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Development of Flipbooks Based on Guided Inquiry Models to Train Science Process Skills of Junior High School Students on Temperature and Heat Materials

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ABSTRACT

Objective: This development aims to produce a flipbook-based guided inquiry learning model to train science process skills that are feasible in terms of validity, practicality, and effectiveness. **Method:** The type of research used is development research. The development model used is the 4D model (define, design, develop, and disseminate). The assessment instrument used in this study consisted of learning device validation sheets and science process skills tests. **Results:** Based on the results of data analysis, it can be concluded that digital-based flipbooks obtain an average validation in the valid category. These results indicate that flipbooks can be used as learning media. **Novelty:** The novelty of this research is an inquiry-based feature on flipbooks about temperature and heat, which can train students' science process skills. In addition, the developed inquiry-based Flipbook is also a digital flipbook.

INTRODUCTION

Education is a concrete activity to develop the potential of human resources through learning activities. Education is also a forming process of primary abilities. The learning process is the key to supporting educational success (Rahamawati & Wulandari, 2020; Ristianti et al., 2021). At the secondary education level, various kinds of knowledge are taught so students can use it to develop their potential. One of the basic knowledge taught at the junior high school level is natural science, which is significantly related to everyday life (Putri et al., 2020). At junior high school, science learning aims to improve learning abilities, curiosity, thinking skills, responsibility, and concern for the social and natural environment. In the 2013 Curriculum, the implementation of science learning must develop science process skills. In the 2013 curriculum, mastery of science process skills is explained in the basic skills of natural science from the fourth core competency, namely skills competency.

Science process skills are a person's basic skills in using thought, logic, and action effectively and efficiently to achieve specific results. Students must master science process skills because science process skills contain various skills such as observation skills, thinking skills, skills to act scientifically, and communication skills, which will be very beneficial for students as provisions to solving daily problems as well as for preparing themselves to face global competition (Libata et al., 2023; Chongo et al., 2021). Science process skills facilitate science learning, activate students, develop a sense of responsibility, and enhance learning and research methods (Inayah et al., 2020). Science process skills apply to everyday life (Siswono, 2018).

Science process skills can be analyzed from student test answers (Fitriana et al., 2019). However, students' science process skills in Indonesia still need to be improved.

These results are based on an assessment conducted by PISA (Program for International Students Assessment). Since joining in 2000, the science process skills of Indonesian students still need to be improved (Wedyawati & Lisa, 2018). In 2012, Indonesia was in the 71st position out of 72 PISA participating countries. This result increased in 2015 when Indonesia was ranked 64th out of 72 countries. Findings from several studies also support these results. Mahmudah et al. (2019) found that 76.00% of high school students in Bandung have low science process skills. Findings by Rahman et al. (2017) at *Satu Atap* Junior High School showed that students' science process skills still needed to be developed. This was identified from the small number of students who made observations and students who asked questions, took measurements, and made conclusions (Orab et al., 2023).

Implementing strategies or models that can train students to be more active in the learning process, such as guided inquiry learning, is a solution to increase students' science process skills. The guided inquiry learning model is a student-focused learning model with educators provide a wide door open for students to find and explore the ideas they learn through exploratory exercises to respond to the questions that arise from the problem given according to their capacity (Muliani & Wibawa, 2019; Sudarman, 2018; Sumarni, 2017). Learning with guided inquiry can improve and train students' science process skills (Erlina et al., 2022; Baharom, 2020). Similar research conducted by several researchers showed that students' science process skills increased in each learning cycle after using guided inquiry learning (Sulistiyono, 2022; Mardaleni et al., 2019; Dijaya et al., 2018).

These findings indicate that learning media is an essential component of learning activities. Wulandari et al. (2023) revealed that appropriate learning media is crucial for student learning. Proper learning media selection can help students to understand the learning material. Similar research by Wasiyah et al. (2023) found that learning media can improve student learning outcomes. Using appropriate media can solve the passive attitude of students during the teaching and learning process (Yani & Hasibuan, 2022). The research results by Orab et al. (2023) found that learning media significantly affected students' science process skills.

Problems regarding the availability of learning media in science subjects and the low level of students' science process skills became a factor for researchers to develop a learning media using the guided inquiry model to increase the training of science process skills in junior high school students. The researcher chose a flipbook as an e-book for further learning media development. Flipbook is an electronic book with three-dimensional e-book technology, where pages can be scrolled like reading a book on a monitor screen. Flipbooks are known to have various benefits related to student learning outcomes (Opidianto et al., (2021). Several studies regarding implementing flipbooks in learning activities show that flipbooks can increase student motivation and learning outcomes (Adnyana, 2023; Hastira et al., 2023; Muhlas, 2018). Apart from the benefits that can be obtained from implementing flipbooks, the researcher chose to develop flipbooks because, at this time, it is vital to develop electronic learning media (Nirwana, 2019). Learning by using digital media is a learning method that attracts students' attention because learning using digital media can eliminate students' boredom and can create a pleasant learning atmosphere that can increase interaction between teachers and students (Adventyana et al., 2023; Arif et al., 2023). This novelty solves students' low science process skills and the limited availability of science learning media.

