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Development of STEM-Based Interactive Multimedia as an Effort to Increase Student Learning Motivation in Biology Learning

Rafyka Basri* & Miza Nina Adlini

Department of Biology Education, Universitas Islam Negeri Sumatera Utara, Indonesia

Abstract: This study aims to develop a interactive multimedia based on STEM that was valid, practical and effective, to able improve motivation Students in biology learning. The study employs the method of research and development. The research model is model 4D (define, design, development, and dissemination). Based on validity test, the interactive multimedia based on STEM was categorized as very valid with 95,6 % by a materials expert and was categorized as very valid with 85% by a media expert. Based on practicality test, the interactive multimedia practically used with 77 % practicality level by educators response and verry practically with 77, 94% by students response. Based the questionnaire motivation students was very effective with 79,07%. From these result, the develop interactive multimedia was very valid, very practical, and very effective to improve motivation learners in biology learning

Keywords: stem, interactive multimedia, motivation, biology learning

Abstrak: *Tujuan dari penelitian ini untuk menghasilkan media pembelajaran berupa multimedia interaktif berbasis STEM yang valid, praktis, dan efektif. Metode dalam penelitian ini adalah research and Development(R&D. model penelitian ini adalah model 4D (define, design, develop, dan dissaminate). Hasil penelitian menunjukkan bahwa multimedia interaktif berbasis STEM yang dikembangkan valid dengan persentase 85% oleh ahli media dan persentase 95,6 % oleh ahli materi. Praktis untuk digunakan dengan persentase 77% oleh respon pendidik dan 77,94% oleh respon peserta didik. Efektif dalam meningkatkan motivasi belajar dengan nilai persentase79,07% . Sehingga dapat disimpulkan bahwa Multimedia interaktif berbasis STEM untuk meningkatkan motivasi peserta didik dalam pemebelajaran biologi valid, praktis dan efektif untuk digunakan.*

Kata kunci: *stem, multimedia interaktif, motivasi, pembelajaran biologi*

▪ INTRODUCTION

Learning motivation in the learning process is the basic capital that students must have to obtain maximum learning outcomes (Emda 2017; Steinmayr et al. 2019). This is because motivation is the driving force that exists in students who encourage and direct their behavior to maintain and strengthen learning activities to achieve the expected competencies. In addition, student motivation also plays an important role in learning because motivation will affect academic success, can develop learning activities, and initiatives in learning activities (Divayana, et al, 2016; Monika & Adman 2017; Rumhadi 2017).

Based on this, student motivation in learning, including biology learning, is something that cannot be ignored. However, from the results of interviews with biology subject teachers at schools, it is known that student motivation in learning biology is low. This can be seen from the lack of students paying attention to the teacher, lack of passion in doing assignments, lack of curiosity in the learning process and low learning outcomes (Haref, et al. 2022). Many factors lead to low motivation in learning, including the rapid

Rafyka Basri
*Email: rafykabasri@uinsu.ac.id

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use of smartphones among students which offers a wide range of services that can be easily accessed which results in students spending more time with smartphones and making learning not the main focus. It is not uncommon to find students carrying smartphones and using them while learning activities are taking place. Behavior like this causes disruption of their concentration so that their motivation in learning decreases (Irna, 2020; Sobon & Mangundap, 2019). In addition, the lack of educators in optimizing the use of smartphones as digital learning media and feelings of boredom as a result of the methods applied by educators who are monotonous are also factors in the low motivation of students (Cahyani, et al., 2017).

Therefore, an effort is needed to increase student motivation in learning biology by optimizing smartphones as a medium by including learning approaches. One of the appropriate learning approaches to increase student motivation in the digital era is the STEM approach. The STEM approach consists of 4 components of disciplines namely Science, Technology, Engineering, and Mathematics which aims to use these four disciplines in education by integrating one another in solving problems in life. everyday (Akpınar & Altun, 2021; Erlinawati, 2021). The content in the STEM approach is considered capable of increasing students' non-cognitive learning outcomes such as learning motivation (Stohlman, et al., 2012). This is because the STEM approach focuses on the process of habituating students to apply their knowledge in problem solving activities and finding solutions in everyday life so as to provide challenges for students in learning activities (Fauzi & Hayya, 2022; Pramadanti, et al., 2021). In addition, the STEM approach is also in line with the goals of learning biology, namely that students are not only required to understand the concepts and theories that have been studied but also apply them (Sudarisman, 2015; Ziraluo, 2021).

