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Respiratory System Science Flashcards: Media Innovation for Grade VIII Students

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ABSTRACT
The observations and interviews with teachers and students indicate that it is still difficult to understand and memorize, especially on specific topics, such as the human respiratory system. The learning process still tends to rely on lectures and PowerPoint presentations. It uses teacher textbooks as media in the science learning process, making it less active and less enjoyable. This study aims to develop a valid and practical flashcard learning medium for grade VIII SMP/MTS students on the human respiratory system sub-material. This research is included in the development research (R&D) using the Plomp development model. The data collection instruments used are student and teacher interview sheets, student needs questionnaires, self-evaluation sheets, validation sheets, one-to-one evaluation test questionnaires, small-group tests, and validated practicality questionnaires or field tests. The sampling technique used is simple random sampling. The results of the material expert validation averaged 88% in the valid category. The results of the media expert validation averaged 97%, with a very valid category. The results of the learning expert validation averaged 97%, with a very valid category. The practicality test averaged 90%, categorizing it as very practical. The conclusion is that the flashcard learning media for the human respiratory system sub-topic is highly valid and very practical.

Keywords: *human respiratory system, development, flashcard*

INTRODUCTION

Education plays a fundamental role in shaping individuals' intellectual, moral, and social development, and it is widely recognized as a key driver of national progress (Mualimah et al., 2024). In the learning process, students are expected not only to acquire knowledge but also to develop critical and creative thinking skills through meaningful learning experiences. To achieve this, various learning components such as instructional design, teaching methods, learning resources, and media must be effectively integrated (Mardianti et al., 2021). Among these components, learning media play a crucial role in delivering abstract concepts and enhancing students' understanding.

Learning media function as tools that support interaction between teachers and students, making learning more engaging and effective (Kurnia, 2022). Prior studies have shown that appropriate media can improve students' comprehension by transforming complex, abstract concepts into more concrete, accessible forms (Mustaqimah et al., 2023). One type of media that

has gained attention is flashcards, which combine visual elements and concise textual information to enhance memory retention. Flashcards were popularized by Glenn Doman and are designed to stimulate cognitive processes, particularly in recognizing and recalling information efficiently.

Flashcards are educational media in the form of cards with images and text tailored to the learning material. Mualimah et al., (2024) described that Flashcards contain images and accompanying text, with the image serving as the source of information and the text explaining. Glenn Doman, a brain surgeon from Philadelphia, Pennsylvania, introduced this medium. This medium aims to train the right brain's ability to remember images and words more easily. (Mustaqimah et al., 2023). According to Chatib in Saputri (2020) Explains that " flashcard media is a card that contains images or writing related to a concept". Another definition is expressed by Windura in Saputri (2020), "Flashcard media, or flashcards, are cards used to remember and review in the learning process. So, in other words, flash cards are media that help recognize and review learning materials such as definitions or terms, symbols, foreign language spelling, formulas, and so on etc.

In science education, particularly at the junior high school level, the human respiratory system is considered a complex and abstract topic. It involves understanding the structure and function of organs such as the pharynx, larynx, trachea, bronchi, lungs, and alveoli. Due to their abstract nature and the inability to directly observe these processes, students often struggle to understand the material (Mufidah & Habibi, 2022). Therefore, the use of appropriate learning media is essential to help visualize these processes and support students' conceptual understanding (Putri & Ferazona, 2024). In this context, flashcards offer a potential solution by presenting information visually and concisely, which can enhance both comprehension and learning motivation.

Despite the recognized benefits of flashcards, a gap exists in the existing literature. Most previous studies on flashcard media focus on general subjects or lower-level cognitive outcomes, such as memorization and recall. They are often applied to topics such as the classification of living things or language learning (Amalatus, 2022). However, there is limited research on the use of flashcards for complex, abstract science topics, particularly the human respiratory system, at the junior high school level. Furthermore, existing studies tend to emphasize media validity and feasibility rather than their effectiveness in addressing real classroom challenges (Lin et al., 2018). In addition, a discrepancy exists between theoretical perspectives and classroom practices. While the literature highlights the effectiveness of interactive and visual media in enhancing student engagement, field observations indicate that teaching practices remain dominated by conventional methods, such as lectures and slide-based presentations. These approaches often result in passive learning environments and limited student interaction, suggesting that the potential of learning media has not been fully realized in practice.

