30 grade XI students of SMA Negeri 2 Pasarwajo who were selected using a random sampling technique. Data analysis techniques used included quantitative and qualitative analysis. The results of the study showed that: 1) The development of teaching materials for knockout serve table tennis was carried out through four stages, namely defining, designing, developing, and disseminating. 2) The feasibility of the teaching materials was assessed as very good based on assessments from material and media experts, with an average score of 4.42 and a percentage of 88.43%. Meanwhile, a small-scale trial on students showed a very feasible category, with an average score of 4.61 and a percentage of 92.31%. 3) The effectiveness test using a paired sample t-test showed a value of -47.677, which indicates a significant difference between the pretest and posttest scores. Thus, the knockout service table tennis teaching material is declared feasible and effective for use in improving the basic service skills of class XI students at SMA Negeri 2 Pasarwajo, Buton Regency.

KEYWORDS: Teaching Materials, Table tennis games, Knockout Serve

I. INTRODUCTION

The curriculum is a set of plans and arrangements regarding the objectives, materials, and methods of implementing learning that serve as a reference in achieving educational goals. Based on Article 29 of Law Number 20 of 2003, the curriculum is defined as a set of plans and agreements that regulate the direction, content, and strategies of learning to achieve the expected educational outcomes (Helmi et al., 2024, p. 1). The curriculum does not merely contain a list of subjects, but also includes a whole series of learning experiences that are systematically designed to support students in achieving predetermined educational goals. In line with the opinion expressed by (Irfiana & Quddus, 2025, p. 359). This curriculum is the basis for designing effective learning, especially at SMA Negeri 2 Pasarwajo in Buton Regency. The curriculum implemented at SMA Negeri 2 Pasarwajo, Buton Regency, especially for grade XI, is the Independent Curriculum.

The Independent Curriculum is a new approach in the Indonesian education system designed to provide more flexibility to educators and students in the learning process (Tumaloto et al., 2024, p. 130) (Hasmarita & Kurnia, 2020, p. 190). The Independent Curriculum is a form of independent learning that gives schools, teachers, and students the freedom to design and manage flexible, relevant learning, and focus on essential materials, competencies, and character. The Independent Curriculum has been implemented in all subjects, especially Physical Education (PJOK), which provides freedom to teachers and students in the learning process to achieve goals according to student needs.

Good PJOK depends on the role of teachers in preparing methods that are appropriate to students' abilities and mastery of the material, in order to create a comfortable and motivating learning atmosphere for students (Dhedhy, 2016, p. 110). PJOK in schools plays an important role by providing opportunities for students to be actively involved in the learning process through physical, sports, and health activities that are designed and implemented in a structured manner. In line with (Widodo & Azis,

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2018, p. 49) PJOK, previously known as Penjas (Physical Education), is basically a form of education that not only focuses on physical development, but also uses physical activity as a means to educate comprehensively.

Physical Education is an integral part of the entire education system, which aims to develop physical fitness, motor skills, critical thinking, emotional intelligence, moral values, and a healthy lifestyle through systematically designed physical, sports, and health activities (Mu'arifin & Kurniawan, 2021, p. 110). Therefore, PJOK can be implemented through various types of games to develop students' physical abilities, technical skills, playing strategies, and mental abilities. Games are activities carried out voluntarily without coercion, free from the pressure of responsibility, and have no specific purpose other than the enjoyment of the game itself (Karim & Wifroh, 2022, p. 104). One form of sports game that is routinely taught to grade XI students at SMA Negeri 2 Pasarwajo, Buton Regency is table tennis.

Table tennis is a game that utilizes a table, ball, and racket as its main equipment (Lestari et al., 2019, p. 96). Table tennis is known as a fast-paced sport, requiring high speed and precision (Haryanto et al., 2024, p. 912). The game of table tennis has various basic stroke techniques that must be mastered, including serve, drive, smash, chop, block, and loop drive. Serving technique is very important and is a primary focus in teaching to 11th grade students at SMA Negeri 2 Pasarwajo, Buton Regency.

Serving in all racket sports is very important because it provides a significant advantage and is expected to be able to win the most points (Raibowo et al., 2024, p. 91). Serving is the initial stage to control the course of the game and becomes the first opportunity to take the initiative to attack. According to (Yudianto, 2018, p. 17) fundamentally, table tennis has two main types of strokes, namely forehand and backhand. The basic forehand and backhand serves are the opening steps in table tennis, also called service. The game begins with a serve, which is bouncing the ball in your own area then over the net and falling on the opponent's table (Fitra & Andrijanto, 2013, p. 566). Serving is the opening step in table tennis and also the initial attack for the player who performs it, a serve that is difficult for the opponent to anticipate can be an effective strategy to start an attack (Ratnasari & Suntoda, 2018, p. 36).