In addition to applying a learning approach, in increasing student motivation, a suitable medium is also needed to increase student motivation by optimizing the role of smartphones as digital learning media. One of them is interactive multimedia. Interactive multimedia is a learning tool that is systematically arranged, displayed in electronic form which contains audio, animation, and navigation (Musdalifa, 2021). This interactive multimedia makes students self-instructional because teaching materials in interactive multimedia can teach students independently so that it can attract students' motivation in learning and instill students' habits to repeat lessons (Purnama & Ridwan 2020). Interactive multimedia biology learning is also considered capable of increasing learning effectiveness, increasing learning motivation and scientific attitudes of students (Khan & Masood 2015; Oktavia 2020).

Several studies have been conducted on the development of STEM-based interactive multimedia in biology learning as a learning medium (Haka, et al., 2021; Pramuji, et al., 2020). Development of STEM-based interactive multimedia in improving students' Critical thinking skills (Husein, et al., 2015; Prasetyo & Nigazizah 2021). However, the interactive multimedia products developed are considered less practical to use. In addition, the developed interactive multimedia focuses on increasing students' critical thinking. Based on the limitations of previous studies, we need a practical interactive multimedia that focuses on students' motivation in learning. However, in making this multimedia, the Ispring Suite 9 application is used, because ISpring allows users to create media such as slides, quizzes with various forms of various questions,

simulations, screen recordings, videos, and for publication of learning content in HTML 5 form which is easy to access. by using a smartphone (Anistalidia, 2021).

The purpose of this study was to determine the validity, practicality, and effectiveness of STEM-based interactive multimedia as an effort to increase student motivation. The developed interactive multimedia is expected to be an interesting learning medium, and can motivate students to be more enthusiastic and understand and study biology. By applying the STEM approach, it is hoped that it can encourage mutual cooperation, increase students' interest in learning, learning becomes more meaningful, helping students in the process of solving problems in real life.

▪ METHOD

Participant.

Participants in this research were class There is 1 biology subject teacher. Two lecturers from the tarbiyah and teacher training faculties of UINSU as media experts and material experts. The sampling technique in this research used a cluster random sampling technique, obtaining class X IPA 1 as a research sample totaling 34 people.

Research Design and Procedure

This research is a type of research and development (Research and Development) or R&D. In this research, we adapted the 4-D development model with the Define, Design, Develop, Disseminate stages (Thiagarajan174). This model was adopted for the reason that this 4-D development model can be used as a basis for developing learning tools with a complete description of the steps arranged systematically and the research process does not require a long time (Arywiantari, et al., 2015).

The product was developed using Ispring Suite application technology. The research procedures that will be carried out through the adoption of this 4-D model are: (1) Define, namely identifying various needs and problems that exist in schools (2) Design, this stage aims to prepare product prototypes that will be developed as learning tools. This stage begins with selecting material, namely Environmental Conservation, then formulating indicators and learning objectives, then analyzing discourse on environmental pollution material and combining the material with STEM components. Next, create a draft design in the form of an interactive multimedia storyboard that is developed (3) Develop, at this stage the aim is to develop the product that has been designed and then validated by media experts and material experts, then revise the product to determine the level of validity and practicality from teacher and student responses (4) Disseminate, after the product has been revised and the results of its validity and practicality are known, then the product's effectiveness is tested to increase student motivation and disseminated widely.

Instruments

The data collection instruments used in this research were (1) material expert and media expert validation sheets; (2) product user response questionnaire sheet (teachers and students) and (3) student motivation questionnaire sheet.

The results of percentage calculations from media experts, material experts and product users are used as a basis for making product improvement decisions according to the criteria in Tables 1, 2 and 3 as follows

Table 1. Validity assessment criteria

Percentage (%)	Criteria	Notes
76-100	Valid	Without Revision
51-75	Valid Enough	Minor Revision
26-50	Less Valid	Major Revision
0-25	Not Valid	Can not be used

Table 2. Practicality assessment criteria

Percentage (%)	Category
76-100	Very Practical
51-75	Practical
26-50	Less Practical
0-25	Not Practical

Table 3. Effectiveness assessment criteria

Percentage	Category
76-100	Very Effective
51-75	Effective
26-50	Less Effective
0-25	Not Effective

Data Analysis

The data obtained is in the form of quantitative and qualitative data. Quantitative data was obtained from validation test results by validators (media experts and material experts), practicality test results from product user responses (students and teachers) and effectiveness test results from the average score of students' motivation questionnaire sheets. Qualitative data was obtained from suggestions, criticism and revisions obtained from media experts, material experts and product users.

