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Feasibility of Biophysics Flipbook on Respiration System Content for Junior High School Student

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Abstract

The rapid progress of the era of globalization is pushing for the necessity of the world of education, especially in learning to adapt to applying digital technology. In line with this, the effect of learning is less than optimal during the pandemic, with many problems surrounding media and teaching materials that are not optimal, less attractive, and monotonous, thus making science learning not as effective as it should be. Based on these problems, we need a media that can effectively learn resources based on digital technology in science learning. This study aims to develop a biophysics flipbook product as a medium and teaching material on respiratory system materials for junior high school students. This development research uses a 4D model which consists of define, design, develop, and disseminates—the focus of the discussion in this article only on the feasibility aspect of the product being developed. The research data is the result of the validation score of each aspect which is descriptive quantitative analysis. The results of this research and development resulted in a biophysics flipbook worthy of didactic, construction, technical, and language aspects with very high categories and can be tested or applied in learning at school.

Keywords: digital technology, biophysics flipbook, respiration system, 4D model

INTRODUCTION

Technological and industrial developments is an essential role in the learning. As we can see now, world civilization is entering the industrial revolution 4.0 which emphasizes the integration of all aspects of human life today with digital technology (Okay and Fernandes 2020; Chen, Chih Hung and Tsai 2021; Perdana et al. 2021). The education is one area affected by this rapid development. This indicates that the modernization and digitization of learning facilities must exist in various educational institutions in Indonesia (Shahroom and Hussin 2018; Li 2020; Perdana et al. 2021). Many digital platforms today provide opportunities for the use of technology in creating progressive digital learning environments with high access (Sert and Boynueğri 2017; Eze et al. 2018; Perdana et al. 2021). This phenomenon makes integrating technology between learning materials, learning tools, and other elements essential that determines the achievement of learning competency goals for students in schools (Bdiwi et al. 2019; Perdana et al. 2021).

The era of globalization has a very rapid influence on the development of digital-based technology which is very much felt in the world of education (Putri et al. 2020; Sakhowati 2020) (Putri et al. 2020; Sakhowati et al. 2020). The digital era has and provides different opportunities from previous eras, because in this era our daily lives are strongly influenced and dependent on the use of existing technology (Dunlop et al. 2016; Wibowo et al. 2019). The presence of technology in the world of education is actually required by existing regulations in Indonesia, where students must receive

learning according to their needs and competencies by adapting learning methods to the development of the times and technology to be able to attract the interest of students in the learning process (Kemendikbud 2020). The application of technology in education is considered to give the impression of learning that is more flexible and supports the effectiveness of the learning carried out (Kodi et al. 2019), so that the world of education must be able to adapt quickly to integrate digital technology in its implementation (Saparina et al. 2020; Febrian et al. 2021; Febrian et al. 2021).

Like a tit for tat, efforts to transform education in the digital era were given vast opportunities when there was the influence of the implementation of online learning by the COVID-19 pandemic two years ago. Therefore, Indonesia's education must be able to transform in various forms and not depend only on conventional dimensions in carrying out operational wheels as before. Learning in today's classrooms must be able to adapt to circumstances so that learning in the classroom which was originally still dominant, is carried out traditionally and minimal integration with technology is starting to be abandoned. Teachers or educators in schools can overcome the obstacles of online learning which is carried out remotely or this PJJ is starting to open up opportunities for the presence of massive and dominant technology in the continuity of learning. Moreover, specifically on the learning media teaching materials that have been used so far. This phenomenon can be seen from the many and currently rampant learning devices developed by teachers in schools based on technology or ICT. This is certainly a breath of fresh air for the progress of Indonesian education.

The integration of technology in learning can be started from the transformation of innovative learning devices such as media and learning resources. Teaching materials, considered important elements in facilitating students to get learning information sources, become vital for continuity, which is very influential (Sa'diyah 2021). This innovation with the help of digital technology can make learning resources used through conventional printed materials accessible online. This phenomenon increasingly makes digital-based teaching materials a major requirement in the learning process (Falah et al. 2021).