To address this issue, a preliminary study was conducted through observations, interviews, and questionnaires involving science teachers and Grade VIII students. The findings revealed several key problems: (1) students perceive science, particularly the respiratory system, as difficult to understand and memorize; (2) instruction remains largely teacher-centered; (3) learning relies heavily on textbooks and worksheets; and (4) there is limited variation in instructional media. Moreover, flashcard media have not been previously implemented in this context. The needs analysis further indicated a strong demand for innovative learning tools, with 88% of teachers and 84% of students expressing the need for more engaging media. Based on these findings, the urgency of this study lies in bridging the gap between theoretical recommendations and classroom realities by developing contextually relevant learning media. Therefore, this study aims to develop and evaluate flashcard-based learning media for the human respiratory system. The research objective is to assess the validity and practicality of the developed media, with the context being junior high school science learning and the unit of analysis being the flashcard media and its impact on students' engagement and understanding.

Finally, this study offers novel contributions by applying flashcard media to a complex biological system that is difficult to visualize directly. It integrates visual-conceptual representations with concise scientific explanations tailored to students' cognitive levels. In addition, the development process is grounded in empirical needs analysis, ensuring alignment with real classroom conditions. Thus, it can be concluded that this study tries to contribute to the advancement of more contextual, practical, and pedagogically effective learning media in science education.

METHODOLOGY

This study employed a research and development (R&D) design to develop and evaluate flashcard-based learning media for the human respiratory system. The development process was guided by the Plomp model, which consists of three main phases: preliminary research, prototyping, and assessment. This model was selected for its flexibility and adaptability to educational design research, enabling iterative refinement based on empirical findings (Ariawan & Putri, 2020). However, this study only carried out the development process until the development stage. Prototype (Prototyping Phase). This is due to limited resources, especially in terms of time and costs, so it is impossible to proceed to the complete evaluation stage. The stages of this development research are as follows: (1) Preliminary Analysis (Preliminary Phase), (2) Prototype Phase, which consists of self-evaluation, expert review, one-to-one evaluation, small group discussion, and field test. The field stage on flashcard media can be seen in Figure 1.