▪ RESULT AND DISSCUSSION

This research is an effort to develop a breakthrough or a new product that is useful in biology learning activities. The results of this study are STEM-based interactive multimedia which contains material on environmental preservation and pollution. Based on the research objective, namely the feasibility test of learning media which consists of validation tests by validators (media experts and material experts), practicality test results from product users (teachers and students), and effectiveness tests. The following are the results of the assessment of each STEM-based interactive multimedia feasibility test that was developed.

Validity Test

The validity test was aimed at determining the feasibility of STEM-based interactive multimedia developed in terms of material and media. Validation was carried out by one material expert validator and one media expert validator. Validation by material experts is intended to evaluate the contents of the developed media. Validation of material in the STEM-based interactive multimedia developed was reviewed from five aspects, namely aspects of appropriateness of content, language, visualization, questions and suitability of multimedia with the STEM approach. While validation by media experts

is to assess the design and appearance of the media being developed. Validation by media experts on STEM-based interactive multimedia developed is seen from three aspects, namely software engineering aspects, learning design aspects, and visual communication.

Based on the results of material validation analysis by experts, it is known that the overall score is 95.6% in the valid category and the results of media validation analysis by media experts show that the overall score is 85% in the valid category, this shows that the STEM-based interactive multimedia developed is valid and suitable for use. as a learning medium.

Practical Test

The practicality test of using STEM-based interactive multimedia was analyzed using a response questionnaire aimed at educators and students. The products developed will be used by educators and students so that the response of educators and students to the STEM-based interactive multimedia being developed is very important to produce practical media. The practicality assessment of the product being developed consists of several aspects, namely the attractiveness aspect, the media content aspect and the quality and appearance of the media.

Based on the results of the practicality test analysis, it is known that the overall score of the educators' responses is 70% in the practical category, and the students' responses show that the overall score is 77.94% in the very practical category, this shows that the STEM-based interactive multimedia developed is very easy to use in biology learning.

Effectiveness Test

The effectiveness test is aimed at finding out the effectiveness of the STEM-based interactive multimedia developed in increasing student motivation in learning biology before and after using the interactive multimedia used. The effectiveness test was carried out by distributing motivational questionnaire sheets to students. The effectiveness assessment of the product being developed consists of 7 aspects which are based on indicators of student motivation, namely the concentration aspect, curiosity aspect, enthusiasm aspect, independence aspect, readiness aspect, enthusiasm and encouragement to never give up, and self-confidence aspect. The results of the effectiveness test are presented in diagrams 1 and 2.

