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Development of Learning Media for the Katapel Quiz Application on the Concept of Energy in Living Systems

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Abstract: This research aims to produce a product and describe the validity, practicality, and effectiveness of the Katapel quiz application learning media on energy in living systems. The research method used is Research and Development (R&D) research and uses the 4D development model. The research target was class VII of SMP Negeri 1 Asparaga, involving 22 students. The results of Katapel quiz application consist of validity obtained 3.73 in the "valid" category; practicality obtained 85.71% in the "Very Good" category, and through student response questionnaires, which received 88.59% in the "Very Good" category; the effectiveness obtained 84.42% in the "Good" category and through learning outcomes tests of students who obtained a pretest score of 39.09% and a posttest of 90.55% with an N-Gain of 0.84 in the "high" category. The research results concluded that the learning media for the Katapel quiz application had met the valid, practical, and effective criteria for improving student learning outcomes on the subject of Energy in Living Systems.

Keywords: Energy; Katapel quiz; Learning media; Living system

Introduction

Education plays a key role in efforts to enhance a nation's intellectual development. Elevating the quality of education, particularly within the learning process is essential because it can influence the delivery of the material that will be given (Hafizah, 2023; Kusnanto et al., 2023; Shavkidinova et al., 2023). Material can be digested or absorbed by students if the learning process has reciprocal interaction and can motivate students. Implementation of the learning process of education is very important. With the learning process in the classroom, it can create reciprocal interactions between educators and students (Alsalhi et al., 2024; Hwang et al., 2023; Mafarja et al., 2024). Government Regulation No. 19 of 2005 on National Education Standards, specifically in Article 19, stipulates that the learning process in educational institutions should be conducted in an interactive, inspiring, enjoyable, challenging, and motivating manner way for students to actively participate in increasing their potential according to their talents and interests. Students to support their physical and psychological development (Aldalur & Perez, 2023; David & Weinstein, 2024; Faiqoh, 2023; Rone et al., 2023; Solekhah et al., 2020).

The continuity of the learning process in the classroom requires good facilities so that students can carefully receive the material provided by the teacher (Antoninis et al., 2023; Paquera, 2023). The learning process has three important components in its implementation, namely: Teachers as educators, students acting as students who receive material, and facilities in the form of media or other learning resources (Badmus, 2023; E. Pratiwi, 2023). In implementing the learning process, media is one of the main components to support students to be careful in capturing the material provided, namely by using learning media, and educators must be able to present more innovative learning media facilities in accordance with current

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rapid technological developments (Charline et al., 2023; Humairah & Safutri, 2023; Sriwati & Syam, 2023).

Learning media is a critical element impacting the quality of education delivery (Afifa & Astuti, 2024; Febrina & Setiawan, 2024; Meliyana & Rohmani, 2024; Yusuf, 2023). The proper selection and use of media that align with the characteristics of the subject matter, combined with the application of appropriate learning methods, will lead to high-quality educational outcomes (Fathurohman et al., 2023; Nababan et al., 2023; Yanto, 2019). If the media used for learning is more interesting, the level of student motivation will be higher. Students will be more enthusiastic in participating in learning (Ananda et al., 2023; Nuraysha et al., 2024; Yusnidah, 2022). Currently, learning media is only used conventionally, such as teaching aids, textbooks, whiteboards, and PowerPoint presentations. The availability of learning media that keeps pace with current technological developments still needs to be increased. This makes students less interested in learning and less focused on learning (Cui et al., 2023; Fatra et al., 2023; Rahmawati & Qamariah, 2023; Sukamto & Ardiansyah, 2023).

This is in accordance with the results of researchers' observations at SMP Negeri 1 Asparaga that teachers still use conventional learning media. At one time, the teacher used learning media that involved students in a game; the students were very enthusiastic and interested in learning because it was easy to understand and not boring. However, the use of learning media, which requires quite a long preparation time, makes teachers tend to rely more on traditional learning media, such as power points or teaching aids, which make students not too active and enthusiastic in participating in the learning process so that learning objectives are not achieved. There needs to be increasing effectiveness on student learning outcomes.

