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Development of Science Module based on Flipbook about Physics in the Respiratory System to Improve Students' Learning Independence

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Abstract: Learning is now gradually recovering from the effects of the COVID-19 pandemic with the start of limited face-to-face learning. This makes educators need to innovate so that students still have independent learning. Less than optimal online learning causes students to be too passive when learning offline. To overcome this, research was carried out through the development of science module based on flipbook about physics in the respiratory system. This study aims to determine the feasibility level of the module, to determine the responses of students, and to find out whether the module can increase students' independence in science learning. This study uses the Thiagarajan 4D (Four-D Model) development model, consisting of four stages, namely the definition stage, the design stage, and the development stage. The dissemination stage was not carried out, this research was only limited to product feasibility testing. This study uses a descriptive qualitative approach. The sample in this study is class VIII A totaling 10 people. The collection technique used is a questionnaire and documentation. The results showed that: (1) science module based on flipbook was feasible, judging from the percentage of the feasibility of the module 96.73% (very feasible), (2) student responses to the module were in the very good category, seen from the percentage of interest in the module 90.00% (very interested), and the students' independence in learning science using flipbook-assisted science modules were included in the high category, with a percentage of 86.25% (high science learning independence).

Keywords: Development research; Science module; Flipbook; Physics in the respiratory system; Learning independence

Introduction

State The world was shaken by the Covid-19 pandemic which changed many lives, did not depend on the field of education. Education during the pandemic is carried out boldly or online, this makes learning less than optimal. This also has an impact on learning that has recently begun to be carried out face-to-face, limited to areas with green zones. Teachers must try to restore the interest and independence of students' learning. Teachers need teaching materials that are able to independently learn independently of students.

Education has a very important position and role, because through education a child's personality can be formed. Education is also one of the human needs in developing themselves according to the potential that exists within the human being (Amin, 2022). Education is a conscious effort made by the community and government through guidance, teaching and or training activities, which take place at school and outside school throughout life to prepare students to be able to play roles in various living environments appropriately in the future (Pujianingtias et al., 2019).

The use of technology supports the educational process. The use of technology is also closely related to the challenges of 21st century education. Educators need technology to improve the safety and effectiveness of learning, while students in the 21st century are growing up in a digital world that is rapidly changing to replace classroom-based learning (Boholano, 2017). Curriculum that involves visual technology in learning will be

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absorbed more quickly and more meaningfully than students' written reports and verbal learning alone. This is because it is easier for students to access information (Nurhidayanti et al., 2022). The technology that is familiar to most students is a smartphone that can run various applications to process data and establish relationships between fellow users. The use of various technologies such as the internet and mobile devices makes students more initiative in their learning efforts (Jaleel, 2017). This ease of accessing information should be put to good use during learning in the 21st Century.

In addition to technology, the challenge of 21st century learning is to train and cultivate independent learning for students. Independent learning or what is called self-directed learning is the process of acquiring academic skills such as setting goals, selecting and expanding strategies, and self-monitoring effective strategies, not as a reaction to the strengths of others (Zimmerman, 2008). Independent learning shows that a person can complete his learning tasks without the help of others and done independently. Students who have independence are students who actively provide meaning, a student who is active for their own learning process (Dwi Evitasari, 2020).

Based on the results of preliminary observations in SMP Negeri 1 Magelang, 77% of students get more enthusiastic about learning if the learning process involves technology experienced in it such as flash animations, interactive video, and using a digital module. A module has advantages when compared to the textbook, which are on a two ways communication, a clear structure, a friendly and motivating (Syahroni et al., 2016). Learning sciences should develop students as inquirers, scientifically literate, caring and responsible individuals who will think critically and creatively when solving problems and making decisions about aspects affecting themselves, others and their social and natural environments - it is more than simply learning technical scientific terminology (Dela Cruz, 2015).

Student independence in learning is very important and needs to be developed in students as individuals who are positioned as learners (Amin, 2022). With the independence of students, students can do everything according to their abilities. Students who have high learning independence will try to complete the exercises or tasks given by the teacher with their abilities, on the contrary students who have low learning independence will depend on others (Pujianingtias et al., 2019).