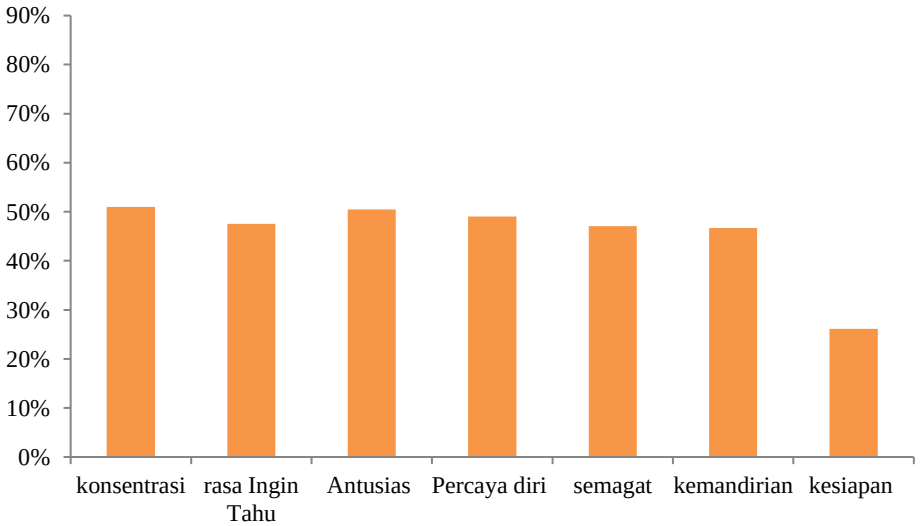

Diagram 1. Student motivation before using interactive multimedia

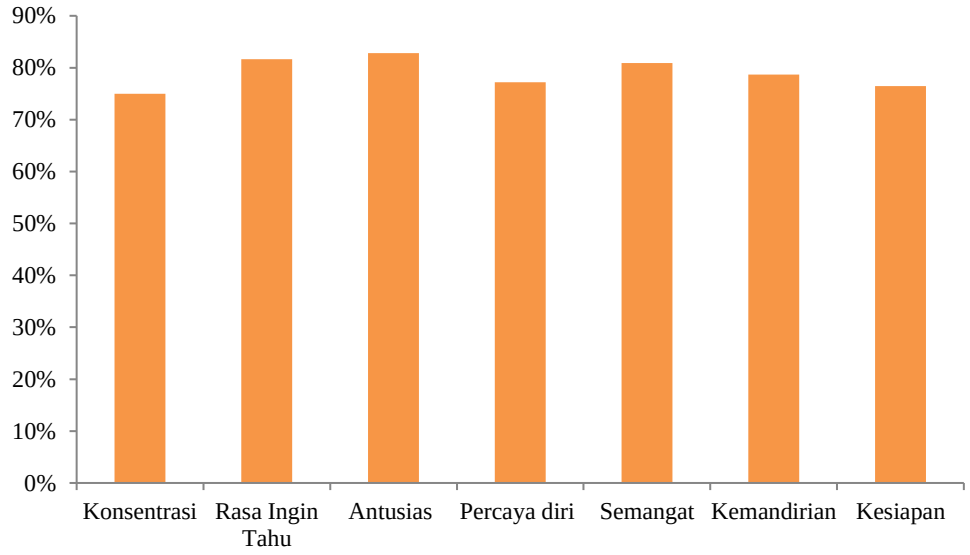

Diagram 2. Student motivation after using interactive multimedia

From diagrams 1 and 2 it can be explained that there has been an increase in student motivation from an overall score of 49.13% to 79.07% in the very effective category. This shows that the STEM-based interactive multimedia developed can increase students' motivation in biology learning activities. This is relevant to previous research which states that the use of interactive multimedia can increase students' interest and motivation in learning (Fauziah, et al., 2016). This is because the diverse displays in interactive multimedia can attract attention and stimulate students' enthusiasm for learning (Sanjaya, 2013). Apart from increasing student motivation, interactive multimedia can also deepen students' understanding, components in media such as video and animation can help students obtain more detailed information so that the capacity to be stored in brain memory also increases (Leow 2014).

The use of interactive multimedia that can be run using a smartphone makes students more flexible in learning and guides students in developing their thinking abilities and can increase students' understanding of concepts (Winarni & Purwandari 2018). The material presented integrates the concepts of science, technology, engineering and the mathematical side (STEM) in learning activities, students are required to be sensitive and aware of a problem raised in learning and students must try to solve and find the right solution by doing various literacy activities and experimental activities (Davidi, et al., 2021; Jolly, 2019). This can make students more interested in exploring the material presented and the learning process becomes more meaningful so that students' motivation in learning can increase (Chittum et al. 2017). This is in accordance with research by Chonkaew, Sukhummek, & Faikhamta (2016) which shows that learning with a STEM approach makes students able to build understanding of concepts independently.

▪ CONCLUSION

Based on the research results, it is known that STEM-based interactive multimedia to increase students' motivation in learning biology which is developed is valid with a percentage of 85% by media experts in the category of valid and feasible to use and with a percentage of 95.6% by material experts in the category of valid and feasible to use . Practical to use with a percentage of 77% by participant responses in the very practical category and 77.94% by the teacher's response in the very practical and effective category used based on a motivational questionnaire sheet with a percentage value of 79.07% in the very effective category. So it can be concluded that STEM-based interactive multimedia to increase students' motivation in learning biology is valid, practical and effective to use. Recommendations for further research, this research was conducted with a very limited number of samples and population, for this reason it is necessary to carry out further research with a wider population and sample. Besides that, the material presented in this study is pollution and environmental preservation, so it is necessary to do research on other materials.

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