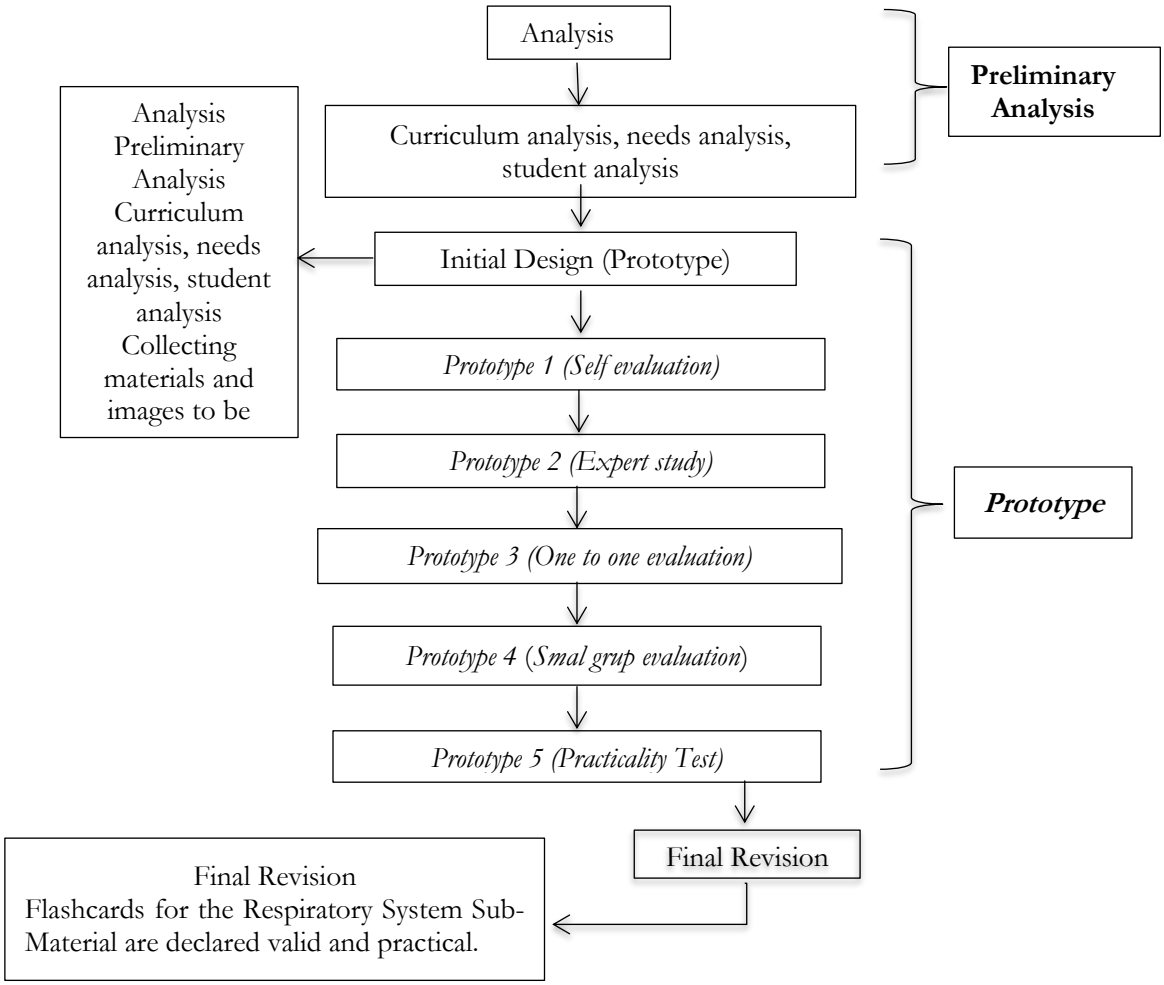

Figure 1. Steps in Developing the Plomp Model (Preliminary Analysis or Preliminary Phase to the Prototype or Prototype Phase). Source: Researcher Modification from Plomp, 2013

The research was conducted in two junior high schools, namely SMPN 1 Siak Hulu and SMPN 4 Siak Hulu. The research subjects were Grade VIII students who had previously studied the human respiratory system. The population included all Grade VIII students in both schools, while the sample was selected using purposive sampling, targeting one class from each school that had completed the relevant material. A total of 60 students participated in the field testing phase, comprising 28 males and 32 females. These participants were selected due to their prior exposure to the topic, enabling them to provide relevant feedback on the usability of the developed media. In addition, expert validators were involved, including two material experts, two media experts, and one science teacher from each school.

The objective of this research was to develop flashcard learning media for the human respiratory system topic. The study focused on two primary variables: (1) the validity of the media, evaluated by experts in terms of content, design, and instructional aspects; and (2) the practicality of the media, assessed based on students' responses after using the flashcards in learning activities. These variables were selected to ensure that the product meets both academic standards and practical classroom needs.

The development procedure followed the stages of the Plomp model. The preliminary phase involved a needs analysis conducted through classroom observations, teacher interviews, and student questionnaires to identify learning challenges and media requirements. The prototyping phase consisted of iterative steps, including self-evaluation, expert review, one-to-one evaluation, small group evaluation, and field testing. During the expert review stage, the prototype was evaluated by material and media experts to determine its validity. The one-to-one and small-group evaluations were conducted to identify usability issues and refine the design before broader implementation. Finally, field testing was carried out to evaluate the practicality of the flashcard media in actual classroom settings.