Teaching materials are a collection of learning tools or media that contain the main topics to be studied by students, including knowledge, skills, and values to be instilled in students (Sholeh, 2017, p. 20). Teaching materials must be structured according to instructional principles to assist teachers and are a key part of the curriculum, encompassing subjects and their detailed content. The success of the learning process is greatly influenced by the teacher's role in designing and developing teaching materials.

Teaching materials in the form of concepts, principles, and procedures for table tennis serving in class XI of SMA Negeri 2 Pasarwajo in Buton Regency are still less interesting and not game-based, so innovative teaching materials are needed to increase student interest and skills. The teaching material that will be given to class XI of SMA Negeri 2 Pasarwajo is the knockout serve table tennis game.

Innovation in teaching materials is crucial in learning. Game-based approaches have proven effective in increasing student interest and engagement. One promising innovation is the knockout serve table tennis game, which teaches serving techniques in a competitive and fun way. With its competitive element, this game helps students optimally improve their serving skills.

II. RESEARCH AND METODE

A. Research Design and Sample

This research falls into the research and development category, applying the 4D model. These four stages include Define, Design, Develop, and Disseminate. This method was chosen to produce teaching materials for knockout table tennis service that can be declared valid, feasible, and effective in improving students' basic service skills.

In the definition stage, an analysis of the research problem is conducted, the characteristics of the students as research subjects are identified, and the learning objectives of the material to be presented are determined. The design stage includes the preparation of learning media by creating test instruments, selecting appropriate media and formats, and designing the initial product. Furthermore, the development stage involves a validation process by experts and potential users, as well as the implementation of a trial of the learning media with grade XI students at SMA Negeri 2 Pasarwajo, Buton Regency.

The subjects in this study were all 11th-grade students of SMA Negeri 2 Pasarwajo in Buton Regency, with a total of 116 students, consisting of 53 males and 63 females. This study involved 2 material experts and 1 media expert. The small-scale trial involved 11th-grade students of SMA Negeri 2 Pasarwajo in Buton Regency.

B. Data Collection Techniques and Research Instrument

The data in this study were obtained from observations, interviews, questionnaires, and table tennis service skills tests. In the initial stage, direct observation was conducted in the learning process to determine what problems occurred in table tennis learning in class XI SMA Negeri 2 Pasarwajo in Buton Regency. There were several problems encountered in the learning process,

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one of which was the lack of innovation and the absence of game-based modifications in table tennis games. The interview process was conducted by the researcher with the research subjects directly to gather in-depth information related to the process of implementing the knockout serve table tennis game teaching materials which can improve basic service skills in class XI students of SMA 2 Pasarwajo in Buton Regency.

Questionnaires were distributed to the research subjects to determine the appropriateness of the media and materials used in this study. The test data consisted of basic table service skills performed directly by the subjects. This service skills test utilized learning media, implementing a point system for each serve.

C. Data Analysis Techniques

To collect data, various instruments were used, such as validation sheets, pre- and post-tests, student response questionnaires, and observation sheets. Data analysis was conducted to assess the validity of the product based on predetermined criteria. The research data was analyzed using a quantitative descriptive approach that applied statistical tests using SPSS software. Quantitative analysis is used to describe the research object based on data obtained directly from the sample or population without generalizing or drawing general conclusions (Sugiyono, 2019:153).

Table 1. Validity Criteria

Value	Criteria
$3,76 \leq Va \leq 5$	Very Valid
$2,51 \leq Va < 3,75$	Valid
$1,26 \leq Va < 2,5$	Quite Valid
$0 \leq Va < 1,25$	Not Valid

This development research used a validation sheet as a data analysis technique. The sheet was used by a team of experts to assess and provide feedback on the designed teaching materials. The assessment scale is shown in the table below:

Table 2. Assessment Scores

Information	Score
Strongly Agree	5
Agree	4
Undecided	3
Disagree	2
Strongly Disagree	1

The data analysis process from the validation sheet by the expert team was carried out in several steps: (1) adding up the scores from each assessment category, (2) determining the level of eligibility based on the total scores, and (3) calculating the percentage using a predetermined formula. The scoring criteria on the validation sheet are explained as follows:

Table 3. Validation Sheet Percentage Criteria

Percentage Range (%)	Qualitative Criteria
86-100 %	Very Eligible
71-85 %	Eligible
56-70 %	Fair
41-55 %	Poor
< 40 %	Failed

III. RESULT

A. Product Development Results

This research resulted in a development product in the form of knockout serve table tennis game teaching materials designed to improve the serving skills of grade XI students at SMA Negeri 2 Pasarwajo, Buton Regency. The teaching materials consist of several parts, namely: 1) cover, 2) table of contents, 3) explanation of the knockout serve game concept, 4) learning video, 5) student worksheet (LKPD), 6) learning module, and 7) assessment instrument to measure students' serving skills.

