



Development of STEM-Based Flipbook Learning Media on the Bloodstream System Materials for Junior High School

Rifki Risma Munandar^{*}, Eka Suhardi, Melsa Nazmaul Husna

Biologi Education, Faculty of Teacher Training and Education, Universitas Pakuan, Bogor

^{*}Corresponding Author. Email: rifki.munandar@unpak.ac.id

Abstract: This study aims to develop the STEM-based flipbook learning media on the Human Circulatory System material for junior high school students. This study uses research and development methods or Research and Development (R&D) with the ADDIE research model and involves 7 validators to validate flipbook learning media. This research instrument uses a validation sheet consisting of a content validation sheet, media validation sheet, material validation sheet, language validation sheet and media and content validation sheet with analytical techniques using quantitative descriptive analysis. The results of this study are the development of STEM-based Flipbook learning media has been declared feasible with an average score of 81%. The criteria are very valid and get positive results from various validators. Based on the validation results, it shows that the learning media developed is suitable for use in learning, because the media has features (videos, quizzes, and STEM LKPD) that can be accessed online.

Article History

Received: 31-12-2021

Revised: 30-03-2022

Accepted: 07-04-2022

Published: 04-06-2022

Key Words:

Learning Media;
Flipbook; STEM;
Bloodstream
System.

How to Cite: Munandar, R., Suhardi, E., & Husna, M. (2022). Development of STEM-Based Flipbook Learning Media on the Bloodstream System Materials for Junior High School. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, 8(2), 367-374. doi:<https://doi.org/10.33394/jk.v8i2.4665>



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Introduction

The world of education is currently required to be able to improve and perfect education, especially in the development of students' abilities and skills. Education today can help students in solving problems that will be faced in everyday life. Education is one of the goals of the nation's progress so that it must be in line with the developments and demands of the times and can make a successful person in a competitive attitude in the 21st century (Retnowati et al., 2020). Entering the era of the industrial revolution 4.0, all human activities are dominated by high-tech products and are also developing rapidly (Arisya et al., 2021). In addition, in the era of the industrial revolution 4.0, education must have a sense of responsibility to make students adapt easily to their environment so that students can grow their sense of trust and skills in learning (Sunarno, 2018).

The 21st century requires employees to master various skills (Angin, 2020). In the face of 21st century education marked by the rapid evolution of information technology, the need for innovation results in the need for students to develop relevant skills and competencies. Overall, 21st century education is centered only on students, but if the 21st century is integrated with the 2013 curriculum, it will look quality if carrying out learning activities, teachers must play a more active role, not only conveying information, but teachers must be able to support students so that students can be trained according to their development. Important skills in the 21st century have several competencies that are needed and are integrated, such as critical thinking (critical thinking), problem solving (problem solving), communication (communication), collaboration (collaboration), and creativity (creativity) or commonly referred to as the 4Cs (Akmaliyah, 2013).



In the results of interviews with 8th grade biology teachers at the Cahaya Rancamaya School, Bogor City, West Java. it was found that the learning process in biology lessons in general was quite good, for teaching materials at the school more used books provided by schools such as Cambridge books and curriculum books, in addition to the books used Schools also use various internet media such as platforms, quizzes, learning apps and videos from YouTube so that students don't feel bored and bored while studying. In addition, for the application of the STEM approach, the school has not implemented it in each class, but still applies it to activities outside the classroom such as extracurricular; this is because the STEM approach has only been implemented this year in extracurricular activities with a function to see how the development of STEM is applied.

Furthermore, another result obtained is that students' responses in learning biology are different because each class has a different grade. In grade 8 there are 2 different grades, first a class with an active grade and a second class with a less active grade, so that if the teacher explains biology material in a less active grade class the teacher must be extra in teaching and delivering material the teacher must have creative ideas or skills so that students are active in class.

Based on the problems above, various variations of learning are needed, especially in learning using media. Therefore, it is necessary to develop a learning media product to make it easier for students to learn in class both offline and online. The learning media product developed is a STEM-based flipbook. The advantages of these media include materials, games, videos, photos and other hyperlink features (Rokhim et al., 2020), which can be accessed anywhere and anytime (Linda et al., 2018), through their own devices, we can store hundreds of teaching materials (Simatupang et al., 2020). In addition, the learning media that was developed not only required students to read, in the learning media there were also STEM-based tasks. Therefore, students can improve their collaboration skills according to the SMP and MTS levels. Therefore this flipbook media is not only for playing but this media can also help students understand the material that has been explained by the teacher, but also this media can improve students' creative thinking skills (Mulyadi et al., 2016). The purpose of developing this flipbook is to determine the feasibility of STEM-based flipbook learning media on the human bloodstream system material.