Therefore, practical and innovative learning media are needed; in this case, learning media can encourage students' activeness, enthusiasm, and interest in learning about the science learning in the classroom. One way is to use the game method. A game that can be an alternative solution in the learning process is the Katapel game. Katapel games can be used as a learning medium. Katapel games are liked by various groups of society, especially students who are still studying at elementary and middle school levels. This can make students interested in participating in the learning process.

Based on the description above, the researcher provides a solution that can be used, namely the use of a Katapel game, which is packaged as an application containing material and quizzes that can be used as learning media using the student teams' achievement division (STAD) type cooperative learning model. This STAD-type cooperative learning model allows students to work together in a small group to achieve a common goal. This model is quite effective and interesting when using the learning media Katapel quiz application in the learning process.

The researcher aims to provide a solution for the Katapel Quiz application to preserve the traditional Katapel game in digital form, which is easy for students to play during the learning process using smartphones; this is because currently, students often use smartphones in their daily activities, so it is easy for them to learn by using smartphones as a modern learning medium. Adam et al. (2023) reported, a smartphone is a tool that can be used as a teaching aid or as a tool to provide information to children or adults.

Apart from that, the researcher aims to provide a learning media solution for the Katapel Quiz application, so that the traditional Katapel game is innovated into an application that aligns with current technological advancements. Apart from that, with the Katapel Quiz application learning media, students can play while learning, be more active in class, work together in solving problems, and improve the quality of teaching. This is in accordance with the opinion of Jais (2019) that such an atmosphere will make students more focused on the learning process so that they can increase their attention to the topic presented by the teacher. Based on the explanation, the researcher intends to research the development of learning media with the topic development of learning media for the Katapel quiz application on energy material in living systems in class VII of SMP Negeri 1 Asparaga.

Method

This development research focuses on developing learning media for the Katapel Quiz Application on topic of Energy in Living Systems. Using the Research and Development (R&D) type of research, the development model used in this research is the 4D model (Define, Design, Develop and Disseminate). This development research was carried out at SMP Negeri 1 Asparaga, Karya Indah Village, Asparaga District, Gorontalo Regency, during the 2023/2024 academic year.

The preliminary study's stage was to collect the information needed to analyze the problem by first making observations at SMP Negeri 1 Asparaga. The researcher observed teaching and learning activities in the classroom carried out by the class VII science subject teacher. The results of this field study became a basis for researchers to draw conclusions about problems in schools and find solutions to these problems.

4D Model Development and Product Design

Flowchart of 4D model development in Figure 1 using Research and Development (R&D) with 4D (Define, Design, Develop, and Disseminate) model.

However, this research was only limited by Define, Design, and Develop.