Independent learning is highly recommended to be developed because this attitude is one of the important factors in higher academic achievement in science (Nurhidayanti et al., 2022). Another advantage of the attitude of independent learning is not only successful in academics but also in life in the future.

The low learning independence of students is caused by their low self-confidence, motivation, and discipline (Nurhidayanti et al., 2022). Therefore, learning independence needs to be continuously developed because this character will greatly support the lives of further students by improving the quality of learning in the classroom.

This teaching and learning process will run effectively and efficiently in increasing the independence of students' science learning if this process is supported by the components in the process. One component in the teaching and learning process is learning resources. Examples of these learning resources are teaching materials (Eka Rahayu et al., 2015). Before teaching and learning activities are carried out, the teacher must prepare the teaching materials needed in the learning process. Completeness of teaching materials can help teachers and students in the teaching and learning process. The teaching materials used can determine the achievement of learning objectives. One example of teaching materials that can be used is the module.

The module is a printed teaching material used by students for learning resources (Eka Rahayu et al., 2015). This module also aims to make students able to learn independently, can be studied anytime and anywhere without any supporting tools. The module also plays a role in training students to learn actively and can also support the effectiveness of achieving learning objectives. The use of modules in the teaching and learning process aims to achieve learning objectives effectively and efficiently (Sudjana, 2007).

Learning that integrates digital technology in learning has been widely used (Ristanto et al., 2020). Digital Flipbook is one of learning media that has been applied in science. The medium is a digital book that has the advantages of a book as well as contains animation and video that could not be found in a book. It could be accessed through smart phone, computer or tablet; thus, its development and implementation could support students' digital literacy.

The advantages of digital module is easily accessible and are more relaxed when compared to the printed books that have been used in the learning process (Syahroni et al., 2016). Modules that contain only a summary of the material will make students less interested in learning it because there are no pictures/illustrations of the material being studied. Another obstacle in the teaching and learning process is the lack of interest of students in reading textbooks. In reading textbooks, if not ordered by the teacher, the books will not be touched and remain intact because they are not read. Obstacles in learning indicate that students' responsibility and self-confidence in science teaching and learning activities are less than optimal, so that student learning independence is still very low.

Basically, independence is the behavior of individuals who are able to take the initiative, are able to

overcome obstacles/problems, have self-confidence and can do things on their own without the help of others (Nuraeni et al., 2012). Moreover, teaching and learning activities (KBM) are not supported by interesting textbooks, so students become lazy to learn. For this reason, there is a need for new developments in the preparation of interesting student teaching materials, so that students feel helped in learning the material while feeling more enthusiastic in studying the material presented and confident in their abilities so that learning independence will develop.

An innovation is needed in a science module that is innovative and interesting and can foster students' independence in learning science. From the results of the study, the researchers determined the development of an electronic science module based on flipbooks. The renewal in this study is the change of printed teaching materials into Kvisoft flipbook-based electronics (Haryanto et al., 2019). This e-worksheet contains subject matter, work procedures, and assessment formats which are all based on science process skills to be able to train or develop students' science process skills. Learning activities are designed so that students can actively build concepts, laws or principles through the stages of formulating a problem, making a background, constructing a hypothesis, testing a hypothesis, analyzing data, drawing conclusions and communicating results.

Electronic teaching materials are teaching materials published in digital format, containing text, images, which can be read through computers or other digital devices (Yulaika & Sakti, 2020). Electronic teaching materials are learning tools designed to help learning both in class and outside the classroom which are displayed in digital format so that learning can be more interactive. Electronic teaching materials also support open learning and can be owned by students because they are easy to share, for example through social media such as Facebook, WhatsApp, Telegram, and the like. So that students really know what basic competencies they must master in each learning implementation.

Students can learn independently by using electronic teaching materials that have been prepared by their subject teachers. In addition, parents can also monitor the quality of learning given to their children. Electronic teaching materials have various functions, including (Yulaika & Sakti, 2020): (a) as an alternative learning media; (b) different from printed teaching materials, electronic teaching materials can contain multimedia content in them so that they can present more interesting teaching materials and make learning more fun; (c) as a medium for sharing information; and (d) compared to printed teaching materials, electronic teaching materials can be disseminated more easily, either through media such as websites, virtual classes, e-mail, and other digital media.