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The validation data from the experts was obtained in quantitative and qualitative forms through a validation sheet. The qualitative data included recommendations and comments regarding the knockout serve table tennis teaching materials, while the quantitative data was analyzed by calculating the average score for all assessment aspects provided by the validators. The results of the validation analysis from the experts and users of the teaching materials are shown in the following table.

Table 4. Media Expert Validation Results

No	Indicator	Validator	Amount	Average	Presentation	Category
1	Teaching material design	5	66	4,40	88%	Sangat Layak
2	Text readability	5				
3	Sound effect selection	4				
4	Background music selection	5				
5	Layer display quality	4				
6	Image quality	4				
7	Animation quality	4				
8	Video quality	4				
9	Lighting	4				
10	Clarity of voice	5				
11	Video smoothness	5				
12	Video duration	4				
13	Narrative quality	4				
14	The attractiveness of the video	4				
15	Ease of information	5				

Based on the table above, the average score was 4.40, with a percentage of 88%, which is categorized as very suitable, as it falls within the 86-100% range, meeting the descriptive analysis criteria and is usable. The validation data from the material experts can be seen in the table below.

Table 5. Media Expert Validation Results

Validation	Mark	Average	Presentation	Category
Material Validation 1	60	4	80%	worthy
Material Validation 2	73	4,86	97,3%	very worthy

Based on the data analysis above, the average scores obtained by the two subject matter experts were 4 and 4.86, indicating a category ranging from feasible to very feasible for use. The quantitative data from the validation also provided various suggestions regarding the knockout serve table tennis teaching materials, both listed on the validation sheet and in the learning media itself. Furthermore, the results of the small group trial, or feasibility test, are presented in the following table.

Table 6. Product Feasibility Test Results

School	number of samples	total value	Average	Presentation	Category
SMA Negeri 2 Pasarwajo	30	2077	4,61	92,31%	very worthy

From the table above, the average score was 4.61, with a percentage of 92.31%, categorized as very suitable for use as learning material and fostering understanding of table tennis. The effectiveness of the teaching materials can be seen in the data below.

Table 7. Pretest and Posttest Effectiveness Test

		Paired Differences			t	df	significance	
		Mean	Std deviation	Std. Error			One-Sided p	Two-Sided p
Pair1	Pretest Posttest	-18.533	2.129	.389	-47.677	29	<.001	<.001

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Based on the results of the pretest and posttest data analysis, the significance value of One-Sided p and Two-Sided p obtained was 0.001, which is less than 0.05, so the null hypothesis (H0) was rejected. Thus, it can be concluded that the development of knockout service table tennis teaching materials has proven to be very effective in improving basic service skills in class XI students of SMA Negeri 2 Pasarwajo, Buton Regency.

IV. DISCUSSION

a. Influence of knockout service table tennis game teaching materials to improve basic service skills in class IX students of SMA Negeri 1 Pasarwajo in Buton Regency.

This study employed the Research and Development (R&D) method because the researcher focused on developing teaching materials. The R&D method itself is a process involving the creation, refinement, and testing of products, while simultaneously striving to find solutions to practical problems (Magdalena et al., 2020, p. 175). The 4D model in development research consists of several stages: Define, Design, Develop, and Disseminate. This model has direct relevance to the current research (Fajri & Taufiqurrahman, 2017), who explain that the 4D model is a step-by-step, structured activity designed as an alternative solution to address needs and adapt to the characteristics of problems in the learning process.

In the first stage, researchers conducted direct observations at SMA Negeri 2 Pasorwajo in Buton Regency. The results of the observations revealed several problems, particularly in table tennis serving techniques. Students' serving skills were still very low, and they tended to make incorrect movements. Lack of understanding of body position, arm swing, and contact between the ball and the racket led to frequent errors during serving, such as the ball not being able to cross the net and the rules being applied incorrectly. According to (Herliana, 2020, p. 49), serving skills are crucial in net play because they can determine, and even be the key to, victory in a match. In addition to the lack of ability to master techniques, it was found that the teaching materials used were very uncreative and not even game-based. Teaching materials that were predominantly theoretical without game elements often made students bored, thus decreasing their motivation and enthusiasm for learning. In line with (Santoso, 2019, p. 14), teaching materials should be made as interesting as possible to arouse students' curiosity and enthusiasm during the learning process. Furthermore, teaching materials also need to be tailored to their learning needs.