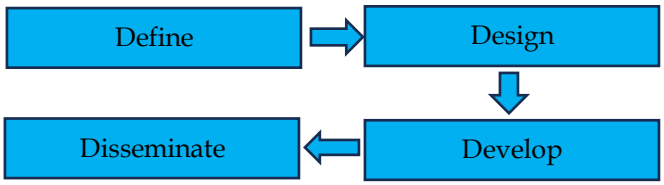


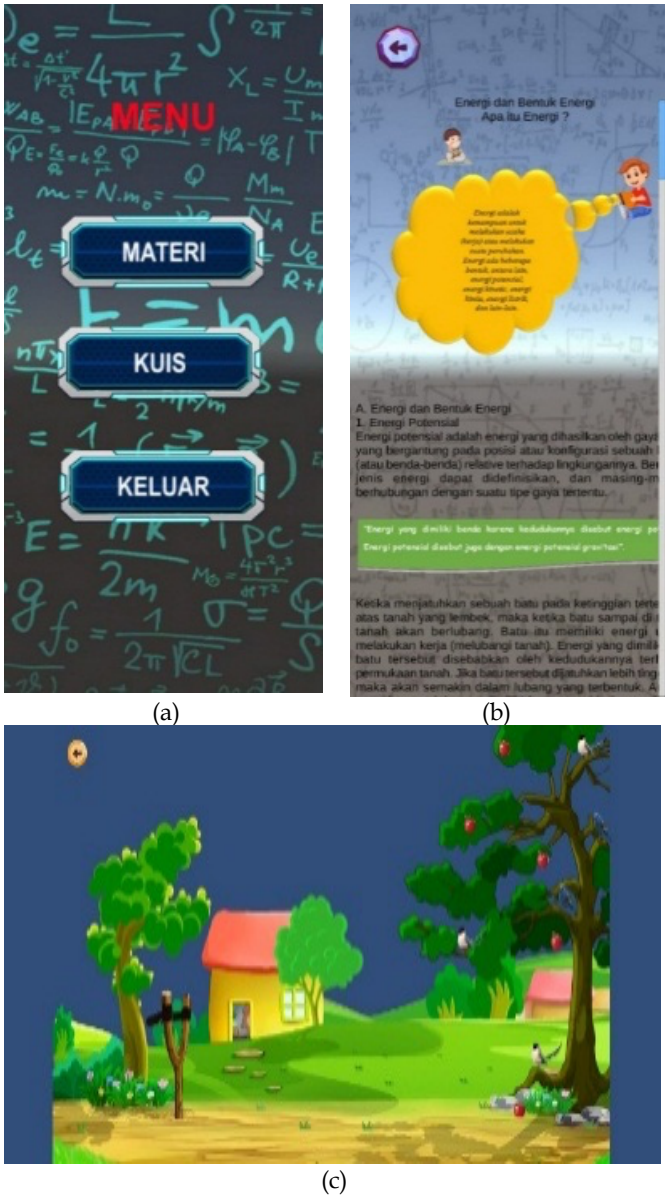
Figure 1. Flowchart of 4D model development

Define

The researcher examined the relevant curriculum and the classroom learning process in this stage, the teacher's use of learning media, and students' participation in learning activities. This stage includes front-end analysis, student analysis, concept analysis, task analysis, and the development of learning objectives. Front-end analysis was analyzed and determine the fundamental problems. The student analysis aims to determine students' characteristics according to the design and development of the Katapel Quiz application learning media. This concept analysis aims to identify, detail, and organize systematic concepts relevant to teaching based on the learning media development carried out. Task analysis is conducted to assess the competencies to be attained according to the curriculum and syllabus, outline the content of the teaching material in a structured format, and evaluate the indicators that students need to master to achieve those competencies. The last, learning objectives are established to define educational goals based on Core Competencies and Basic Competencies, which are adjusted to students' behavior and the achievement of predetermined learning outcomes.

Design

This Design stage was carried out to design Learning Media for the Katapel Quiz Application on topic of Energy in Living Systems as well as a follow-up to the problems identified in the Define stage by formulating the objectives to be achieved in this research. This design stage includes the material and test preparation stage and the initial design of learning media. This stage consists of Preparation and test of topic, as well initial draft design (Draft I). The stage of preparation and test of topic, researchers prepare learning materials tailored to the learning objectives. The researcher's first step was to determine the learning material on energy in living systems in the 2013 curriculum. The subject matter that will be presented consists of energy and forms of energy, energy sources, changes in energy form, and food as a source of energy. The second step is that the researcher prepares learning tools that are by core competencies and essential competencies in the form of lesson plans, teaching materials, student worksheet, and learning outcomes tests where the researcher prepares test questions and quizzes that are adapted to the material to be taught and will be included in the learning media design for the Katapel Quiz application. The initial design of the learning media for the Katapel quiz application can be seen in Figure 2.



