

Development of Interactive E-Modules in Physical Education for Badminton Material for Seventh Grade Junior High School Students in Kendal Regency

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Abstract

This study was motivated by the use of teaching materials that are still dominated by conventional printed modules that are less interactive, less varied, and not yet integrated into a single digital platform that combines material, technical visualization, exercises, and evaluation. This study aims to produce interactive E-Modules that are suitable and effective for badminton material for seventh grade junior high school students. The method used is Research and Development (R&D) with the Borg and Gall model consisting of 10 steps. Data were collected through observation and questionnaires, then analyzed descriptively, quantitatively, and qualitatively. The results of validation by media experts, subject matter experts, and learning experts obtained an average of 92% (excellent category). The small-scale trial obtained 83% (very good), and the large-scale trial obtained 90% (very good). The effectiveness test showed a percentage of 87%, so the E-Module is categorized as effective. Thus, the interactive E-Module developed is feasible and effective for use in supporting learning in junior high schools.

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INTRODUCTION

Education is very important in today's world (setiawan, 2022). The main purpose of education is to improve the quality of human life. One way to achieve this is through the teaching and learning process at school (aripin et al., 2024). Learning is the process of changing a person's behavior, from initially being unable to do something to being able to do it. Learning involves interaction between students and teachers, or between learners and facilitators (setiawan et al., 2024). In this process, teachers also use various learning media such as books, modules, and other tools that are tailored to the chosen learning model (ardiansyah, 2023).

Effective learning is very important to support the success of education, especially in physical education (setiawan et al., 2025). Education will feel incomplete without physical education (hidayah & setiawan, 2023). Currently, physical education learning is still not well developed due to limited textbooks and teaching methods that lack innovation. As a result, students become less interested and enthusiastic about participating in physical education classes (prayuda, 2022).

Currently, traditional teaching methods are no longer effective enough to achieve the maximum learning objectives of physical education. Therefore, creativity and innovation are needed in the learning process so that the quality of physical education can be improved and keep up with the ever-changing needs of education (li et al., 2024). Teachers are required to deliver lessons well, create a comfortable learning environment, and use learning media that is interesting, creative, and innovative. This is important so that students can understand the material more easily and learning objectives can be achieved (resmini et al., 2021). In today's digital era, many things are technology-based, where technological advances are rapidly increasing and the education system

is required to be able to face various challenges. The use of digital technology in education is also developing rapidly in line with the times. Specifically in physical education, digital technology can be utilized to support the teaching and learning process to make it more effective and interesting (natalia & sukraini, 2021). According to (fajar sidik siregar et al., 2024) the use of digital technology in the physical education learning process can encourage an increase in student motivation to learn. Success in achieving educational goals is highly dependent on how students engage in the learning and teaching process. According to (fitriady et al., 2020) the use of interactive multimedia has been proven to enhance students' skills and understanding of lesson materials, making the learning process more engaging, efficient, and easier to comprehend. According to (saputri et al., 2024) the problem that arises is that many teachers do not yet have the ability to utilize technology in developing subject matter and learning aids that can support students in the learning process. Several previous studies have shown that the use of E-Modules significant in the learning process has a effect on increasing student engagement. This can be seen from the increased interest and enthusiasm of students in participating in learning activities and in utilizing E-Modules as a learning resource (sukawirya et al., 2017 in saputri et al., 2024). Research conducted by (azhari et al. 2022 dalam wardani et al., 2025) hows that the limitations of conventional media are one of the causes of low student engagement in PJOK learning. Meanwhile, according to (mayer 2020 in wardani et al., 2025) the use of a combination of text, images, animations, and audio in learning can help improve concept understanding while strengthening students' memory. This confirms that the use of digital learning media is an important requirement in the modernization of PJOK learning. Along with advances in educational technology, various innovations in digital

media have begun to be applied to overcome these challenges.

The results of observations at junior high schools in Kendal Regency show that, first, the teaching materials used are still dominated by conventional, non-interactive printed modules. Second, learning in the digital age requires more innovative, easily accessible media that can support flexible learning both at school and at home. Third, the available exercises or learning activities are still lacking in variety and do not utilize interactive features that can provide immediate feedback to students. Fourth, the availability of integrated digital learning media is still limited, especially those that are able to combine material presentation, technical visualization, exercises, and evaluation in a single platform that is easy to use and in line with the developmental characteristics of junior high school students. This condition makes the learning process less than optimal, especially in supporting students to learn flexibly and independently.

