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Development of Branching Programmed Learning Media for Science Subjects

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Abstract: The background of this study is the results of observations on science learning at MTsN 3 Tanjung Jabung Barat, which show that the science learning process has not been able to create effective learning activities to obtain essential competencies, and the learning resources used are not enough to motivate students and support the content in explaining science concepts. The study aims to develop branching programmed learning media, which can increase the motivation and learning outcomes of class VIII MTs students for science subjects on the topic of vibrations, waves and sound. This type of research is development research that refers to the ADDIE model. The results show that the branching programmed learning media in science subjects has met the valid, practical, and effective criteria in increasing the experimental group's average value of learning outcomes by 85.37. In contrast, the control group obtained a mean score of 73.89. The results of hypothesis testing at a significant level of α 0.05 show t count 5,484 > t table 2,007 which means there are significant differences in the average value of learning outcomes between the control and experimental group. Based on the results of research, the branching programmed learning media meets the valid, practical, and effective criteria to be used as a learning resource for science subjects.

Keywords: ADDIE Model; Branching Programmed; Media Learning; Science

Introduction

Information and communication technology development advances rapidly at times, bringing changes to all areas of life, including the field of education. Recognizing the importance of adapting to the dynamics and development of technology and people's lives, the government is restructuring its national education system through several key stages. One of them is the issuance of Government Regulation Number 4 of 2022 concerning National Education Standards. Graduate proficiency standards are set as the first criterion. The learning process plays an important role in meeting the eligibility requirements of graduates. Process standards state that learning in academic units should be interactive, stimulating, interesting, and challenging, encourage active participation, and develop according to the student's abilities, interests, and physical and intellectual development. Successful implementation of these process standards is highly dependent on the competence of educators. Educators, therefore, need to constantly update their knowledge and skills to drive innovation in the learning process. Complementary facilities and infrastructure also play an important role in supporting the learning process.

Rapid technological advances have also led to the development of science, including the natural sciences (IPA). Therefore, science learning should be designed and implemented in combination with other subjects and appropriate technology so that science learning can be done more effectively and efficiently. In an implementation, scientific learning only partially optimizes the expected standards. As shown in several studies, including Arviansyah, 2016; Hasanah & Anfa, 2021; Panggabean et al., 2021 found that the following problems are common in junior high school science learning: The inability of educators to apply learning strategies, the lack of educator creativity in packaging

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materials and developing interesting learning media, the lack of use of technology in the scientific learning process, and the lack of student motivation to learn due to difficulty to understand abstract content and many mathematical formulas.

The situation described in the previous observation is similar to that at MTsN 3 Tanjung Jabung Barat. Educators should have planned and implemented learning in a standard process as expected. Educators' skills in embedding technology into learning need to be improved. Even though they have used learning media in the form of PowerPoint slides with images, the media needs to provide more support for content that explains overall scientific concepts. There are no learning support facilities such as science laboratories, so there are no practical activities to promote student understanding.

Based on the results of the interviews, it is known that from the educator`s perspective of the five basic competencies in the second semester of class VIII science subjects, the achievement of KD 3.11 regarding vibration, waves, and sound material has not been maximized. Implementing learning in KD 3.11 is dominated by mastery of knowledge related to formulas and is not matched by exploring knowledge related to the concepts of vibration, waves, and sound. Educators need help teaching abstract concepts of vibration, wave, and sound material. This situation can certainly hinder the success of the goals to be achieved through learning. It can be seen from the results of the cognitive evaluation of vibration, wave, and sound material, where on average, only 59,11% of students achieved the KKM score.

In light of this situation, educators must continue to develop and innovate methods and media that meet students' needs and characteristics and improve learning quality. Today, learning media play an important role in learning. Because its use can affect how we think, the process of information retrieval, and the process of information adaptation. Based on data from online surveys, students want a variety of sources to support their learning, including images, audio, video, and animation. Therefore, providing visualization is suitable for learning vibrations, waves, and sounds. Understanding student characteristics also reveals the need for mobile learning-based media, as students spend more time playing games on their mobile devices.