Data were collected using multiple instruments to ensure comprehensive and credible findings. Experts used validation sheets to assess the quality and appropriateness of the media. At the same time, a practicality questionnaire was administered to students to measure their perceptions of ease of use, attractiveness, and usefulness. In addition, observation sheets, interview guides, and documentation were employed to support data triangulation. The use of appropriate research instruments is essential to obtain valid and reliable empirical data (Rahman et al., 2023). Furthermore, data collection techniques included observation, interviews, questionnaires, and documentation, which are considered fundamental procedures in obtaining research data (Nafisatur, 2024). These techniques were used to ensure that both qualitative and quantitative data were systematically gathered.

Data analysis employed both qualitative and quantitative descriptive approaches, with a stronger emphasis on quantitative analysis. Qualitative data, such as expert feedback and student suggestions, were analyzed through data reduction, categorization, and interpretation to inform product revisions. Meanwhile, quantitative data obtained from validation sheets and practicality questionnaires were analyzed using descriptive statistics. Mean scores were calculated to determine the average rating for each indicator, while percentage values were used to standardize interpretation across assessment criteria. The mean score for each indicator was calculated using the following formula:

$$\overline{X} = \frac{\sum X}{N} \quad (1)$$

Where $\overline{X}$ represents the mean score, $\sum X$ is the total score obtained from all respondents, and N is the number of respondents. This calculation was used to determine the average rating for each indicator assessed by experts and students.

To facilitate interpretation, the scores were further converted into percentages using the formula:

$$P = \frac{\sum X}{\sum X_{max}} x100\% \quad (2)$$

Where P denotes the percentage score, $\sum X$ is the total empirical score obtained, and $\sum X_{max}$ is the maximum possible score. This percentage-based approach facilitates clearer categorization of the results.

The resulting percentages were then categorized into predefined criteria levels (e.g., very valid, valid, fairly valid, less valid; and very practical, practical, less practical), as presented in Tables 1 and 2. This approach enables an objective evaluation of the developed media and supports evidence-based conclusions regarding its feasibility.

Table 1. Validity Criteria According to Validator Assessment

No	Percentage Scale	Criteria
1.	90 % - 100%	Very valid, or can be used without revision
2.	80 % - 89 %	Valid, or can be used, but needs a little revision
3.	65 % - 79 %	Fairly valid, or usable, but needs major revision
4.	55 % - 64 %	It is not valid; it is recommended not to use because it needs revision.
5.	≤ 55 %	Invalid, or may not be used

(Hutabri, 2022)

Table 2. Practicality Criteria

No	Average	Category
1.	80%-100%	Very practical
2.	60%-80%	Practical
3.	40%-60%	Quite practical
4.	20%-40%	Less practical
5.	20%-40%	Not practical

(Putri & Reinita, 2023)

RESULTS AND DISCUSSION

Preliminary Research
Curriculum Analysis

The curriculum analysis examined the implementation of the curriculum at SMP Negeri 1 Siak Hulu and SMP Negeri 4 Siak Hulu. The findings indicate that both schools have implemented the Kurikulum Merdeka, which emphasizes student-centered learning and the achievement of learning outcomes. The development of flashcard media aligned with this curriculum, particularly the learning objectives and competencies outlined in the Grade VIII science teaching modules. The analysis also revealed that the human respiratory system topic is allocated limited instructional time (two 40-minute meetings), which constrains in-depth conceptual exploration. This condition underscores the need for efficient, concise learning media that facilitate students' understanding within a limited timeframe. These findings reinforce the importance of preliminary research in identifying contextual needs prior to media development (Mellisa & Anthonia, 2024).

Analysis of Interviews with Science Teachers

Interviews with science teachers from both schools revealed several instructional challenges. Teaching practices were still predominantly teacher-centered, relying heavily on lectures and PowerPoint presentations. As a result, students tended to be passive, less engaged, and easily lost focus during lessons.