Based on these issues, this study developed an interactive E-Module learning medium. The media is designed according to the characteristics of junior high school students. Therefore, this study aims to develop E-Module learning media, determine the feasibility of the media based on expert assessment, and test its effectiveness. The presence of the E-Module is expected to help students understand badminton material more effectively and serve as a tool to strengthen the learning process carried out by teachers. Education is very important in today's world (setiawan, 2022). The main purpose of education is to improve the quality of human life. One way to achieve this is through the teaching and learning process at school (aripin et al., 2024). Learning is the process of changing a person's behavior, from initially being unable to do something to being able to do it. Learning involves interaction between students and teachers, or between learners and facilitators (setiawan et al., 2024). In this

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METHODS

This study uses the research and development method. This method aims to produce or refine a product that can be used as a solution to various problems in the field of education. The development procedure in this study refers to the stages of Research and Development according to Sugiyono (2019), which includes several systematic steps, namely: (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revision, (6) product testing, (7) product revision, (8) usage testing, (9) product revision, and (10) mass production.

Figure 1 Borg and Gall's 10 Step Procedure



Instrumen Penelitian

The instrument used in this study was a questionnaire. A questionnaire is a data collection technique that involves providing questions or statements to respondents to be answered in writing (Sugiyono, 2019).

Expert questionnaires were given to several parties with expertise in specific fields, namely media experts with competence in interactive E-Module media, material experts who understand badminton material, and learning experts who understand the field of learning. The purpose of filling out the questionnaire by these experts was to determine the level of validity or feasibility of the developed product.

In addition, the questionnaire was also filled out by students to provide an assessment of the tools used. The assessment in the questionnaire used a Likert scale with the following range of values: 1) strongly disagree, 2) disagree, 3) agree, 4) strongly agree.

Table 1 Media Expert Validation Grid

Aspect	Indicators	Item
Self Intruction	- Independent learning according to ability - Adjusting to abilities Item and Self-contained needs - Interesting videos - Easy-to understand information	5,12,14,15
Self Contained	Complete materials, exercises, and evaluations	8
Stand Alone	Studied without other media	11
Adaptive	- Displays material clearly - Smooth video playback	4
User Friendly	- E-Modules comply with learning principles - Appropriate text and font - Comfortable screen display	1,2,3,4,7,9,10

	- Clear images - Appropriate sound - Easy and attractive display and language - Sufficient lighting	
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Table 2 Expert Validation Grid For Content

Aspect	Indicators	Item
Self Intruction	- The explanation of basic techniques is clear and easy to understand. - Exercises and activities are relevant to the material. - The material in the E-Module is motivating. - Can learn independently through the E Module	5,13,14 15
Self Contained	- The material is in line with the CP and TP - The material covers the basic concepts of badminton - The breadth of the material is sufficient - Badminton terms are clear.	1,2,6, 9
Stand Alone	- The material presented is accurate - The language is easy to understand	4,8
Adaptive	- Material tailored to characteristics - The material is motivating	3,14
User Friendly	- Clear images and videos - Sentence structure is appropriate - Presentation of material follows a logical flow - Sub-topics are sequential	7,10,11, 12

Table 3 Validation Grid For Learning

Aspect	Indicators	Item
Self Intruction	- Increases student activity. - Helping students' understanding. - Supporting independent learning. - Encouraging participation in badminton learning.	4,8,11, 15
Self Contained	- Interactivity aids learning. - Easy-to understand material. - Clear instructions. - Videos and images provide support.	5,6,7, 9
Stand Alone	- Facilitates badminton learning. - Assists teachers in teaching physical education.	10,14
Adaptive	- Learn according to ability. - Tailored to the student's personality.	11,12
User Friendly	- Attractive interface, boosts motivation. - Easy navigation, smooth learning. - Structure consistent with the material. - Easy-to-read text and images.	1,2,3, 13