(a) (b)

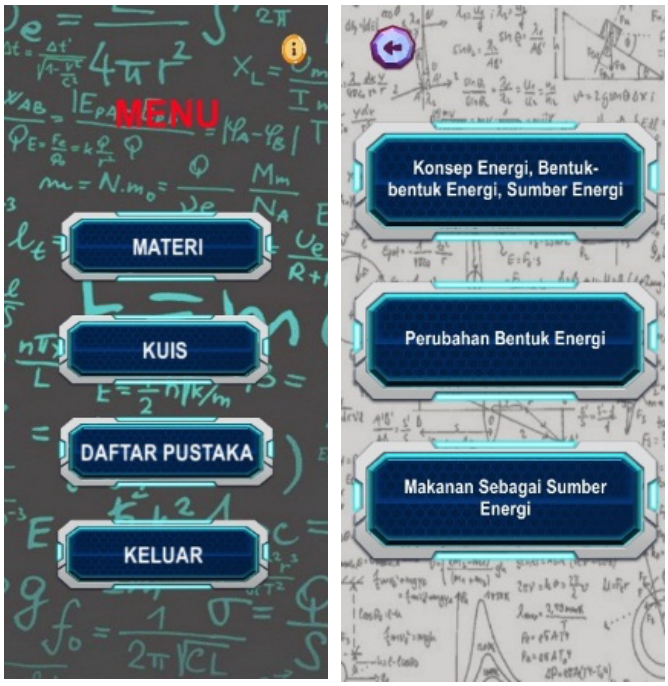
(c)

Figure 2. Initial display of (a) menu on learning media, (b) menu option for material, and (c) Katapel quiz display

The stage of initial design was done to design initial activities before validation and testing. At this stage, the learning media for the Katapel Quiz application, which includes learning material and quiz questions appropriate to the learning material about energy in living systems, is created. In this process, the media design is made as attractive and straightforward as possible so that operating this learning media is easy for students and teachers to understand.

Develop

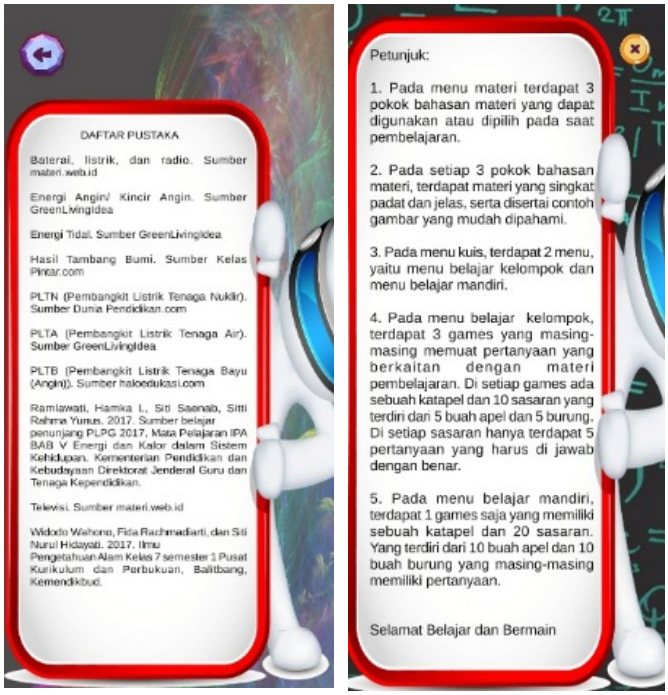
At this development stage, the initial product design (draft I) will be evaluated for feasibility by validator lecturers or experts based on the suggestions and input provided. Then, the suggestions and input provided will be used as a guide for revising and improving the initial draft. This stage consists of expert validation, revision, and development test (Revised media Draft II). Expert validation consists of 2 expert lecturers. The aspects that will be assessed by the validator lecturer in the learning media for the Katapel quiz application are physical aspects, media use, and language. After the validator lecturer provides suggestions and input, the researcher revises the initial draft or draft 1. Revision, the researcher revised the initial design (draft 1) of the Katapel quiz application learning media based on input and suggestions from the validator lecturer. Thus, the latest media design was produced (draft 2). The last, development test (Revised media draft II), the researcher validated it again with the validator lecturer.