Quality learning is not only accompanied by good learning methods and strategies, but also must include quality learning media (Ariani et al. 2017) So far, apart from being constrained by conventional teaching materials, learning in schools is still lacking involve innovative learning media, so that students feel bored and bored with the media or teaching materials used (Wibowo and Pratiwi 2018). Media has an important function in facilitating the provision of information from teaching materials from teachers to students to achieve the learning objectives set (Maulidya et al. 2022). Good learning will always require teaching materials and good learning media to be able to facilitate students in understanding the material being taught (Putri et al. 2020). Developing effective teaching materials and media that are well combined and attractive is considered to increase students' motivation, enthusiasm, or personal psychology in learning (Falah et al. 2021).

One type of media that contains interesting teaching materials is flipbook. The choice of flipbook as a media developed as a learning resource is considered more attractive by emphasizing important points in the learning material presented (Maulidya et al. 2022). The use of books as teaching materials or the main learning resources that are still dominant at this time are considered to have substantial obstacles such as large sizes or weight when carried everywhere, so that students often cannot use them optimally. The teaching materials and media used so far also give the effect of saturation or boredom for students, because they are considered too monotonous and less interactive. The advantages of this flipbook are that it can make learning more interesting, varied, easy to access and take anywhere, and is a reflection of technological innovation in education (Damayanti and Raharjo 2020; Putri et al. 2020; Falah et al. 2021; Syafii et al. 2021). The development of this flipbook provides a space for integration between education and digital technology which is now very much needed (Solikhatus and Widihastrini 2017).

Flipbook is a PDF media that is converted into a digital book in the form of packaged teaching materials that can be used for participants equipped with interesting, interactive media, such as videos, music, animation, and many other features (Maf'ula et al. 2017; Oktaviara and Pahlevi 2019; Wibowo et al. 2019; Puspitasari, Hamdani and Risdianto 2020; Erna, Elfizar and Dewi 2021; Maulidya, Yeni and Titin 2022). This flipbook was developed to help students understand the material being taught, improve learning outcomes, and interest or motivation to learn students (Sa'diyah 2021). The use of this media is highly recommended for students in learning because it can be accessed using a device or

laptop (Wibowo et al. 2019). Thus, learning, especially in science learning, which is commonly known as abstract, can now be visualized through the existing flipbook media.

In line with the above, flipbook development is considered to be a very helpful medium for learning with abstract material that needs to be visualized. For example in this study is the material of the respiratory system in the study of physics. This material requires innovative media to make it easier to convey the material, such as through visualization of videos, images, or animations. Moreover, during this time, most of these materials were taught to be less interesting, monotonous, abstract, and less representative. This is considered necessary because this material is essential, important, and contextual material with the lives of students, so the concepts of this learning theory really need to be understood by them (Damayanti and Raharjo 2020). This encourages the development of flipbook-based teaching materials to facilitate science learning in junior high schools in particular to be better during this pandemic. Junior high school science learning which is required to be integrative with other science sub-disciplines, is also the basis for developing a biophysics-based flipbook. Due to the fact that in the field there are not many biophysics-based junior high school science studies, especially in respiratory system learning materials.

Biophysics as an integration of two science sub-disciplines contained in this flipbook, is believed and expected to be able to bridge the fragmentation that has occurred so far in science learning. This makes science learning considered separate instead of actually having a strong relationship foundation. The presentation of material in this flipbook is also expected to be able to provide students with an understanding of how the respiratory system of living things works from the point of view of biology and physics which is integrated accumulatively and associatively. It is hoped that the material obtained by students will be wider, deeper, and meaningful. Based on the problem description above, the researcher developed a biophysics flipbook on the respiratory system material for junior high school students. In this article, what will be discussed specifically is the validation of the developed product.