Tabel 4 User Questionnaire Grid

Aspect	Indicators	Item
Self Intruction	- Self-directed learning. - Easy to learn. - Simplifies badminton material. - Quickly understand the material. - Boosts motivation.	4,7,12, 18,19
Self Contained	Clear and comprehensive information.	9,10,11, 16

	- Helps understand badminton material. - Effectively completes tasks. - Meets all learning needs.	
Stand Alone	- Effectively and efficiently 3, 5, 8 completing tasks. - Enhancing learning productivity.	3,5,8
Adaptive	Satisfied with the ease, performance, and functionality of the E-Module.	1,17
User Friendly	- Simple and comfortable to use. - Clear layout. - Facilitates learning. - Attractive display.	2,6,13, 14,15,20

Data Analysis Techniques

The data analysis techniques used in this study are quantitative descriptive analysis and qualitative descriptive analysis. Quantitative data was obtained from the validation sheets filled out by experts and from product feasibility assessment questionnaires filled out by students.

Meanwhile, qualitative data was obtained from input, suggestions for improvement, and information about the shortcomings and weaknesses of the products that had been developed. The data obtained was then calculated and converted into percentages. The formula used to process quantitative data is as follows:

$$P = \frac{f}{n} \times 100\%$$

Explanation :

P = Percentage Value

f = Frequency of answers

N = Total number of respondents

100% = Constant

Next, the scores will be classified into five score categories according to (Arikunto 2010 dalam Hasan et al., 2021) as follows :

Table 5 Percentage Assessment Criteria

No	Percentage	Classification
1.	0-20%	Very Poor
2.	21-40%	Poor
3.	41-60%	Fair
4.	61-80%	Good
5.	81-100%	Very Good

To determine the level of learning effectiveness, an analysis was conducted on student learning outcomes after the learning process was completed. The learning outcome data was then analyzed by calculating the average value of student learning outcomes using the following formula:

$$X_{pk} = \frac{Apk}{n}$$

X_{pk} : Level of learning effectiveness

Apk : Total percentage of learning outcomes of all students from all meetings

N : Number of meetings

The percentage of effectiveness obtained from student learning outcomes was then interpreted or explained based on the effectiveness level criteria in the following table (Mingka, 2022).

Tabel 6 Effectiveness Assessment Criteria

No	Persentase Kualitas Efektif	Kategori
1.	1% ≤ P < 24%	Not Effective
2.	25% ≤ P < 49%	Less Effective
3.	50% ≤ P < 74%	Moderately Effective
4.	75% ≤ P < 100%	Effective

Product Design

The product developed in this study is an interactive E-Module for Physical Education, Sports, and Health learning. The material covers badminton for seventh-grade junior high school students. This E-Module is designed to help students understand the material in a more engaging, interactive, and flexible way through application-based digital devices. presentation of material in the E-Module is supplemented with text, images, instructional videos, and animations

aimed at improving students' understanding and motivation to learn.

The interactive E-Module content design developed includes the following sections:

1. Learning Outcomes

This section contains the learning outcomes that students must achieve after studying badminton material. The learning outcomes are adjusted to phase D so that students can identify the expected competencies after the learning process.

2. Learning Objective

The learning objectives outline the abilities that students are expected to achieve after studying the material in the E-Module. These objectives are clearly defined so that students understand the learning outcomes to be achieved.

3. Instructions For Using The E-Module

This section contains guidelines or steps for students to use the E-Module so that they can operate and utilize the E-Module properly.

4. Learning Materials

The learning materials provide explanations of basic badminton techniques presented in a systematic manner. The materials are displayed in text format combined with images, instructional videos, and animations to help students better understand the concepts and movements of basic badminton techniques.

5. Summary

This section provides a summary of the material that has been studied. The summary aims to help students recall the important points from the badminton material that has been studied.

6. Sample Questions

This section contains several practice questions designed to help students practice their understanding of the material that has been studied before taking the evaluation.

7. Evaluation

The evaluation consists of questions used to measure students' level of understanding

after studying all the material in the E-Module.

8. Psychomotor Evaluation

Psychomotor evaluation is used to assess students' skills in practicing basic badminton techniques on the court. Assessment is based on predetermined skill criteria or indicators.

9. Glossary

The glossary contains a list of important terms related to badminton material along with explanations to help students understand the terms used in the material.