Additionally, instructional media were limited to textbooks and student worksheets (LKS), with minimal integration of interactive or visual learning tools. This finding is consistent Mustofa & Riyanti (2019), who argue that lecture-based instruction without adequate media support reduces student engagement and limits meaningful learning experiences. This discrepancy between recommended interactive learning approaches and actual classroom practices indicates a pedagogical gap, reinforcing the need for innovative learning media such as flashcards.

Analysis of Problems and Needs of Class VIII Students

The analysis of students' needs, based on observations, interviews, and questionnaires, revealed that many students perceive science, particularly the human respiratory system, as difficult to understand and memorize. 84% of students expressed a strong desire for more engaging, easily digestible learning materials. They highlighted that the existing instructional approaches fall short in promoting active engagement and fostering a deeper conceptual understanding of the subjects being taught. The reliance on conventional media limits their ability to visualize abstract biological processes. These findings are supported by Yeni et al. (2023), who state that the absence of appropriate learning media can lead to decreased attention and motivation. Similarly, Antoh et al. (2024) emphasize that interactive and visually engaging media significantly enhance student engagement and learning outcomes. Overall, this stage confirms the urgency of developing innovative, visual-based learning media to address students' conceptual difficulties.

Prototyping Phase

Prototype Design

The prototype design stage is the initial step in the flashcard media development process, which aims to produce an initial design (prototype) of the media to be developed. This flashcard learning media on the human respiratory system material for grade VIII SMP/MTS was created using the Canva application/web. This flashcard learning media refers to the independent curriculum by looking at the teaching modules used by science teachers. This flashcard learning media has parts: a cover, foreword, table of contents, instructions for use, content standards in the form of learning outcomes and learning objectives, learning materials, Author biodata, bibliography, and flashcards for the game. This respiratory system material has a time allocation of 2 x 40 minutes with two meetings.

Self Evaluation

Flashcard learning media development process at this stage was carried out through self-evaluation, namely by reviewing and revising the media that had been created. Revisions improved the material, clarity of information, and the display of images and text, making it easier for students to understand. Through this evaluation, researchers realized the importance of creating flashcards that were not only visually appealing but also clear and appropriate to the level of understanding of eighth-grade junior high school/Islamic junior high school students. These results are supported by research (Kasmayanti et al., 2023). It showed that using flashcard media in Biology learning significantly improved students' cognitive abilities and learning motivation. The study concluded that flashcard media positively influenced students' understanding of Biology material.

Flashcard Validation Test on the Respiratory System Sub-Material

Flashcard learning media was validated by five validators, consisting of three experts: one material expert, one media expert, and three learning experts.

Flashcard Validation Results by Subject Matter Experts

A material expert validator has validated Flashcard learning media on the human respiratory system for grade VIII SMP/MTS. The results of the material expert validator's assessment before and after revision can be seen in Table 3 below:

Table 3. Validation Results of Flashcard Learning Media on Respiratory System Material by Material Experts

No	Indicator	Percentage Before Revision	Percentage After Revision	Average %	Category
Content Suitability Aspect					
1.	sequence	75%	100%	88%	Valid
2.	Depth/Complexity of Material	50%	100%	75%	Quite Valid
3.	Compliance	100%	100%	100%	Very Valid
Average percentage			**88%**		**Valid**

(Source: Researcher Data 2025)

A validation conducted by material experts aimed to evaluate the feasibility of the developed flashcard learning media. The assessment focused on the content feasibility aspect, which includes three leading indicators: the sequence of material presentation, the depth or complexity of the information, and the suitability of the material to learning outcomes and objectives. These three indicators were designed to ensure that the flashcard content is conceptually appropriate, systematically arranged, and relevant to the learning needs of grade VIII SMP/MTS students. Based on the assessment results from material experts, an average validation percentage of 88% was obtained, which is categorized as "Valid." This achievement indicates that the media have met high-quality standards for conceptual accuracy, completeness of material, and alignment with applicable basic competencies. In addition to quantitative results, the validator provided several qualitative suggestions, such as simplifying some terms or parts of the material to make it easier for students to understand. It is in line with the opinion of Wulandari et al., (2024) who emphasized that the development of effective learning media must consider the relationship between the media used and the teaching and learning process and pay attention to student characteristics. In addition, (Meliyani et al., 2022), stated that, in using learning media, general criteria are needed to make learning activities more effective and adapt to current conditions.