One of the software that can make the display of electronic modules more interactive and attractive is Flipbook. The advantages of this flipbook include hyperlink features, interesting images, audio, video, and flip effects that can open or flip a book so that it is like real reading. In addition, this flipbook is very easy to use and the products produced are in the form of SWF or Flash, HTML to be published through the website (Nufus & Sakti, 2021).

Based on the background that has been described, the purpose of this study is to analyze the independence of students' science learning through the implementation of a flipbook-based science module for class VIII on the respiratory system material in humans.

Method

This type of research is research and development (R&D). The development model used is the R&D model according to Thiagarajan (1974). This research was conducted on May 9, 2022, for the academic year 2021/2022. The flipbook-based science module from this development research was tested at SMPIT Bakti Insani Yogyakarta, which is located at Jumeneng Kidul, Sayidan, Sumberadi, Kec. Mlati, Sleman Regency, Special Region of Yogyakarta 55288.

The subjects in this study were 10 students of class VIII A of SMPIT Bakti Insani Yogyakarta to carry out the learning process with a flipbook-based science module developed and testing a flipbook-based science module to increase students' learning independence.

The research procedure consists of four stages, namely the define, design, develop and disseminate stages. At the define stage includes the initial stage, students, assignments, concepts and formulation of learning objectives. At the design stage (design) includes the preparation of instruments, media selection, format selection and initial product design. The develop stage includes the expert assessment stage and development trials. Then in the disseminate stage, it is only done in a limited way.

This study uses a descriptive qualitative approach. The type of research in this study is a case study so that research can be carried out in more depth about a matter according to the human perspective being studied.

The method used in this research is descriptive method. According to Nawawi (2012), "descriptive method can be interpreted as a problem-solving procedure investigated by describing/describing the current state of the subject/object of research based on the facts that appear, or as they are".

This research is qualitative because the research was carried out by researchers in natural conditions by conducting experiments with students. According to Sugiyono (2006), "qualitative research methods are often called naturalistic research methods because the

research is carried out in natural conditions (natural settings)".

Validation data includes expert validation questionnaire data and flipbook-based science module practicality questionnaire data. Data on the learning independence of students was obtained using a questionnaire. The research instrument includes a questionnaire sheet.

The feasibility and practicality of flipbook-based science modules were analyzed by converting scores using a scale of 4 (Mardapi, 2008).

Result and Discussion

The results of this study are in the form of a science module based on flipbook about physics in the respiratory system to increase students' learning independence. The development science module aims to produce products that help the learning process. The flipbook-based science module developed must have a level of validity and practicality that meets the criteria.

The science module based on flipbook cover display design uses a picture of the lungs as an illustration of the contents in the module. The cover of the module consists of two, namely the front cover and the back cover. The cover color is designed in full color with a yellowish orange base color for the front cover and light blue for the back cover. The module is a form of teaching material that is packed intact and semantic, containing a set of planned learning experiences designed to help learners understand specific learning objectives (Budi et al., 2018).

The science module based on flipbook content design with 30 pt font size with Montserrat Semi-Bold writing theme, margin size with arrangement (1410 pixels wide and 2250 pixels high). In the science module based on flipbook there are several pictures such as the lungs and their constituent structures, the structure of the respiratory organs of the nasal cavity, pharynx, larynx, vocal cord structure in the larynx, chest and abdominal breathing mechanisms during inspiration and expiration, in addition to pictures related to the human respiratory system. There are also some motivational pictures. Flipbook worksheet is closely related to computer literacy, media literacy, distance learning, and e-learning literacy (Sumarmi et al., 2021).

The Flipbook application is software that can convert files in PDF format. This software can input data in images, videos, music, keys, animations, and even links to other sources into one. The form of stimulus used as media includes human socialization and interactions, moving images, writing and recorded sound (Agustina & Maharani, 2021). Besides converting PDF format files, this software can convert Words, PowerPoint, and Excel with more varied output formats such as EXE, HTML, ZIP, and APP. So, it can be used on students' smartphones, laptops, and PCs (Sumarmi et al., 2021).