10. Bibliography

The bibliography includes reference sources used in the development of the E-Module material, including books, journals, and other relevant sources related to badminton learning material.

With this product design, it is hoped that the interactive E-Module developed can become an effective and interesting learning medium, as well as being able to help students understand badminton material in PJOK lessons in the seventh grade of junior high school.

RESULTS AND DISCUSSION

Effective physical education learning at the junior high school level can be achieved through systematic learning that is tailored to the characteristics of the students. However, based on initial observations, it appears that badminton material is still taught in schools using conventional methods that focus on teacher explanations and simple practices, so the use of interesting and interactive learning media is still limited.

Based on preliminary studies, the problems found in the teaching materials used are still dominated by conventional, print-based modules that lack interactivity. Second, learning in the digital age requires more innovative, accessible media that can support flexible learning both at school and at home. Third, the available exercises or learning activities are still lacking in variety and do not utilize interactive features that

can provide immediate feedback to students. Fourth, the availability of integrated digital learning media is still limited, especially those that are able to combine material presentation, technical visualization, exercises, and evaluation in a single platform that is easy to use and suits the developmental characteristics of students. This study developed an interactive E-Module for physical education lessons on badminton for seventh-grade junior high school students in Kendal Regency. This E-Module was designed using interactive digital media to help students understand the concepts and basic techniques of badminton in a more interesting and easy-to-understand way. The development of this E-Module is expected to increase learning motivation, student activity, and student learning outcomes in physical education lessons.

Expert Validation of Initial Product Draft

Before the initial product resulting from the development of interactive E-Modules for badminton material was tested on a small scale, a validation stage was first carried out by experts. This stage aimed to assess the feasibility of the product and identify any shortcomings that still needed to be improved based on input from the experts. In this validation process, we involved media expert Muhammad Bakhtiar Subardi, S.Pd., M.Pd, who is an expert in the field of media, and subject matter expert Dr. Agus Raharjo, S.Pd, M.Pd, who is a lecturer in the field of badminton, as well as learning expert Khoerul Hidayat, S.Pd, who is a physical education teacher at SMP N 2 Cepiring. This validation process aims to assess the aspects of self-instruction, self-contained, stand-alone, adaptive, and user-friendly. The suggestions and input from the experts are used as a basis for improving the product so that the developed media is suitable and effective for use in physical education learning on badminton material.

To analyze the validation results, this study used percentage- s analysis techniques

as the basis for determining the feasibility level of the learning model.

Table 6 Expert Percentage Result

No	Ahli	Hasil	Keterangan
1.	Muhammad Bakhtiar Subardi, S.Pd., S.Pd. (Media Expert)	88%	Very Good
2.	Dr. Agus Raharjo, S.Pd., M.Pd. (Subject Matter Expert)	93%	Very Good
3	Khoerul Hidayat, S.Pd. (Learning Expert)	93%	Very Good
Average		92%	Very good

The suggestions and input from the experts were obtained as evaluation material to refine the developed learning model, so that the game-based learning model becomes more effective, practical, and in line with the characteristics of elementary school students. Tabel 7 Improvement Suggestions by Experts

No	Expert Name	Suggestions
1	Muhammad Bactiar Subardi, S.Pd., M.Pd.	1. Replacing the cover design with one that is more appropriate for teenagers, using illustrations or photos of badminton activities that are more realistic, colors that are more bold, and simple yet modern typography. These changes are intended to make the E Module look more professional and attractive to

		junior high school students. 2. The sound in the video was deemed suboptimal in supporting the delivery of the material. As a follow-up, adjustments were made to the audio quality by adding clearer and more balanced sound, and adjusting the volume so as not to distract the students' concentration. The background sound was chosen to be simple and not excessive.
2	Dr. Agus Raharjo, S.Pd., M.Pd	1. In the initial version, the badminton material was considered too complex and contained concepts and techniques that were not fully in line with the developmental level and characteristics of the students. Therefore, the material was simplified by focusing on mastering basic badminton techniques. 2. The sequence of material Alif Mazida Salsabila & Ipang Setiawan./ JPES 10 (1) (2026) presentation

		starts from the simplest concepts and moves on to their application in practical activities. Advanced material or material that requires a higher level of skill is reduced or eliminated so that learning is easier to understand and does not burden students.
3	Khoerul Hidayat, S.Pd.	The e-module used has demonstrated good quality in helping students understand and learn the basic techniques of badminton. Moving forward, it is hoped that the quality and features of the application can continue to be developed and improved, particularly in the presentation of advanced badminton techniques, so that it can provide more comprehensive and sustainable learning support.