Based on the above background, the researcher is motivated to develop a flipbook based on the guided inquiry model to train junior high school students' science process skills on temperature and heat material. This development aims to produce flipbooks based on the guided inquiry learning model to practice appropriate science process skills. Flipbook feasibility in terms of validity to be used in helping the learning process on the temperature and heat material.

RESEARCH METHOD

The type of this research is developmental research. The development model used is the 4D model, adapted from Thiagarajan et al. (1974) in Ibrahim (2010). The application of this model follows four stages of development: define, design, develop, and disseminate. The defining stage helps determine and define the requirements needed in the learning process and gathering information related to the product to be developed (Arkadiantika et al., 2019). The second stage is the design stage, which aims to design a flipbook tool based on the guided inquiry model to train science process skills. This process includes media selection, format selection, etc.

The third stage is development, which is done to perfect the Flipbook through review and validation by experts from Surabaya University. The flipbook validation aims to assess the feasibility of several aspects carried out by experts/experts (validators) before use. Then, the Flipbook is revised based on suggestions and input from the validator. The last stage is the dissemination stage, which is carried out by publishing educational journals. Schematically, the stages of the research are presented in Figure 1.

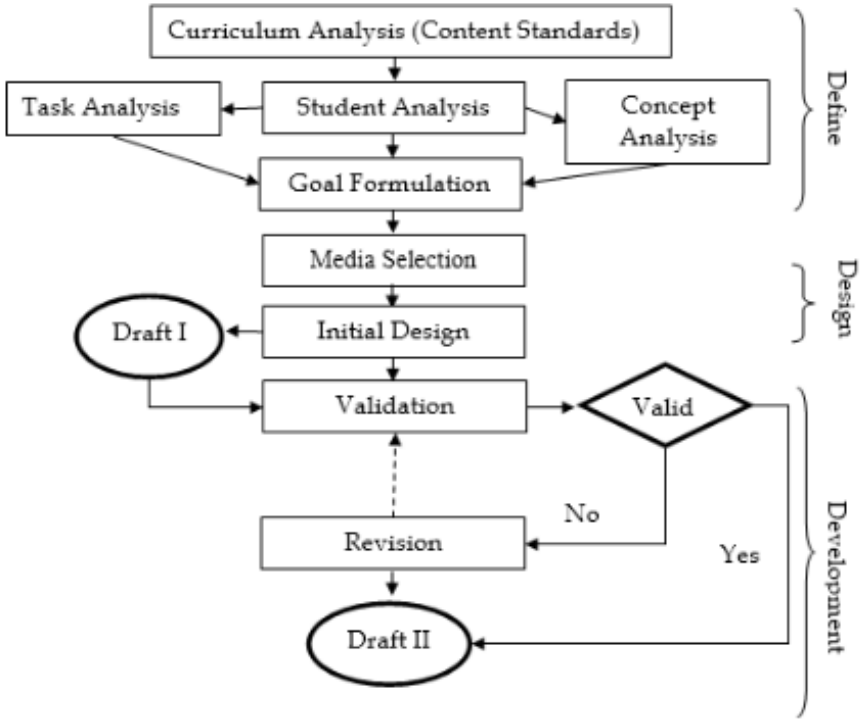

Figure 1. The stages of the research.

The research instrument used in this study is a validation sheet. The flipbook validation sheet is used to obtain flipbook validity data. This sheet contains instructions and requests to the validator to provide an assessment. The device's validity is reviewed from format, language, and content (Siregar et al., 2020). Information on the

validation results of learning tools obtained from two experts was analyzed descriptively and qualitatively. The formula used to determine the level of validity of the developed Flipbook is as follows:

$$The\ score\ of\ each\ criterion = \frac{\Sigma\ score\ of\ the\ criteria\ obtained}{\Sigma\ maximum} \times 100\%$$

The validation results are then interpreted according to the following learning device validation criteria in Table 1.

Table 1. Learning devices validity criteria.

Interval Score	Criteria
3.26 - 4.00	Very Valid
2.51- 3.25	Valid
1.76 - 2.50	Quite valid
1 - 1.75	Less Valid

(Riduwan, 2013)

After the Flipbook has been developed and assessed for validity, the next step is to calculate the level of reliability. The percentage of agreement is used to calculate the instrument's reliability with the following equation:

$$R = 1 - \frac{A - B}{A + B} \times 100\%$$

R : Reliability
A : The frequency of the observed behavior aspect by the observer giving the high-frequency
B : The frequency of aspects of behavior levels observed by observers who give low frequencies

The instrument is considered good if it has a reliability coefficient greater than or equal to 0.75 or 75.00% (Borich, 1994).