The module is a component that plays an important role in the learning process (Yuliawati et al., 2013). The prepared science module contains material about physics in the respiratory system. In the science module based on flipbook, the relation between physics and the respiratory system is explained. There is a relationship between Boyle's law and the mechanism of the respiratory system. This law states that for a mass of gas at a constant temperature, the pressure is inversely proportional to its volume. If there is an increase in volume it will be followed by a decrease in pressure, and vice versa. During inspiration, lung volume increases, while intrapleural pressure decreases. Meanwhile, during inspiration, the volume of air in the lungs increases, while during expiration, the volume of air in the lungs decreases.

Figure 1. Initial view of science module based on flipbook

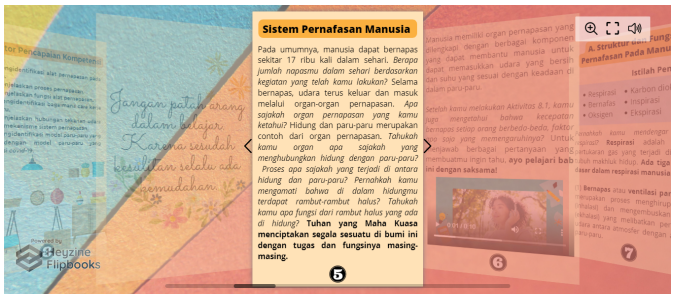

Figure 2. Display of science module based on flipbook content

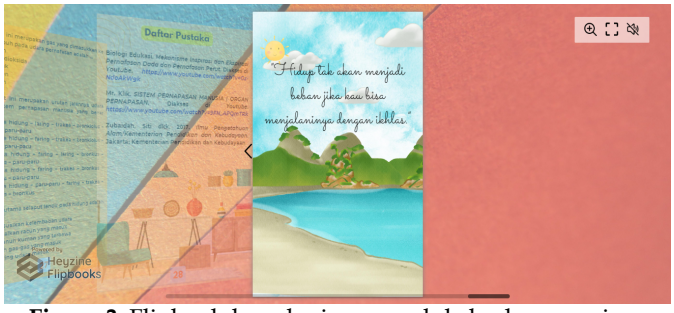

Figure 3. Flipbook-based science module back cover view

The feasibility of the science module based on flipbook is known from the assessment of the expert validators. The effectiveness of flipbook-based science

modules to increase students' learning independence is known through limited trials in the field.

The feasibility of the science module based on flipbook was obtained by finding the average rating between the six raters. Obtaining the average score of each component of the assessment aspect using the Equation 1.

$$\bar{x} = \frac{\sum x}{n} \quad (1)$$

Information:

$\bar{x}$ = mean score

$\sum X$ = total score of each component

N = number of validators/appraisers

Next, all the data that has been obtained on each assessment item are totaled so that it is referred to as the actual score (X). The actual score that is quantitative is converted into a qualitative value by referring to the conversion of the score to a scale of four to determine the feasibility of the quality of the science module based on flipbook developed. The reference for changing the score to a scale of four according to Mardapi (2008) can be seen in Table 1.

Table 1. Conversion of Actual Scores into Four Scale Values

Interval	Score	Criteria
X > (Mi + 1.5 SDi)	A	Very good
(Mi + 1.5 SDi) > X ≥ Mi	B	Good
Mi > X ≥ (Mi – 1.5 SDi)	C	Not good
X < (Mi – 1.5 SDi)	D	Very not good

Information:

X = Respondent score

Mi = Average/ideal mean

SDi = Ideal Standard Deviation

Mi = ½ (Xmax + Xmin)

SDi = 1/6 (Xmax – Xmin)

X = the average score obtained

Mi = ideal average
= 1/2 (ideal maximum score + ideal minimum score)
= 1/2 (4 + 1)
= 2.5

SDi = ideal standard deviation
= 1⁄6 (ideal maximum score - ideal minimum score)
= 1/6 (4-1)
= 0.5

Ideal maximum score = ∑item criteria x highest score

Ideal minimum score = ∑ item criteria x lowest score

Based on the four-scale assessment criteria, it can be interpreted the 4-scale assessment criteria in Table 2.