Small Scale Trial Phase I

Tabel 8 Small Scale Trial Data Phase I

Small Scale Trial	VII A	VII B	Average Percentage
Skala Kecil I	80%	82%	81%

The table presents the results of the small-scale trial phase I of the interactive E-Module on badminton material, which was assessed through 20 statements in a student response questionnaire. This trial involved 64 seventh-grade junior high school students

at SMP N 2 Cepiring as respondents. Each statement shows the number of students who responded positively to the E-Module, which was then converted into a percentage.

Overall, the average percentage of student responses to the interactive E-Module on badminton material reached 81% and was categorized as Very Good. These results indicate that the E-Module is acceptable to seventh-grade junior high school students because it is considered interesting, easy to use, and able to support student engagement in the physical education learning process. Therefore, the interactive E-Module. During the implementation of the small-scale trial phase 1, several technical obstacles were found. These problems need to be followed up so that the developed product is truly in line with user needs and suitable for use in learning. The problems that arose are as follows:

1. During the small-scale trial, several students encountered difficulties in downloading the E Modules. This was because the download process took a long time, so that part of the learning time was spent waiting for the E Modules to finish downloading. Students were instructed to download the E-Modules before the lesson began. This was done so that learning time could be used optimally without being hampered by the lengthy download process.
2. In conducting small-scale interactive E Module development research, time constraints became an obstacle because the learning process included classroom explanations that had to be completed first, followed by practical activities in the field. This situation resulted in limited time allocation for each activity. Students were advised to prepare themselves and understand the material independently before learning, so that class time could be fully utilized for additional explanations activities in the field.

Small Scale Trial Phase II

Tabel 9 Small Scale Trial Phase II Data

Small Scale Trial	VII A	VII B	Average Percentage
Small Scale Phase II	84%	84%	84%

The table shows the results of the second phase of small-scale testing of the interactive E Module on badminton material, which was assessed using 20 statements (P1–P20). This test involved 64 seventh-grade junior high school students who responded to the E-Module learning material after improvements were made based on the results of the previous test. Each statement reflects the number of students who gave a positive response, which was then converted into a percentage.

Overall, the results of the second phase of small-scale testing showed an average percentage score of 84% on the , which falls into the Excellent category. These results indicate that the interactive E-Module developed is increasingly easy to use, engaging, and aligned with the characteristics and needs of seventh-grade junior high school students. This improvement in results demonstrates that the product revisions made after the Phase I trial had a positive impact, thereby making the interactive E Module on badminton suitable for progression to a larger-scale trial.

Large Scale Trial

Figure 2 Big Data Analysis



Based on the percentage diagram of the results of large-scale trials conducted in three stages, there was a very clear improvement in the quality and feasibility of the interactive E-Module for badminton material. In the Phase I large-scale trial, the E-Module obtained a percentage of 88%, which shows that the E-Module is still in the very good category and still needs improvement so that it can be used optimally in physical education learning. After improvements were made based on the evaluation results in Phase I, the results of the Phase II large-scale trial showed a significant increase with a percentage of 89%. This result falls into the excellent category, indicating that the E Module has met most of the feasibility criteria, in terms of appearance, ease of use, and suitability of the material to the characteristics of seventh-grade junior high school students.

In the large-scale trial of Phase III, the interactive E-Module again experienced an increase of 94%, which is in the excellent category. These results show that the E-Module has achieved a very high level of feasibility and is ready for widespread use in physical education learning of badminton material. Overall, the average of the large-scale trials I, II, and III reached a presentation of 90%, which is in the excellent category. The percentage increase from Phase I to Phase III shows that the interactive E-Module for badminton material has undergone a gradual and continuous improvement in quality, making it suitable for use as a learning medium for seventh-grade junior high school students.