(a) (b)

Figure 3. Initial display of (a) the katapel quiz application, and (b) material menu display

After the validator lecturer had given an assessment, the media design product (draft II) was declared valid but with slight revisions. Then, after validating the draft two design product, the researchers tested it in class VII of SMP Negeri 1 Asparaga with a limited trial with a total of 22 students. In this trial process, researchers looked at students' responses, reactions, or comments when using the Katapel quiz application learning media. Then, the results of this trial are used as a guide for revising the final media product. The storyboard for the learning media for the Katapel quiz application in Figure 4.



(a) (b)

Figure 4. Menu display of (a) Reference, and (b) Instructions.

The next section, students will choose the quiz menu after studying the material. The Katapel quiz menu has two built-in menus. On the learning menu, groups of students will choose games menu 1 to game 3, according to the learning meeting. After the game display appears, students prepare to pull the base of the Katapel backward along with the bullet at the target (a bird or an apple, each of which has a question) that is already in the game. For the system, the answer is to be answered directly in the application, and the correct answer will also appear if the student answers correctly. Next is the independent learning menu. There are 20 questions in this menu, and the display is the same as the Katapel quiz displayed on the group study menu in Figure 5.

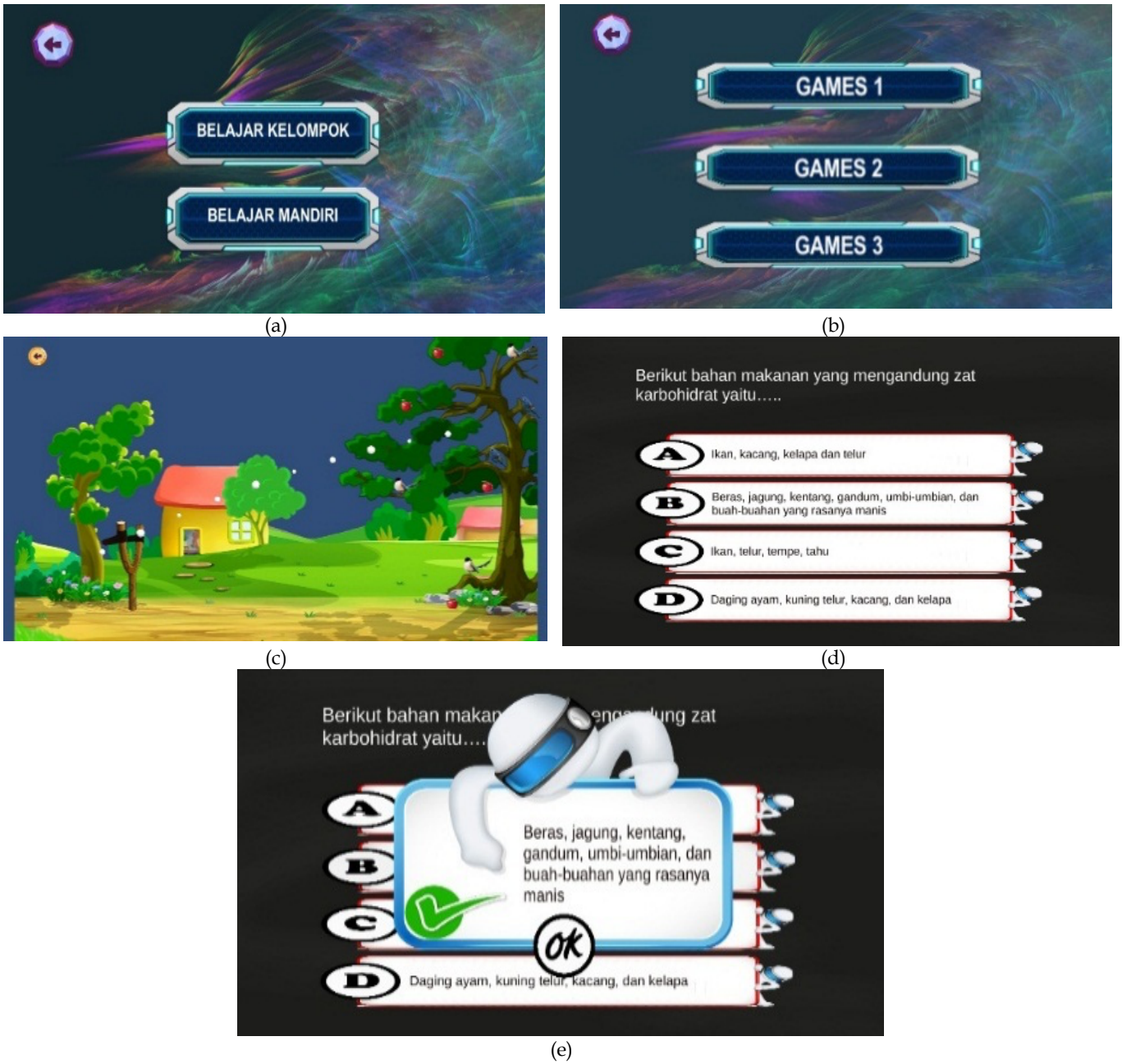


Figure 5. Images for (a), (b), (c), (d), and (e) are Katapel quiz menu display

Product Trial

Product trial consists of trial design, test subjects, and data type. Trial design uses a one-group pretest-posttest design as a trial design in Tabel 1 (Sugiono, 2015). Test subjects used test subjects as class VII students at SMP Negeri 1 Asparaga. The test subjects in this trial's development model and design include limited trials. Meanwhile, data type used in this research is a qualitative and quantitative approach.

Table 1. One Group Pretest-Posttest Model Research

Pretest	Treatment	Posttest
O_1	X	O_2

Data Collection Technique

It used by researchers here is to measure the quality for the Katapel Quiz application on Energy Materials in Living Systems. The methods for collecting data in this research consist of validation, practicality, and effectiveness (Sugiyono, 2015). The validation test was determined the level of validity of the Katapel Quiz application learning media before it was tested. The practicality test in this research was obtained the learning implementation sheet and student response questionnaire sheet regarding developing the Katapel Quiz application learning media. Meanwhile, testing the developed effectiveness Katapel Quiz application learning media will be reviewed in two ways: student