The second stage, after analyzing the data obtained from interviews and observations, showed that for teachers and grade XI students, the researcher will create a design for the product's appearance. The first step is to determine and organize the material to be included in the developed teaching materials. This is based on the Learning Outcomes (CP) in the independent curriculum. The teaching materials are also equipped with supporting media such as images, videos, and audio. To ensure the quality of the teaching materials, a validation instrument in the form of a questionnaire that has been tested by expert validators is also prepared. In line with (Mardatillah et al., 2023, p. 100), learning materials need to be designed by considering student characteristics, the objectives to be achieved, and the learning strategies used. The researcher chose knockout service material to improve basic serving skills in table tennis.

The third stage or development, this stage is the process of developing teaching material products by realizing them according to the previously designed design. After the product is completed, the next step is to validate it by experts to obtain assessments, input, and comments that can be used as a basis for researchers to refine the product before being tested on students. The development of teaching materials developed is a knockout serve table tennis game in learning table tennis serving techniques. This product was developed as a solution to various problems that have been found previously, such as low basic serving skills of students, limited variety of teaching materials, and lack of student interest and participation in the learning process. Researchers developed knockout serve table tennis game materials as an effort to improve basic serving skills in grade XI students of SMA Negeri 2 Pasarwajo. This material consists of two main sub-materials, namely understanding basic table tennis serving skills which include the definition and types of serves such as forehand and backhand, and knockout serve game activities which include the definition, rules of the game, and game evaluation.

The final stage, Disseminate, is the application of the developed teaching materials to students. In this stage, researchers piloted the teaching materials on 11th-grade students at SMA Negeri 2 Pasarwajo, Buton Regency.

b. The validity and effectiveness of knockout service table tennis game teaching materials to improve basic service skills in class XI students of SMA Negeri 1 Pasarwajo in Buton Regency.

The development of knockout serve table tennis teaching materials underwent a trial to determine their validity before being implemented with students. Researchers conducted a validity test, assessed by two expert lecturers, and the validation results were both 97%, categorized as highly valid. Several other factors demonstrated validity, including: 1) The knockout serve table tennis teaching materials are able to implement and apply technological advances, allowing students to see, observe, and even

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hear the movements and steps directly. 2) The addition of media that follows global trends will certainly attract students' attention and enthusiasm. 3) The use of grammar pays attention to accuracy in language use.

The effectiveness of the knockout serve table tennis teaching materials was determined by student scores in tests and questionnaire responses from both students and teachers. Implementation of the teaching materials was conducted in two sessions. Learning began with a technical explanation, followed by students studying the distributed teaching materials. After the lesson, they completed a questionnaire as feedback on the teaching materials. The total score obtained was 2077 with an average score of 4.61 and a presentation score of 92.31% with a very suitable category for use as learning material for table tennis. Another factor that can show the effectiveness of the use of these teaching materials is seen from the enthusiasm and enthusiasm of class XI students of SMA Negeri 1 Pasarwajo in Buton Regency in performing movements/during knockout service practice in table tennis games.

The effectiveness test in this study was conducted to prove the proposed hypothesis, using a paired sample t-test. The test results showed a significance value of one-sided p and two-sided p of 0.001, which means it is smaller than 0.05. Thus, the alternative hypothesis (H_a) is accepted. This shows that the development of knockout service table tennis teaching materials has proven very effective in improving the basic service skills of grade XI students at SMA Negeri 2 Pasarwajo, Buton Regency.

V. CONCLUSIONS

Through this research, the researcher concluded the following: (1). The development of knockout service table tennis teaching materials to improve basic service skills in class XI students of SMA Negeri 2 Pasarwajo was carried out by applying the 4-D model, which includes the stages of defining (Define), designing (Design), developing (Develop), and disseminating (Disseminate). (2). The validation results showed that the teaching materials were suitable for use. Material expert one gave a score of 4 (80%, suitable), material expert two 4.86 (97.3%, very suitable), and media expert 4.40 (88%, very suitable). The overall average was 4.42 with a percentage of 88.43%, included in the very suitable category. Small-scale trials by students resulted in an average score of 4.61 (92.31%), also classified as very suitable as PJOK teaching materials for class XI at SMA Negeri 2 Pasarwajo in Buton Regency (3). Based on the effectiveness test results, the data showed a normal distribution because the significance value before treatment was 0.247 and after treatment was 0.074, both exceeding the 0.05 limit. Then, the results of the paired sample t-test produced a significance value (p-value) of 0.001, which is smaller than 0.05, so H_0 is rejected. This means there is a significant difference between the conditions before and after the use of teaching materials.

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