Tabel 13 Product Effectiveness Results

Trial Phase	Percentage of Implementation
Small Scale Trial Phase I	81%
Small Scale Trial Phase II	84%
Large Scale Trial Phase I	88%
Large Scale Trial Phase II	89%
Large Scale Trial Phase III	94%
Media Effectiveness	87%

Overall, the analysis results show that the Interactive E-Module learning media has an effectiveness level of 87%, which is classified as effective. Thus, this media is considered suitable for use in physical education, especially for seventh-grade junior high school students learning badminton.

Description of Final Product Draft



The final product of this development research is an interactive E-Module for Physical Education, Sports, and Health (PJOK) learning on badminton for seventh grade junior high school students that can be used as a digital-based learning medium. This E-Module is designed to help students understand the learning material in a more interesting, interactive, and flexible way through Android-based devices. This interactive E-Module was developed by combining various multimedia elements such as text, images, instructional videos, and animations that are systematically arranged to make it easier for students to learn basic badminton techniques. In addition, the E-Module display is made attractive and easy to use so that students can access the material more comfortably both inside and outside the classroom.

This interactive E-Module product consists of several main parts, namely learning outcomes, learning objectives, instructions for using the E-Module, learning materials supplemented with videos and animations, material summaries, practice questions, learning evaluations, psychomotor evaluations, glossaries, and bibliographies. The material presented in this E-Module focuses on basic badminton techniques tailored to the characteristics and level of

understanding of seventh-grade junior high school students. The use of instructional videos in the E Module aims to provide clearer examples of basic badminton techniques so that students can understand the steps more easily. In addition, the animations help clarify the concepts of the movements and increase students' interest in learning the material. This E-Module also includes exercises and evaluations designed to measure students' level of understanding of the material they have learned. In addition, there is a psychomotor evaluation used to assess students' ability to practice basic badminton techniques directly on the court. With this interactive E-Module, it is hoped that the PJOK learning process, especially in badminton, can be more interesting, effective, and able to increase students' motivation and understanding in learning the basic techniques of badminton.

Product Advantages

In an effort to improve the effectiveness of PJOK learning, the use of digital-based learning media has become an increasingly important alternative. One of these is the interactive E Module, which is designed to help students understand the material independently and in an engaging way. This interactive E-Module has a number of advantages that support the student learning process. E-Modules can be used anytime and anywhere without being bound by time and place, thus providing flexibility for students in learning. In addition, E-Modules can be accessed through Android-based devices, making it easier for students as most of them already have such devices. Within the E-Module, there is an evaluation feature that allows students to measure their level of understanding of the badminton material they have learned. Once downloaded, the E-Module can be accessed offline, so students can continue learning even without an internet connection. The material is presented interactively through a

combination of text, images, and animations, thereby increasing the interest and motivation of seventh-grade junior high school students to learn. The attractive and systematic display of the E-Module also helps students understand basic badminton techniques more easily and in a structured manner.

Product Shortages

Although this interactive E-Module is designed to facilitate PJOK learning, especially badminton material, the use of digital media still has several limitations that need to be considered. Currently, the E-Module cannot be used on iOS based devices, so its use is still limited to certain devices. Continuous use of digital devices for long periods of time has the potential to cause eye strain if not accompanied by adequate rest periods. In addition, the E-Module requires devices with sufficient storage capacity, so students with low-spec devices may experience difficulties in operating it. The process of downloading E Modules on some devices can take a long time, which can be an obstacle for some students in accessing learning materials. Furthermore, E Modules cannot be installed on devices that use parental control mode , so students who use these settings need permission or adjustment of settings before they can access the application.

CONCLUSION

Based on the results of research and development, it can be concluded that the interactive E-Module for physical education lessons on badminton developed is suitable and effective for use by seventh grade junior high school students in Kendal Regency. The results of validation by experts and trials on a small and large scale show that the use of this E-Module is able to improve students' understanding of badminton material. In addition, this interactive E-Module can also increase learning motivation and student

activity, as well as make the learning process more interesting and easier to understand. Thus, the development of an interactive E-Module on badminton material can be an alternative innovative learning medium for physical education teachers in improving the quality of learning for seventh grade junior high school students in Kendal Regency.

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