Research Method

The method used in this research is research and development (Research and Development) using the ADDIE development model. This model consists of five main stages, namely Analysis, Design, Development, Implementation, and Evaluation (Perbadi, 2016). The study was carried out only until the limited test phase which was carried out in August - November 2021. The population in this study was class VIII students and the sample selected was class 8A, which consisted of 19 students.

This study involved teachers at the Cahaya Rancamaya School. This study involved 7 validators. The research instrument used a questionnaire in the form of statements related to content, media presentation, and language. The validation assessment used Likert scale criteria 1-4 with categories 1) not good, 2) quite good, 3) good and 4) very good. The data analysis technique used was descriptive quantitative analysis of the feasibility of the developed media which was validated by experts and practitioners. Learning media is categorized as feasible to use, if the percentage of validation test results by the validator is more than 61% (Sugiyono, 2017). The categories of eligibility criteria for learning media are described as follows: percentages 0-20% (Highly Invalid), 21-40% (Invalid), 41-60% (Sufficiently valid), 61-80% (Valid), and 81-100% (Very valid).



Results and Discussion

The development of digital-based media is currently growing very rapidly. In addition, at this time, learning media is really needed that can facilitate face-to-face learning activities without reducing the essence of direct learning activities. To facilitate this, flipbook learning media was developed. The development of these teaching materials goes through several stages, including through the Analysis, Design, Development, Implementation, and Evaluation stages.

The first stage is analysis, at this stage reviewing the needs needed in schools, especially in carrying out online learning activities. The needs analysis stage is through interviews with teachers at the Cahaya Rancamaya Middle School. The results of the interviews showed that the learning process in biology subjects generally used books provided by schools such as Cambridge books and curriculum 13 books. The results of this analysis showed that there were no learning media presented online to facilitate learning activities during the Covid-19 pandemic.

The second stage is design, at this stage a process related to the initial design and design is carried out in forming a learning media structure. The contents of the flipbook contain KD 3.7 which is taken from the material of the human circulatory system, namely analyzing the human circulatory system and studying various disorders and prevention efforts in the human circulatory system. And for 4.7, which is to present experimental results on the influence of the human circulatory system with the aim of learning to analyze the circulatory system, circulatory system disorders and efforts to prevent circulatory system disorders. The flipbook does not only contain KD and objectives, there is also material explained by KD, STEM project assignments in which students will be asked to work on a STEM project about the human circulatory system, and the media is equipped with hyperlinks, videos, photos and also assignments to expand students' knowledge on the material of the circulatory system and to expand the amount and type of information (Purwaningsih, 2020).

The third stage is development, after the draft is prepared at the design stage. The next step is the validation stage of the flipbook learning media. This media validation was carried out by 7 experts, content validation expert, media validation experts, material validation expert, language validation expert, media and content validation experts. The purpose of this validation is to find out suggestions and comments from various validators so that the media is feasible to be tested on students. The results obtained from various validators are for content validators the score is 77%, media validators are 90%, material validators are 88%, language validators are 75% and media and content validators are 96%. This is in accordance with (Sugiyono, 2017) which states that the media or teaching materials are said to be feasible if the percentage results obtained are more than 61%. The following is a comparison of the results of the percentage scores of several validators that have been calculated using the Likert scale which is presented in the form of Figure 1. below:

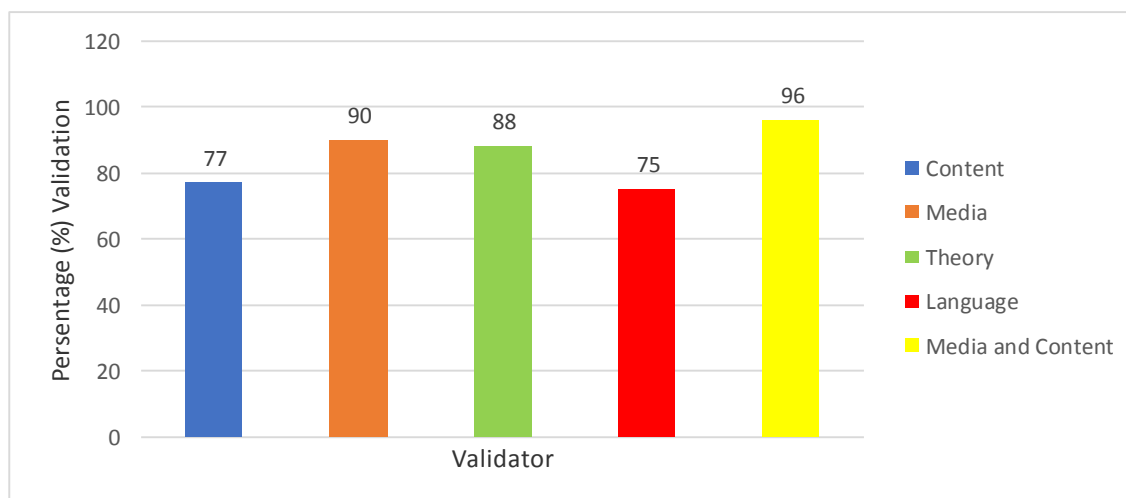


Figure 1. Validation Results

STEM-based flipbook learning media from various validators had an average score of above 81% with (very valid) criteria (Khoirudin, 2019). The feasibility of learning media is seen from all aspects that have been validated both in terms of content, media, materials, language and materials and content (Torlakson, 2014). The validation score from the content aspect gets an average of 77% with valid criteria. According to (Zaini & Asnida, 2010) content aspects such as the suitability of learning objectives, suitability of the material with the indicators used, clarity of material description, clarity of material description, accuracy of animation displayed, accuracy of material order, sample questions, and exercises clearly do not make students confusion. So that students can understand what is included in the STEM-based flipbook media.

The development of STEM-based flipbook media contains content and several additional items to enhance the existing learning media. These additional items include activities that are included in the instructional features of learning activities and assignments that can be done in the classroom and outside the classroom and are equipped with photos and videos so that students do not feel bored or bored when reading digital books which have an impact on making learning activities more interesting (Tafonao, 2018).

The percentage of validation scores from the media aspect got a score of 90% with very valid or perfect criteria. This is because the media aspect meets the elements of the quality level of learning media. Flipbooks are functionally adapted to the cover display to encourage students to explore, easy-to-select menus so students don't get confused in choosing the material and sub-materials to be studied clearly can help students understand learning media, arrangement of pictures or photos, writing, writing colors, and so on. The completeness of the presentation is quite neat (Arohman et al., 2016). The feasibility of the media has been quite feasible to be tested because it has met the elements of good media graphics. This can be seen from the legibility of letters, image media, audio video that works well, animations used in accordance with the context and precise media layout (Suryani et al., 2020).

The material for the human circulatory system has been approved by the material validator so that the material is in accordance with the truth of concepts and theories (Noval, 2016). In the material aspect, the validation score obtained was 88% with very valid criteria. The material about the human circulatory system in this flipbook can encourage students to explore and experiment. Not only because there are game features, but because the media can make it easier for students to answer various questions or tasks provided in flipbook media

which have an impact on increasing enthusiasm and responsibility in doing assignments (Widayati, 2020). Game feature functions and other features are applied to train students' memory about terms in the human circulatory system material. In addition, the game features can improve students' reading skills in learning (Citra & Rosy, 2020).

The percentage of the validation score from the linguistic aspect gets 75% with valid criteria, this aspect is based on good Indonesian and English rules and is in accordance with PUEBI (Pedoman Umum Ejaan Bahasa Indonesia), foreign words are written in italics so that students can know the scientific names in the flipbook (Africa et al., 2020). Learning media prepared using Indonesian and English are able to motivate students in fluency in their language and can also increase students' interest in reading and in presenting the material contained in the media. Because this is in accordance with the requirements of the proposed learning materials which include readability, clarity of information and conformity of rules, both Indonesian and English (Cahyadi, 2019).

The development of a STEM-based Flipbook on the material of the human circulatory system is declared valid and theoretically acceptable. The STEM-based flipbook on the human circulatory system includes material on the structure of the blood circulation, the mechanism of blood circulation, and the efforts and disorders of the human circulatory system. Flipbook consists of three parts, namely introduction, content (material), and conclusion. Here's what the STEM-based flipbook layout looks like Figure 2:

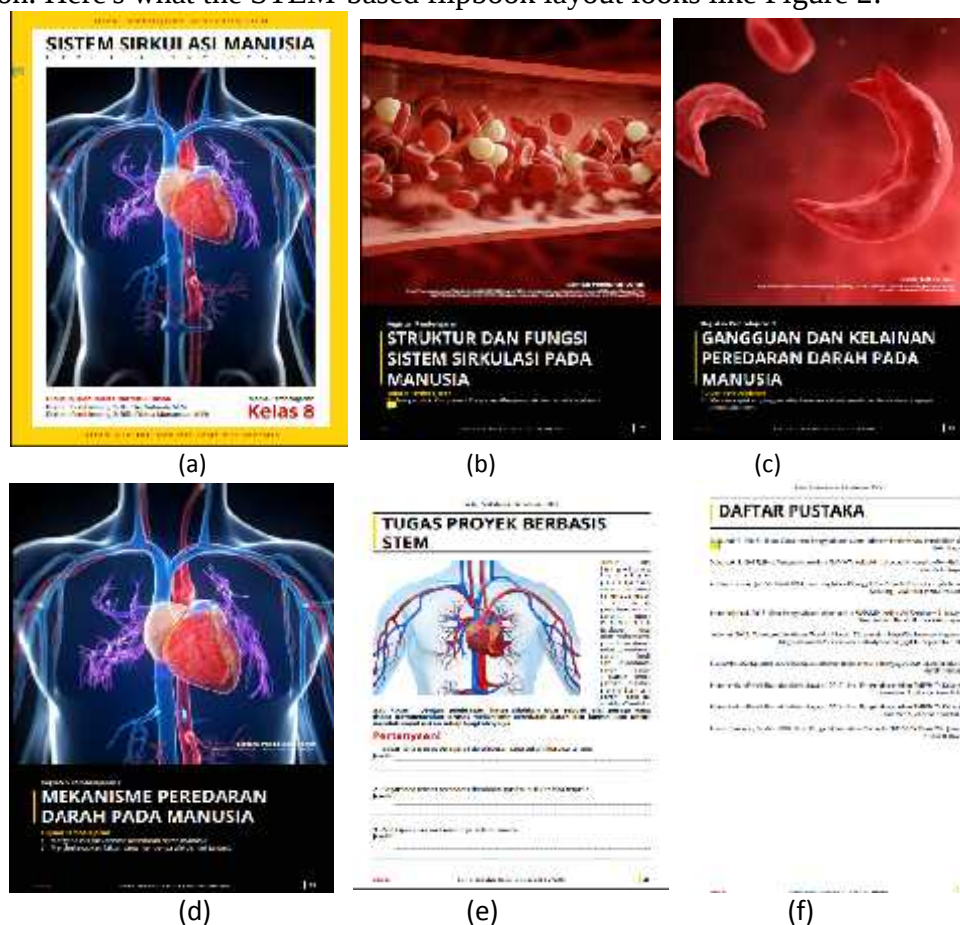


Figure 2. The inside of a STEM-based Flipbook with materials on the Circulatory system (a) Cover (front cover) (b) contents of sub-material 1 (c) contents of sub-material 2 (d) contents of sub-material 3 (4) STEM project assignments and (f) Bibliography



The fourth stage is implementation, carrying out and conducting limited trials in real situations with 19 students in 1 class. Media developed and improved in accordance with the advice and opinions of experts. This product trial was tested to find out how much influence flipbook media has on the quality of student learning which includes attractiveness, effectiveness and efficiency in student learning (Africa et al., 2020). Once implemented in class, students are given a response questionnaire which they can access online. The purpose of distributing this questionnaire is to ensure the readability of the developed learning media. The results obtained from the percentage score got 82% with very valid criteria. This is determined by the Likert scale criteria if the score above 61% is declared valid and acceptable. The high student response is possible because the flipbook learning media developed is STEM-based. Through the STEM approach, you will train thinking and collaboration skills. Students will be brought into reality in everyday life to be able to solve problems with critical and logical thinking (Putri et al., 2020). In addition, flipbook media is a category of audio-visual media where the media is a set of tools or digital books that can project images or videos according to the original (Amanullah, 2020).

The fifth stage is evaluation, at this stage only a formative evaluation is carried out. This is done to validate the developed product and revise it according to input (Tegeh et al., 2015). In accordance with the stages in the ADDIE model, evaluation is carried out at each stage of development. After using flipbook media, the results of the student response questionnaire and the input results received from various validators were evaluated to ascertain whether the flipbook product developed was successful as expected or not. If appropriate, this flipbook media can be used and disseminated in schools. In line with research (Andaresta & Rachmadiarti, 2017) showing that STEM-based flipbook learning media can attract students and increase student motivation in learning because the media has hyperlink features, color images, videos and games that can make it easier for students to understand the material, especially on materials bloodstream system.

Conclusion

STEM-based flipbook on circulatory system material was developed to be used as a learning medium for junior high school students. Through this study, the feasibility of a STEM-based flipbook will be seen from the validation results of experts. STEM-based flipbooks developed using the ADDIE model can be declared very valid and feasible to use in learning. This feasibility is seen from the results of student questionnaire assessments as well as assessments and input from various validators consisting of 77% content validators, 90% media validators, 88% material validators, 75% language validators and 96% media and content validators.

Recommendation

Based on the research that has been carried out, there are recommendations for further researchers, namely the need for limited testing and extensive testing to determine the response to the developed media, and then it is necessary to develop STEM-based flipbook learning media on other materials. Other features on flipbooks need to be redeveloped according to student learning styles, so that the learning media used are more attractive. Special advice for teachers is that the STEM-based flipbook media that was developed can be used as an alternative learning media during online learning.

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