learning activities and learning outcomes tests. The test created by the researcher consists of 15 multiple-choice questions and five essay questions with cognitive levels C1 (Knowledge), C2 (Understanding), C3 (Application), and C4 (Analysis).

Result and Discussion

Validation of Learning Media Katapel Quiz Application

Assessment of the feasibility of the Katapel Quiz application learning media by expert validators seen from aspects: physical, media use, and language. After validation, the validator provides suggestions and input for the learning media for the Katapel Quiz application that has been developed. Then, the researcher considers these suggestions and input in revising the learning media that is being developed so that it produces a draft 2 product, which then becomes a valid learning media for the Katapel Quiz application.

Suggestions from validators, a value is obtained from the validation results of each validator, and an average value is produced for all validators. The resulting values from the validation of the Katapel Quiz application learning media are presented in Table 2.

Table 2. Validation of the Katapel Quiz Application

Validators	Validation	Average	Criteria
I	3.70	3.70	Valid
II	3.70		

Based on Table 2, the results of the validation of the Katapel Quiz application learning media by two validators obtained an average score from all validators of 3.70, which is included in the "Valid" category, by the valid category in the range of 3.01 - 3.75, the assessment. The learning media for the Katapel Quiz application by the validator shows that this media can be used with slight revisions.

Revisions were made so that the learning media for the Katapel Quiz application could be relevant to trials and used in the learning process at school. This is in accordance with the opinion of (Pratiwi & Ritonga, 2023), who stated that before learning media is tested, a validation stage is needed to get the final product results in a more perfect form so that they can be tested on students at school.

Practicality of Learning Media Katapel Quiz Application

The practicality of the learning media for the Katapel Quiz application is generated from the analysis of learning implementation and the analysis of student response questionnaires. Based on trials carried out by researchers, the results of the practicality of the Katapel Quiz application learning media were obtained in data analysis of learning implementation and learning implementation.