METHODS

This development research uses a 4D model consisting of 4 stages: Define, Design, Develop, and Disseminate. In the define, the researcher conducted curriculum analysis, student analysis, concept analysis, and task analysis are carried out. At the Design stage, a flipbook product design is carried out, including a product grid, design and layout design, content design, and features such as images, animations, videos or music. Flipbook development is carried out at the Develop stage with the creation and feasibility test by 5 experts/practitioners as validators. At this stage, revisions are also made if there are suggestions and input from the validators. In the Disseminate stage, the researcher wrote this article as a form of product dissemination through scientific publications.

The target of this research is a biophysics flipbook on the subject of physics in the respiratory system. This flipbook is designed according to the needs of the junior high school curriculum in K.D. 3.9 and 4.9 class VIII even semester. Data collection in this development research is through a validation sheet filled out by 5 experts/practitioners covering didactic, construction, technical, and language aspects of feasibility testing. The feasibility measurement is carried out on a dichotomous scale by ticking the Yes or No column in the validation sheet provided. Where Yes is 1 and No is 0. Data analysis techniques in this study used quantitative descriptive analysis.

The data from the validation results are tabulated and then the average of each aspect of the validator's assessment is calculated with the following equation (Widyoko 2014).

$$\bar{x} = \frac{\sum x}{n} \tag{1}$$

\bar{x} = Average score

$\sum x$ = The total score of each rater for a particular component

n = Number of validators

The calculation results are then converted into categorical data that has levels and conditions as shown in TABLE 1.

TABLE 1. Determination of Product Eligibility Criteria Interval (Widyoko 2014)

| No | Interval Score | Grade | Category |
|----|--|-------|-----------|
| 1 | $X > (\bar{X}_i + 1,8Sb_i)$ | A | Very High |
| 2 | $(\bar{X}_i + 0,6Sb_i) < X \leq (\bar{X}_i + 1,8Sb_i)$ | B | High |
| 3 | $(\bar{X}_i - 0,6Sb_i) < X \leq (\bar{X}_i + 0,6Sb_i)$ | C | Enough |
| 4 | $(\bar{X}_i - 1,8Sb_i) < X \leq (\bar{X}_i - 0,6Sb_i)$ | D | Low |
| 5 | $X \leq (\bar{X}_i - 1,8Sb_i)$ | E | Very Low |

Informations:

X = Empiric Score

\bar{X}_i = Ideal mean (1/2 (maximum score + minimum score)

Sb_i = Ideal standard deviation (1/6 (maximum score – minimum score)

RESULTS AND DISCUSSION

This article focuses on discussing the feasibility of a product in the form of a biophysics flipbook. In contrast, a detailed discussion of the research stages of other 4D model development, such as needs analysis, design, and effectiveness, will be discussed in another article. Here are some snippets of the shape of the flipbook design that was developed.