To use a mobile device effectively needs to support it correctly. One possibility is a program-branching teaching method. Applying a branching scenario allows it to apply the information presented in the media to students and see how the consequences of the decisions are immediately implemented. This direct feedback reinforces understanding of the material and is important in motivating students to continue learning. Several previous studies have also demonstrated the effectiveness of using branching programmed learning media in the learning process. Jogan & Hoovinbhavi (2017) found that branching programmed learning materials can improve student performance. A study by (Rusman & Dewi, 2017) shows that students learning with branching programmed materials show great interest in the subject matter. Using learning media with branching programmed could optimize the learning process and improve student learning outcomes. Therefore, the goal that will be achieved in this research is to reveal how the process of developing branching programmed learning media meets valid, practical and effective criteria for improving student learning outcomes in class VIII MTs on science subjects on the topic of vibration, waves and sound.

Method

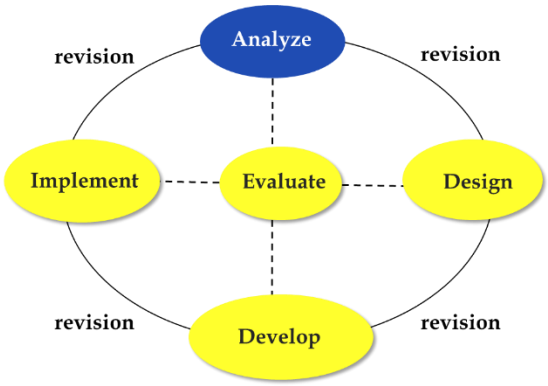

Figure 1. ADDIE model (Branch, 2009)

This research belongs to Research and Development (R&D). The study population consisted of 8th graders from MTsN 3 Tanjung Jabung Barat, i.e., class VIII A (experimental group), class VIII B (control group) and six students in class VIII C (small group) who were taken using a random sampling technique. Following the ADDIE development model, which consists of five stages of development, including: (1) The analysis stage includes needs analysis (knowing the root of the problem and finding possible solutions), student analysis (learning environment, knowledge and skills possessed, etc.), curriculum analysis (providing references in designing and presenting lessons), and instructional objectives analysis (determining the results desired ending); (2) At the design stage, it is determined development strategies such as determining the content structure, tools or technology used, media to be created (images, videos, animations, etc.), creating a storyboard and compiling media assessment instruments and test instruments; (3) The development phase involves activities for making learning media and evaluating media produced through expert assessment to ensure there are no basic errors such as grammar, spelling,

appearance and design of lesson materials; (4) At the implementation, small group trials and field trials were carried out to determine the convenience of developed media; and (5) The evaluation phase is a crucial stage to ensure that researchers have achieved their goals by using learning designs and media by carrying out pre-tests and post-tests to see the effectiveness of the media.

The data in this study were obtained by testing the media's validity, practicality, and effectiveness. Validity data was obtained through validation sheets by experts to assess subject matter, language, and media design, which were analyzed using Aiken's V statistics. Media practicality data was obtained through interviews, response questionnaires, and observation sheets to obtain student and teacher feedback about the media analyzed quantitative descriptive. Media effectiveness data was obtained from student learning outcomes through pre-test and post-test, which were analyzed using the T-test and N-Gain score.

Result and Discussion

This research has produced branching programmed learning media operated through smartphone *android* for class VIII students at MTsN 3 Tanjung Jabung Barat who meet valid, practical, and effective criteria. The resulting product display is as Figure 2 and 3.