Flashcard Validation Results by Media Experts

A media expert validator has validated Flashcard learning media on the human respiratory system for grade VIII SMP/MTS. The results of the media expert validator's assessment can be seen in Table 4 below.

Table 4. Validation Results of Flashcard Learning Media on Respiratory System Material by Media Experts

No	Indicator	Average percentage%	Category
Display Aspect			
1.	Flashcard Media Cover Design	100 %	Very valid
2.	Readability of Text	100%	Very valid
3.	Attractiveness	100%	Very valid
4.	Clarity of Image Display on Flashcard Media	100%	Very valid

No	Indicator	Average percentage%	Category
5.	Interactive	100 %	Very valid
Average percentage		**100%**	**Very valid**
Usage/Usage Aspects			
6.	Maintainable (can be managed easily)	100%	Very valid
7.	Usability (ease of use)	100 %	Very valid
8.	Compatibility (ease of operation)	75%	Quite valid
9.	Reusable (can be reused)	100%	Very valid
Average percentage		**94 %**	**Very valid**

Validation conducted by media experts on learning media in the form of flashcards involves assessing two aspects: the first is the appearance aspect, which comprises five leading indicators: the flashcard media's cover design, text readability, attractiveness, clarity of image display, and interactivity. The second is the usage or use aspect, which consists of four leading indicators: maintainable (easily managed), usability (easy to use), compatibility (easy to operate), and reusable (reusable). The validation results from media experts showed an average score of 94% (very valid category). The highest scores were obtained in visual aspects such as design, readability, and attractiveness, indicating that the flashcards were visually well-developed. However, the compatibility aspect received a relatively lower score, suggesting minor limitations in usability or adaptability. Despite this, the overall results confirm that the media meets high standards in both design and functionality.

Flashcard Validation Results by Learning Experts

Expert learning validators and two science teachers from both schools have validated Flashcard learning media on the human respiratory system for grade VIII SMP/MTS. The results of the expert learning validator's assessment can be seen in Table 5 below.

Table 5. Validation Results of Flashcard Learning Media on Respiratory System Material by Learning Experts

No	Indicator	V1	V2	V3	Average	Category
Display Arrangement Aspects						
1.	Appearance	80 %	100 %	100 %	93 %	Very valid
2.	Clarity of learning objectives	100 %	100 %	100 %	100 %	Very valid
3.	The suitability of learning objectives with achievements learning	100 %	100 %	100 %	100 %	Very valid
4.	Suitability of questions and answers to learning objectives	100%	100 %	100 %	100 %	Very valid
Average Percentage				**98%**		**Very valid**
Language Aspects						
5.	Linguistics	100 %	100 %	100 %	100 %	Very valid
Average Percentage				**100%**		**Very valid**
Readability Aspect						
6.	Easy to read	80 %	100 %	100 %	93 %	Very valid
7.	Kemu branch to understand	80 %	100 %	100 %	93 %	Very valid
	Average percentage			**93%**		**Very valid**

(Source: Researcher Data 2025)

The validation conducted by learning experts on flashcard learning media assessed three main aspects: display layout, language, and readability. Based on the assessment results, the flashcard learning media development achieved an average validation percentage of 97%, placing it in the very valid category. This finding is supported by research results from Pujilestari & Susila (2020), which state that attractive visual media can increase active student engagement in learning and create a

more enjoyable learning atmosphere. In line with this, Akbar et al. (2025) emphasized that the integration between basic competencies, learning objectives, and the material's clarity determines the success of learning media

One-to-One Evaluation (Individual Evaluation)

The one-to-one evaluation stage was the initial stage in the testing process for the developed flashcard learning media product. In this stage, the practicality questionnaire was completed by six students from two different schools. The results of the practicality questionnaire from the one-to-one evaluation stage can be seen in Table 6 below.