Table 2. Interpretation of Ideal Assessment Criteria with a 4 Scale

Quantitative Score Range	Category
X > 3.25	Very good
3.25 > X ≥ 2.5	Good
2.5 > X ≥ 1.75	Not good
X < 1.75	Very not good

(Mardapi, 2008: 123)

Table 3. Average Expert Validator Assessment Results

Assessment Aspect	Rating result	Category
Content Eligibility	3.76	Very good
Serving Eligibility	3.88	Very good
Language	3.96	Very good
Graphics	3.83	Very good
Media Flipbook	3.92	
Average	3.87	Very good

Based on Table 3, the average result of the expert validator's assessment of the science module based on flipbook developed is 3.87 which is in the very good category. The results concluded that the flipbook-based science module could be used with a few revisions.

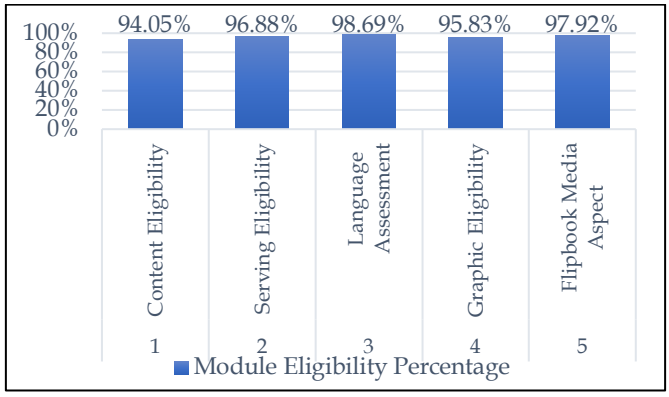

Figure 4. Assessment by Expert Validators

Overall, the average value of all aspects that have been assessed by expert validators is 3.87 with a percentage of 96.73% eligibility. This percentage shows that the quality criteria for science module based on flipbook are very feasible. With content feasibility aspects 94.05%, presentation feasibility aspects 96.88%, language assessment aspects 98.96%, graphic feasibility aspects 95.83%, and flipbook media aspects (format, content, language, practical, and effective) 97.92%.

The product is said to be valid if it includes several components, namely (1) the content feasibility component includes the suitability of the SK with KD, needs, substance truth, benefits, moral values, and social values. (2) The presentation component includes the clarity of the objectives to be achieved, the order of presentation, the provision of motivation, attraction, interaction (providing stimulus and response) and completeness of information. (3) The linguistic components, including limitations, clarity of

information, conformity with Indonesian language rules, effective and efficient use of language, then all of these components will be assessed by the validator on the validation sheet to determine the level of product validity based on the validity criteria (Desmiwati et al., 2017).

All aspects of the assessment are in the valid category, so the science module based on flipbook can be used in field trials in classroom learning to measure its effectiveness. The level of practicality of the flipbook-based science module can be seen from the results of the student response questionnaire which contains a response statement to the science module based on flipbook developed by the researcher.

Table 4. Data on Student Response Results

Assessment Aspect	Rating result	Category
Module Content Interests	3.60	Very good
Theory	3.40	Good
Language	3.90	Very good
Average	3.60	Very good

Based on table 4, it can be concluded that the assessment categories obtained from the students' questionnaire results are very good for the science module based on flipbook developed and students are interested in participating in learning activities with the help of science module based on flipbook. Thus, the practicality criteria of science module based on flipbook about physics in the respiratory system can be said to be achieved.