RESULTS AND DISCUSSION

Results

The results of this study are the development of flipbooks on temperature and heat materials using the guided inquiry learning model, which has a display that can be accessed online using the flippingbook.com application for free. The Flipbook has instructions and work methods for conducting experiments according to the guided inquiry learning model and a temperature and heat material summary. The display of the Flipbook developed in this study is likely in Figure 2.

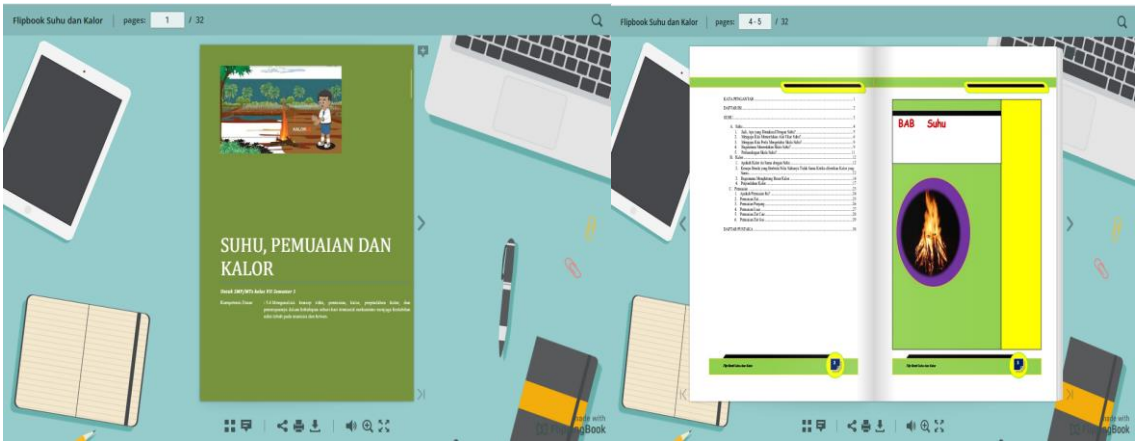

Figure 2. Display of the Flipbook.

The results of the flipbook validation for training science process skills for junior high school students on temperature and heat are listed in Table 2.

Table 2. The results of the flipbook validation.

No	Statement	Validity Score			Total	Averages	Category	Reliability (%)
		V1	V2	V3				
Content Eligibility								
1	Compatibility with Basic Competency	4	4	4	12	4.00	Very Valid	100.00
2	Concept accuracy	4	4	4	12	4.00	Very Valid	100.00
3	Easy-to-understand concept	4	3	4	11	3.60	Very Valid	85.71
4	Conformity with the development of science	3	3	4	10	3.60	Very Valid	85.71
5	Inclusion of images according to the environment	4	3	4	11	3.60	Very Valid	85.71
6	Inclusion of a description	4	3	4	11	3.60	Very Valid	85.71
Language Eligibility								
1	Language Communication							
	Simple	3	3	4	10	3.60	Very Valid	85.71
	Interesting	4	3	4	11	3.60	Very Valid	85.71
	Easy	4	3	4	11	3.60	Very Valid	85.71
2	Language Accuracy							
	According to the sentence	4	3	4	11	3.60	Very Valid	85.71
	Terms by the agreement	4	3	4	11	3.60	Very Valid	85.71
Display Eligibility								
1	Ease of using Flipbook	4	3	4	11	3.60	Very Valid	85.71
2	Easy to carry	4	4	3	11	3.60	Very Valid	85.71
3	Attractive cover design	4	3	3	10	3.60	Very Valid	85.71
4	Font size	4	4	3	11	3.60	Very Valid	85.71
5	Material layout:							
	Consistent	4	4	3	11	3.60	Very Valid	85.71

No	Statement	Validity Score			Total	Averages	Category	Reliability (%)
		V1	V2	V3				
	Harmonious	4	3	3	10	3.60	Very Valid	85.71
	Complete	4	3	3	10	3.60	Very Valid	85.71
Average Score						3.60	Very Valid	85,71
Overall Mode						3.60	Very Valid	85,71

Flipbook validation results in Table 2 show that of the 13 assessment criteria, content, language, and appearance, all assessment criteria scored very valid categories with an average percentage of 3.60. Based on the percentage of the feasibility value, it shows that the flipbook-based guided inquiry learning model to train science process skills on temperature and heat material has very valid criteria.