Data Analysis of Learning Implementation

The learning implementation data were obtained from the learning implementation sheet, which observers had filled in while the researcher was carrying out the learning process in the classroom. The learning implementation sheet aims to see whether or not learning was implemented using the Katapel Quiz application learning media, which the researcher developed. The observation results obtained from the percentage of learning implementation in 3 meetings with limited trials can be seen in Table 3.

Table 3. Percentage of Learning Implementation

Meetings	Percentage (%)	Criteria
1	85.71	Very Good
2	80.95	Good
3	90.48	Very Good
Average	85.71	Very Good

Based on Table 3, the average percentage of implementation of learning carried out by researchers during three meetings for class VII students at SMP Negeri 1 Asparaga reached 85.71%, which is included in the "Very Good" category, the good category is around 76%- 85%. The results of the analysis of the learning media for the developed Katapel Quiz application showed that the results of limited trials were carried out well or were classified as "practical." This aligns with research from Wiratama (2019), which states that learning tools are practical if the minimum average score percentage is in a good category.

Data Analysis of Student Response Questionnaire

The results of the analysis of student response questionnaires were obtained from the student response questionnaire sheets. The student response questionnaire has four indicators: Enjoyment, Attention, Interest, and Engagement. The response questionnaire contains 18 statements to assess students' level of interest in using the Katapel Quiz application learning media in the learning process. Students then check the learning process in the classroom for three meetings. The scoring for each statement uses a Likert scale and results from student response data to the Katapel Quiz application learning media. Based on the student response questionnaire data analysis, which was carried out using limited trials, the percentages obtained can be seen in Table 4.

In Table 4, the average percentage score from the student response questionnaire regarding the Katapel Quiz application learning media is 88.59%, placing it in the "Very Good" category. The Katapel Quiz application developed by the researchers has received positive student feedback. According to the student response questionnaire results, the Katapel Quiz application is deemed "practical" or user-friendly in the learning process at SMP Negeri 1 Asparaga. This aligns with

Milala et al. (2022), who state that practicality refers to the ease of use of the developed learning media for both students and teachers, ensuring that the learning experience is meaningful, engaging, enjoyable, and beneficial for students while enhancing creativity in learning. A similar opinion by Adam et al. (2023) is that the use of smartphone-based learning media (mobile learning) can provide a positive learning experience to students and has an impact on learning motivation, which can influence their perception of learning.

Table 4. Percentage of Student Response Questionnaires

Indicators	Percentage (%)
Joy	89.39
Attention	88.07
Interest	88.26
Involvement	88.64
Average	88.59

The Effectiveness of the Katapel Quiz Application

The Katapel Quiz application's learning media effectiveness was determined by analyzing student engagement and the results of student learning outcome tests related to using the Katapel Quiz application in the educational process. This aligns with research by Awila et al. (2024), which states that the effectiveness of learning media is assessed based on two indicators: student activity and learning achievement tests.

Student Activity Analysis

The effectiveness of the Katapel Quiz application learning media was evaluated based on the analysis of student activity data collected by observers during the learning process. This observation took place over three meetings, during which the Katapel Quiz application learning media was utilized to monitor students' activities. Based on the results of observations of student activities, the following are the percentage values of student activities in Table 5.

Table 5. Percentage of Student Activity

Meetings	Percentage (%)	Criteria
1	81.25	Good
2	84.20	Good
3	87.82	Very Good
Average	84.42	Good

Based on Table 5, the average percentage of student activity was 84.42% and was included in the "Good" criteria. Based on these criteria, it is concluded that the Katapel Quiz application learning media is "effective" for use in the learning process. Milala et al. (2022) argue that effectiveness testing is a test carried out on media that is developed by involving students as media users. Damopolii et al. (2019) argue that learning is said to be effective if the learning objectives that have been formulated are successfully effectiveness implemented in learning.