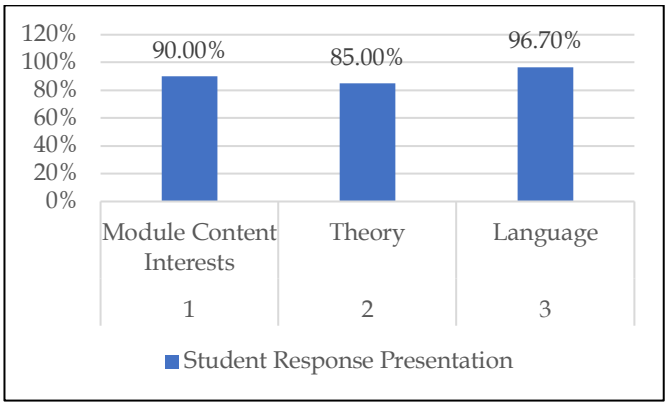

Figure 5. Assessment of Student Responses

The overall score of all aspects is 90.00%. This percentage shows that students are interested in science module based on flipbook. The percentage of the material aspect is 85.00%, the interest aspect of the module content is 90.00%, and the language aspect is 96.70%.

Learning independence data from student questionnaires were analyzed using descriptive statistics (percentages). The percentage calculation for each indicator is calculated by dividing the total score by the maximum score then multiplied by 100%. The percentage results are then converted into qualitative values into categories in Table 5.

Table 5. Category of Independent Learning

Learning independence score (%)	Category
80 – 100	High
60 – 79.99	Medium
50 – 59.99	Low
30 – 49.99	Very low

(Linda et al., 2020)

The results of independent science learning of students after using a science module based on flipbook on the human respiratory system material obtained based on a questionnaire showed an average percentage of 86.25% and was included in the high category. The learning independence questionnaire used contains six indicators of student learning independence which consist of independence from others, having self-confidence, behaving in a disciplined manner, having a sense of responsibility, behaving based on their own initiative, and exercising self-control.

The percentage of each indicator is shown through the graph in Figure 6.

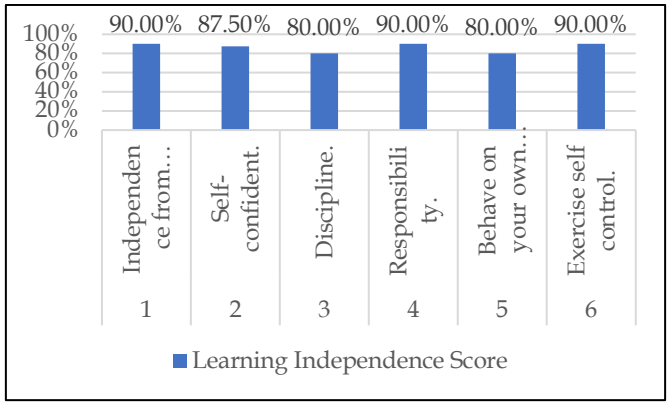

Figure 6. Profile of students' learning independence in science for each indicator

Referring to the graph of the percentage of each indicator in Figure 6, the indicator of independence from others, responsibility, and self-control has the highest percentage of 90%, while the indicator of discipline and behaving according to one's own initiative gets the lowest score of 80%. The following are the scores for each indicator, which are presented in table 6.

Table 6. Results of the Student Learning Independence Questionnaire for Each Indicator

Indicator	Scor (%)	Category
Independence from others	90.00	High
Self-confident	87.50	High
Discipline	80.00	High
Responsibility	90.00	High
Behave on your own initiative	80.00	High
Exercise self control	90.00	High

Based on these data, it can be said that there is an increase in students' learning independence in science on the material of the human respiratory system using science module based on flipbook.

Conclusion

The science module based on flipbook developed in this study is suitable for use in science learning. The results of the validation of science module contains material about physics in the respiratory system according to the expert validator's assessment showed a score of 3.87 with a very good category. The percentage of science module quality based on the validator's assessment is 96.73%, indicating the criteria are very feasible. The response of students to the science module contains material about physics in the respiratory system shows a score of 3.6 with a very good category. The percentage of interest in flipbook-based science modules is 90%. This value shows that students are interested in flipbook-based science modules. The independent learning of students after using the flipbook-based science module showed 3.45 in the very good category. The percentage of students' learning independence is 86.25% which is high.

Acknowledgements

A good module is one that fits the needs of students. So that the learning process, the level of activity, and student learning outcomes continue to increase. It is better to try out the product developed not only in one class so that it can involve large numbers of students.

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