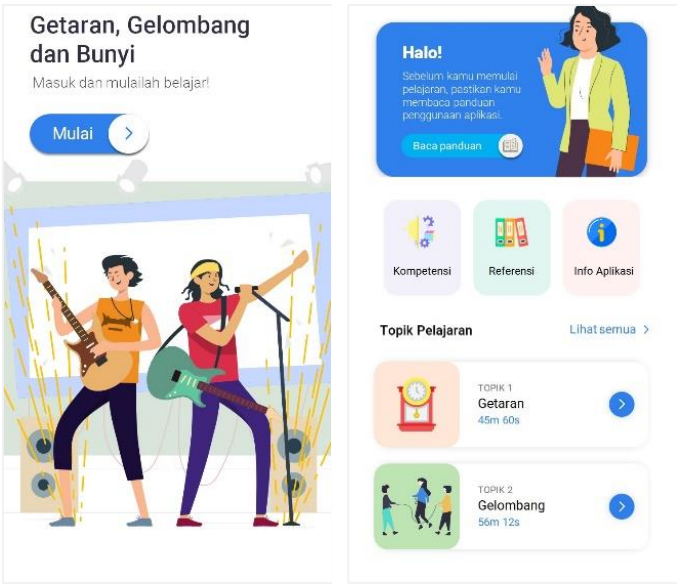

Figure 2. Start page and menu page view

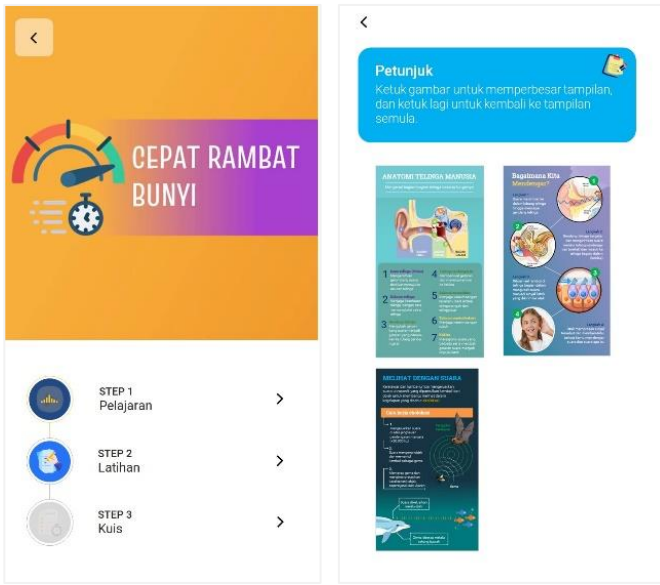

Figure 3. Material and summary page view

Validation Results

In this study, three experts carried out validity tests, including subject matter experts who assessed the media from learning and content aspects, media experts who assessed the media from the presentation aspect, and linguists who assessed the media from the linguistic aspect. The results of the expert assessment can be seen in Table 1.

Table 1. Expert Validation Results

Aspect	Validity Score	Category
Instructional design	0.90	Valid
Content	0.87	Valid
Presentation	0.75	Valid
Linguist	0.87	Valid

The learning and content aspects obtained a validity score of 0.9 and 0.87 (valid). This result shows that the material presented is well organized and relevant to the essential competencies, indicators, and learning objectives to be achieved. The material is also presented accurately, up to date, and includes all the material in the essential competencies. Ilham et al., 2020; Istifarida et al., 2017show that material in teaching materials that are entirely arranged and organized following scientific systematics will help convey core concepts more effectively so students can easily understand them.

A validity score of 0.75 (valid) is obtained in the presentation aspect. The acquisition of this value indicates the quality of the display so that media operations developed are considered good. Using videos that combine audio, visual and animation elements is appropriate and complementary to help students find their understanding and increase interest and participation in the lesson material. Munir in Fikri & Madona, (2018)state that multimedia is suitable for use as text to explain the material, graphics to display images, audio to create media with sound, video to

display simulated natural objects, and animation to attract students' interest. The technical quality of the media is generally stated to be good in terms of the level of interactivity during use, ease of navigation, and clarity of instructions for use. As explained by Walker and Hess in Putri et al., (2023), the criteria for suitable multimedia suitability are providing instructions and guidance for users, a high level of readability, display quality and programming management.

In the language aspect, a validity score of 0.87 is obtained, which indicates that the use of language in the media is by good and correct Indonesian language rules, sentence structure is effective in conveying ideas, and is relevant to the level of development of students so that they can understand and digest the subject matter well. When presenting material, it is necessary to consider using simple language and terms that are familiar and appropriate to the level of students' cognitive development so that students' abilities can develop well and quickly (Panjaitan et al., 2020; Purnanto & Mustadi, 2016; Wahyuni & Puspari, 2017). Based on the suitability of the media with the learning criteria, content, presentation, and language assessed by the experts, branching programmed learning media was declared valid. Development product is valid if it is theoretically appropriate and consistency in each of its components based on experts (Van den Akker, 1999).