Learning Results Test Analysis

The results of the analysis of the cognitive learning outcomes test are obtained through the assessment sheet of the test results, namely Pretest and Posttest. The learning outcomes tests were carried out by 22 students each. Learning outcome tests are prepared and adjusted based on learning indicators. The learning outcome tests' cognitive level starts from C1 – C4. The average score of the learning outcomes test is calculated using the N-Gain formula for the pretest and posttest scores carried out with limited trials, along with the learning outcomes for limited trials in Table 6.

Table 6. N-Gain Learning Results in Limited Trials

Pretest (%)	Posttest (%)	N-Gain	Category
39.09	90.55	0.84	High

It is based on Table 6. Limited trials for the Pretest score (before being given treatment) obtained an average score of (39.09%), while the average Posttest score (after being given treatment) was (90.55%). The N-Gain value obtained in limited trials was 0.84, and it was included in the "High" category. It shows students' learning outcomes regarding the learning process using the Katapel Quiz application learning media developed by "Effective" researchers to influence student learning outcomes in the knowledge aspect. This is in line with Damopolii et al. (2019) that the importance of students' perceptions can positively influence their learning outcomes. Effective learning can be achieved if it provides new experiences, shapes students' competencies, and delivers them to the goals they want to accomplish optimally. The researchers analyzed N-Gain per indicator, as seen in Table 7.

Table 7 shows an increase in students' understanding of each indicator. Each indicator has results above an average of 0.3, which is by the law according to Hake (1998), which is included in the medium or high classification. This shows that using the Katapel Quiz application learning media can improve student learning outcomes because it is included in the "effective" category.

The learning media for the katapel quiz application developed by researchers is one of the learning media included in electronic media because it is used via smartphones with material features. Quiz features are packaged as detailed and exciting as possible, making it easier for students and teachers in the learning process. This is the opinion of Isnaeni & Hildayah (2020), stating that learning media not only makes it easier for teachers in the learning process but also makes it easier for students to train their thinking and their five senses will actively participate in the learning process, such as sight,

hearing, touch and so on. With media, students get lots of new experiences, increasing their interest in learning.

Table 7. N-Gain Analysis per Indicator

Indicators of Competence Achievement	N-Gain
Explain the concept of energy, forms of energy, and energy sources	0.20
Describe potential energy and kinetic energy	1.00
Determine renewable and non-renewable energy sources	0.20
Give examples of uses in life	0.98
Explain changes in forms of energy	0.36
Determine changes in energy forms	0.07
Analyzing changes in energy forms	0.18
Explain food substances that act as energy sources	0.38
Classify food ingredients that act as energy sources	0.94
Analyze food ingredients that act as energy sources	0.37

The learning media for the Katapel Quiz application is a learning medium that can create a fun learning process because students can learn while playing with the available Katapel Quiz feature. In line with the opinion of Isnaeni & Hildayah (2020), media is beneficial for teachers and students because it makes it easier for teachers to provide information to students and provides new experiences with learning methods for students so that students are more motivated to learn. With the existence of teaching media, teachers are not focused more dominantly, but students must be more active and creative in the learning process.

Conclusion

The learning media for the Katapel Quiz application on Energy in Living Systems meets the quality of learning media: valid, practical, and effective. The validity was obtained an average score of 3.73, which is included in the valid category. The practicality of learning implementation analysis was obtained an average score of 85.71%, including in the "Very Good" category. Meanwhile, the practicality of student response questionnaires in the limited trial was 88.59%, including in the "Very Good" category. The effectiveness of student activity analysis scores in limited trials obtained an average score of 84.42%, included in the "Good" category. Meanwhile, the analysis of learning outcomes tests obtained from the N-Gain value carried out in limited trials received a value of 0.84, which was included in the "High" category.

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Author Contributions
Sridiyanti S. Dunggio: Conceptualization, methodology, writing—original draft preparation; Tirtawaty Abdjul: Methodology; Citron S. Payu: Curation; Masrid Pikoli: Writing—review and editing; Ritin Uloli: Formal analysis; Abdul Haris Odja: Validation.

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Conflicts of Interest
The authors declare no conflict of interest.

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