Discussion

The validity of the developed Flipbook in temperature and heat material is assessed from eligibility aspects of the content, language eligibility, and display eligibility. The feasibility of the Flipbook is assessed based on the eligibility of the content, which consists of conformity with Basic Competency (BC), easy-to-understand concepts, conformity with scientific developments, inclusion of images according to temperature and heat material, and inclusion of descriptions. The validation results are then interpreted using the validator review score.

Based on the validation results of the three validators, the feasibility of the developed flipbook content is by the basic competency. In the component of conformity with the development of science and the inclusion of images following the material, a validation score of 3.60 is obtained with a very valid category. In the conformity component with basic competency, the easy-to-understand concept scores 3.6 with a very valid category. The content feasibility aspect obtained a validity result of 85.71, so it could be declared very valid. Similar research has been conducted by Rachmadyanti (2020) on e-book development research for Unesa *PGSD* students, which results in the development of teaching materials that obtain a validity of 80.00% by obtaining a feasible category for use. This follows the opinion of Smart & Jagannathan (2018), which states that the material must be adjusted to the needs and level of understanding and can make it easier for students to receive the material. The Flipbook obtained a validation score of 3.60 in a very valid component category, including descriptions and material. The low score for this component is due to the absence of references in each description. Regarding this, the researcher has made improvements and revisions based on the validator's input and suggestions by adding references to each description.

Language feasibility in Flipbook is assessed based on the language communication component, which includes simple, engaging, and accessible to understand, and language accuracy, which includes conformity with extensive sentences and terms following scientific agreements. The validation results on language feasibility obtained a validation score of 3.60 with a very valid category. The language used in the developed Flipbook has been adapted to Enhanced Spelling so that the sentences contained in the Flipbook are appropriate and well organized. The terms used have also been adapted to scientific agreements (Hasrawati et al., 2019). This is by the Ministry of National Education, where suitable teaching materials have clear and understandable sentence structures, use language appropriate to the level of student development, and

do not cause multiple meanings or interpretations. Teaching materials were said to be good when (1) the coverage of the material or content was by the curriculum, (2) the presentation of the material fulfilled learning principles, (3) language and readability were good, and (4) exciting book or graphic format. In terms of language, the sentences used in Flipbook use sentences that are easy to understand, use appropriate punctuation marks and do not cause double interpretations (Dayanti et al., 2021).

The feasibility of the Flipbook display is assessed based on the ease of use of the Flipbook as an identification tool, portability, attractive design, font size, layout of the Flipbook, and the attractiveness of the colors and illustrations on the Flipbook. In the portability sub-component, e-book cover design, font type size, and the attractiveness of the colors and illustrations obtained a validation score of 3.60 with a very valid category. The writing format used in the Flipbook has the appropriate size so that it can be read correctly. The colors used in the Flipbook also contrast to make it easy to read. This follows a statement from Listya (2019), which states that words in visual media must use simple letters with a letter style that is easy to read and not too diverse in one appearance or a series of visual appearances.

In the ease of use and layout sub-component, the Flipbook obtained a validation score of 3.6 in the very valid category. Colorful pictures accompany the developed Flipbook, and the layout of the Flipbook is arranged in such a way that it is easy to read. This is supported by the opinion of Oktarina et al. (2020), which states that the brain will respond quickly in accepting the meaning of writing when colorful pictures or illustrations accompany it. Colored pictures and illustrations can help readers visualize material in books and help to attract students' attention to reading books.

The results of this study are similar to research by Yulaika et al. (2020), which obtained results that the use of flip book-based electronic teaching materials in economics learning had a positive impact on improving student learning outcomes and increasing student activities, including visual, oral, listening, writing and emotional. Next, research on using digital-based learning media by Mulyaningsih & Saraswati (2017). This research investigates the impact of using Physics Digital Book learning media using Kvisoft Flipbook Maker on students' understanding of concepts and learning interests. Then, research by Andani & Yulian (2018) and Abror et al. (2020), focusing more on high school material with the same concept, uses Kvisoft Flipbook Maker. In addition, Saparina et al. (2020) also examined the suitability of digital flipbooks as learning media for circle material in grade 8 junior high school. These studies show that the use of digital flipbooks as learning media significantly increases literacy in students.

CONCLUSION

Fundamental Finding: Based on the results of data analysis, digital-based flipbooks obtain an average validation in the valid category. **Implication:** These results indicate that flipbooks can be used as learning media. Flipbooks could also train junior high school students' science process skills on temperature and heat material by looking at the elements: ease of use, readability of writing, interest, and understanding of the material. **Limitation:** This research only developed a flip book on temperature and heat material. **Future Research:** It is necessary to develop flipbooks on other materials and carry out development up to the dissemination stage in school.

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