Practicality Results

Practicality is measured based on visibility, ease of use, efficiency and satisfaction of branching programmed learning media. Through the test results, the media received positive feedback from users. The average practicality in the small group test was 89% (practical), while in the field test group, it was 94% (practical). In visibility, students and educators can use the media appropriately in the way it was designed, meaning that the media has provided clear guidelines regarding the use of the various menus available so that users do not experience difficulties when using the media. This follows research by Safitri & Harmanto, 2022; Sukardi et al., 2017state that presenting instructions for use are helpful to make it easier for students to use learning media.

Ease of use aspect, students and educators can quickly understand or learn the media even though they are using it for the first time. As revealed by Ekayani, (2017), learning from media that is easy for students to understand and use can stimulate the mind and improve learning. Regarding efficiency, educators and students agree that media helps achieve the desired learning goals more quickly by presenting material in videos supported by examples, exercises and quizzes. Presentation of material via video, enabling more efficient processing and information. Some studies, such as Fridayanti et al., 2022; Harna & Hakim, 2022; Pranata & Jayanta, 2021; Ulyana et al., 2019 prove that video learning media can increase students' interest in learning, increase students' learning references, arouse students' interest and imagination and help students understand the material quickly. The availability of practice questions and quizzes supports students in focusing more on understanding the lesson material (Irhasyuarna & Yulinda, 2022; Otania & Asi, 2019).

On the satisfaction aspect, students show interest in media, which can be seen from their activeness in using media to complete learning tasks. Media is also considered to attract students' interest because it runs on mobile devices based on Android. The operating system, mobile-based Android, has become one of the applications most widely used and in demand by many junior high school students for communicating or searching for information (Setiawan et al., 2016) .From this, the media can be used practically. Users (teachers and students) find the media visually appealing and easy to use to meet their needs for learning resources on vibrations, waves, and sound materials. As Nieveen, (1999) explains, the usefulness of a developed learning tool is determined by user satisfaction, both from the level of user preference, user understanding and the level of product usability.

Effectiveness Results

The final activity in the development phase is to test the effectiveness of the learning media in achieving the desired research outcomes, i.e., improving student learning outcomes. Researchers compared learning outcomes in control and experimental groups before and after various learning treatments. The experimental group was treated by learning using branching programmed learning media, while the control group used media slides presentation. Data on the learning outcomes of control and experimental students are shown in Table 2.

Table 2: Average Test Scores

Group	Pretest Average	Posttest Average
Control	40.93	73.89
Experiment	47.04	85.37

To confirm a significant difference in learning outcomes (after testing), control and experimental groups tested the hypothesis by t-test. Based on the results of the analysis, we know that a value of t count (5.484) > t table (2.007) means that Ho is rejected and Ha is accepted. From this, there is a significant difference in the average learning outcomes of students after learning how to use branching programmed learning media compared to students using media slide presentation.

This is consistent with the statement, according to Nieveen & Folmer, 2013; Van den Akker, 1999, a product is considered effective if its use produces results consistent with the expected goals.

Conclusion

Based on research objectives, researchers have successfully developed a branching programmed learning media in science subjects for Class VIII MTs, which can operate via an android smartphone. The validity test related to learning, content, presentation, and language aspects is included in the excellence category. Practicality tests are also considered met by users of learning media. The small-group test had an average practicality score of 89%, while the field test score was 94%. Media use in learning activities increases the achievement of learning objectives and enhances student learning outcomes.

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Author Contributions

The main author, Anesia, contributed to designing research, conducting research, data curation, and writing research articles. The second author, Indrati Kusumaningrum, contributed to guiding research to writing articles. The third and fourth authors contributed to review the original draft.

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Conflicts of Interest

The authors declare no conflict of interest.

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