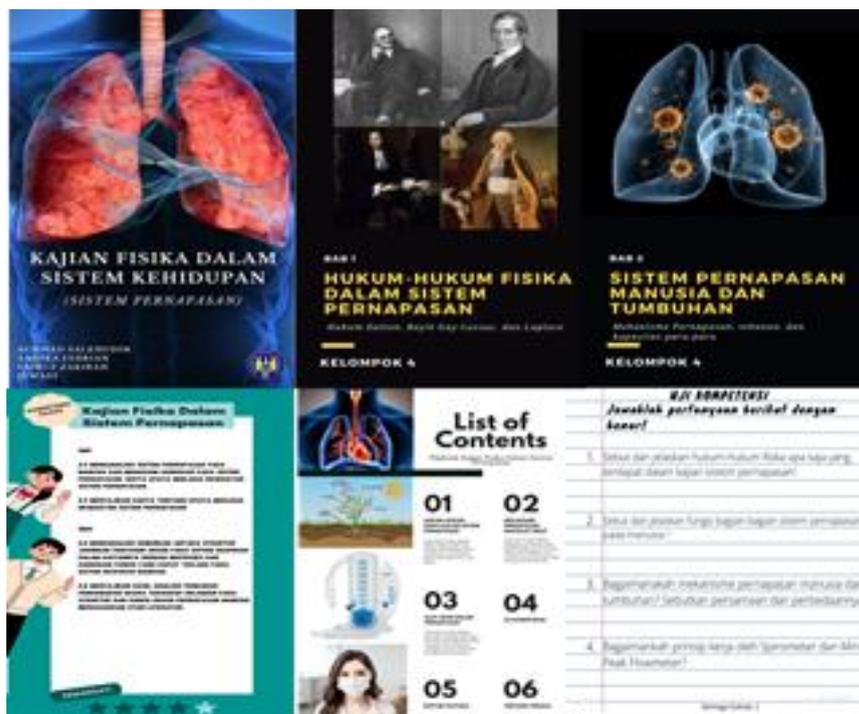


FIGURE 1. Flipbook Multiple Parts Snippets

At the development stage, researchers carry out comprehensive manufacturing and development for the resulting product. After going through the stage of making a flipbook product, it is validated and revised if there is a score that is still relatively low/very low/or not yet valid. At the validation stage, this biophysics flipbook product has been tested for feasibility by 5 educational experts/practitioners in several aspects, namely didactic, construction, technical, and language aspects. At this stage, the experts/practitioners also provide suggestions and input for the product. Aspects and indicators of the assessed validation sheet were generated through the synthesis of several types of relevant sources

(Nugroho and Syamswisna 2016; Ariani et al. 2017; Sakhowati 2020; Saparina et al. 2020). The validation indicators consist of didactic, construction, and technical and language aspects. The data from the feasibility test on the didactic aspect can be seen in the image below:

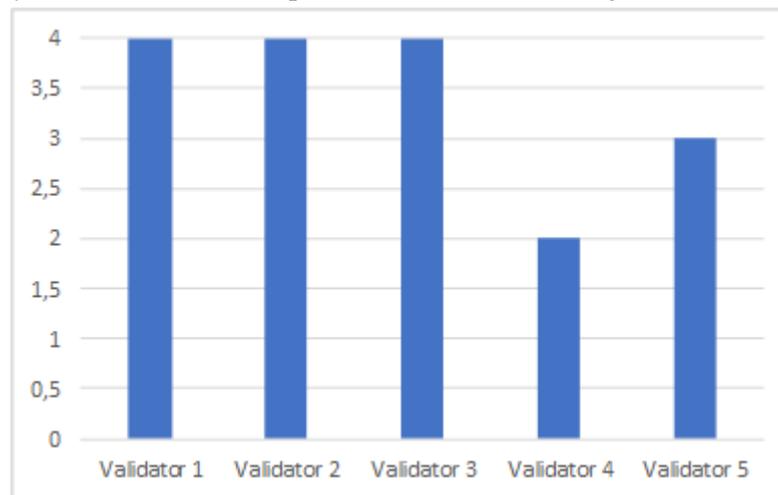


FIGURE 2. Product Feasibility Test Results on Didactics Aspects

Based on the validation results in the image above, the didactic aspect of the biophysics flipbook product was declared feasible with an average score of 3.4 out of 5 validators. Suppose the score is calculated using EQUATION 1 and the provision of category intervals in TABLE 1. In that case, this didactic aspect is greater than 3.21 (the result of calculating the total ideal mean + standard deviation), so that this didactic aspect is declared feasible in the very high category. In the didactic aspect, the indicators assessed are conformity with the curriculum, such as Competency Standards, Basic Competencies, indicators, and clarity of learning objectives to be achieved. In this aspect it is also assessed to what extent the material presented can facilitate the understanding of students' concepts and the initial questions presented, so that can be understood and stimulate students well when applied. The component of the didactic aspect in the assessment of the feasibility test is considered very crucial. Because the existence of this aspect in the product being developed provides the starting point for a good teaching material to be applied and used in learning at school, through this aspect, teaching materials are encouraged to be able to have slices and be guided by the required junior high school curriculum, so that learning can be facilitated and does not go out of the corridor that has been set. With completeness in the didactic aspect, these teaching materials will undoubtedly be very influential in stimulating the attractiveness and interest of students in learning. This aspect component becomes the most important element to be assessed, because the indicators covered in this aspect are components of material content that are the main learning resources, so that they must be fulfilled completely, deeply, appropriate and easily accepted by students (Ariani et al. 2017; Falah et al. 2021). Attractive module packaging can also give a pleasant impression and learning environment, stimulate students' motivation to learn enthusiastically, and reduce boredom (Sa'diyah 2021; Wijayanti et al. 2021). Meanwhile, the validation results for the construction aspect can be seen in the image below:

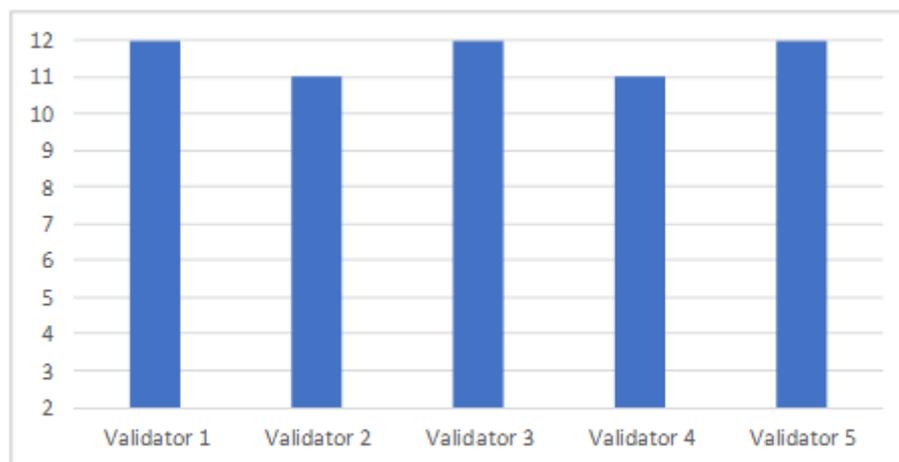


FIGURE 3. Product Feasibility Test Results on Constructions Aspects

Based on the validation results in the figure above, the construction aspect of the biophysics flipbook product was declared feasible with an average score of 11.6 from the 5 validators. Suppose the score is calculated using EQUATION 1 and the categorical interval provisions in TABLE 1. In that case, this construction aspect is greater than 9.6 (the result of calculating the total ideal mean + standard deviation), so this construction aspect is declared feasible with a very high category. In the construction aspect, the indicators assessed are the integrity of the flipbook format starting from the cover, preface, table of contents, contents, bibliography, to the author. This aspect is also assessed for completeness, depth, clarity, truth, and the suitability of the material or concept in the form of writing, images, or videos that are included in the flipbook, so that the resulting flipbook is an interesting and easy-to-understand teaching material. The role of this aspect is considered crucial because it is the construction aspect that has an influence in meeting learning achievement for students (Fajrul Falah, Sifak Indana and Tukiran 2021). Interesting, unique, and innovative learning media can encourage students' motivation and interest in learning, as well as improve their ability to understand learning materials, therefore this flipbook is designed to be able to influence the realization of these impacts for students in learning activities (Chaerunisa 2019; Damayanti and Raharjo 2020; Talakua and Aloatuan 2021; Maulidya et al. 2022).

The urgency of this construction aspect will give a claim that the product of teaching materials developed guarantees the quality of the material presented. The validators considered that the completeness of the flipbook format as a teaching material indicates a good learning resource in terms of construction. The completeness and depth of the material will also influence learning content which is of very essential value and becomes the main point for a teaching material, so that the learning resources used can accommodate the knowledge needs that must be possessed by students, of course, with reference to the applicable curriculum. The determination of the type and size of the font as well as the color composition is also the attraction of a learning medium, this is an indication that it is hoped that it will help students easily understand what they are learning (Maulidya et al. 2022). Meanwhile, the results of the validation of the construction aspects can be seen in the image below:

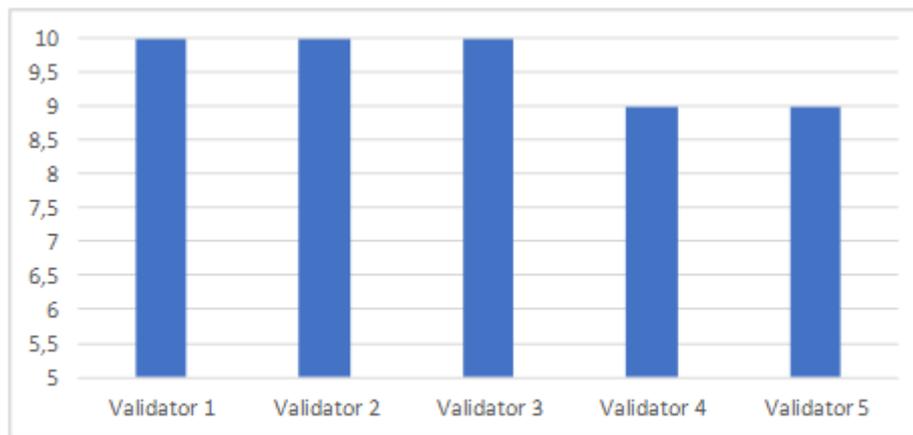


FIGURE 4. Product Feasibility Test Results on Technical and Language Aspects

Based on the validation results in the image above, the technical and language aspects of the biophysics flipbook product are declared feasible with an average score of 9.6 out of 5 validators. Suppose the score is calculated using EQUATION 1 and the category interval provisions in TABLE 1. In that case, the technical and language aspects are greater than 8.01 (the result of the calculation of the total ideal mean + standard deviation), so that the technical and language aspects are declared eligible in the very category. tall. On the technical and language aspects, the indicators assessed include the flipbook's design and layout, such as colors, pictures, videos, or music that are appropriate, attractive, proportional, and representative of the contents of the flipbook. In this aspect, the correctness and effectiveness of the language, spelling of words, sentences, and punctuation used are assessed, so that the flipbook can become more communicative and interactive for students later. This technical and linguistic aspect is considered very important and essential because it becomes a communication link, attracts attention, clarifies the content, or illustrates facts from the media for students to be able to understand the content presented by Flipbook (Ariani et al. 2017; Falah et al. 2021; Maulidya et al. 2022).

In addition to paying attention to didactic and construction aspects, technical and language aspects are also important aspects that must also be included in a teaching material product. Because with this aspect it is representative of the product to be used and displayed in learning. Flipbooks as learning resources that are identical with many representations of sources such as animated images, videos, and so on must have language construction as a good bridge in communicating learning content for students. This makes the language component, the spelling of words or sentences, even the punctuation used to be appropriate to convey the message of the loaded learning content. In addition, video media, images, music, and colors displayed must match each other. This is because these elements characterize the main display of the learning resource media used. These elements will certainly impact students' interest in using these teaching materials (Mulyadi et al. 2016; Wibowo et al. 2019).

Based on the results of the feasibility test above, it can be seen that the results of the biophysics flipbook feasibility test on the respiratory system material have been feasible with very high categories in all three aspects. Thus, this product has also been able to be applied or tested its effectiveness as a medium/science teaching material in the learning process at school. With the application of this product in learning in schools later, science learning is expected to be more interesting, efficient, and attractive with the integration of digital technology in the sources of teaching materials used. This can support and improve the quality of modern learning in the 21st century.

CONCLUSION

Based on the results and discussion described above, it was found that the biophysics flipbook on respiratory system material for junior high school students can be declared eligible with a very high category. The results of this validation indicate that the developed product has been considered

theoretically feasible by experts and practitioners as a source or teaching material that can be applied in school learning. The hope is that this product can be an alternative solution in realizing science learning that is more interesting and interactive for students in the era of modern digital technology-based learning.

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