Table 6. The Results of The One-to-One Evaluation in The Form of a Practicality Test

No	Indicator	Junior High School 1 Siak Hulu	Junior High School 4 Siak Hulu	Average	Category
Appearance					
1	Product Display Design	91%	82%	87%	Very Practical
2	Text Readability	97%	90%	93%	Very Practical
3	Clarity Presentation	90%	93%	92%	Very Practical
4	Font usage	87%	89%	88%	Very Practical
5	Clarity of image and material display	93%	96%	94%	Very Practical
Average percentage			**91%**		**Very Practical**
Linguistics					
6	Use of language	91%	89%	90%	Very Practical
Average percentage			**90%**		**Very Practical**
Material					
7	sequence	97%	97%	97%	Very Practical
8	Presentation of Material	87%	89%	88%	Very Practical
9	Study Materials	78%	82%	80%	Very Practical
Average percentage			**88%**		**Very Practical**
Presentation					
10	Motivation	92%	88%	90%	Very Practical
Average percentage			**90%**		**Very Practical**

(Source: Researcher Data 2025)

Based on the questionnaire assessment, the flashcard media received an average score of 90% and was categorized as very practical. This score indicates that the flashcards were attractive, used communicative language, and systematically presented material relevant to the learning outcomes. Furthermore, this media presentation was also considered capable of increasing students' motivation to learn actively and independently. These results indicate that flashcard media is suitable for use in the learning process as an effective and enjoyable tool for students. Students provided positive comments, including stating that the flashcards on the human respiratory system were very helpful in quickly understanding the material and were attractive. They also expressed greater interest in actively participating during the learning process. These findings align with research. Masna (2022) stated that attractively designed, contextually relevant flashcards can increase interest in learning and facilitate students' understanding of concepts at the junior high school level. Similarly, research by Hafidzoh Rahman et al. (2021) shows that Flashcard media is effective for learning because it is practical and increases students' learning independence. With these results, it can be concluded that the developed flashcard media efficiently teach the

respiratory system for class VIII SMP/MTS students. It can increase students' understanding and learning motivation before continuing to the small group stage evaluation and field test.

Small Group Test

A small group test is a follow-up stage conducted after revising the learning media based on the results of one-to-one evaluations. At this stage, a practicality questionnaire was completed by 12 students from two different schools. This stage aimed to measure the extent to which the flashcard media could be used effectively in small groups before being implemented on a larger scale. The results of the practicality questionnaire from the small group test are presented in Table 7 below.

Table 7. Results of the Small Group Test Practicality Questionnaire

No	Indicator	Junior High School 1 Siak Hulu	Junior High School 4 Siak Hulu	Average	Category
Appearance					
1	Product Display Design	97%	78%	87%	Very Practical
2	Text Readability	95%	78%	87%	Very Practical
3	Clarity Presentation	90%	77%	83%	Very Practical
4	Font usage	97%	73%	85%	Very Practical
5	Clarity of image and material display	93%	71%	82%	Very Practical
Average percentage			**85%**		**Very Practical**
Linguistics					
6	Use of language	97%	78%	87%	Very Practical
Average percentage			**87%**		**Very Practical**
Material					
7	sequence	97%	75%	86%	Very Practical
8	Presentation of Material	96%	77%	86%	Very Practical
9	Study Materials	92%	72%	82%	Very Practical
Average percentage			**85%**		**Very Practical**
Presentation					
10	Motivation	97787%	79%	83%	Very Practical
Average percentage			**88%**		**Very Practical**

(Source: Researcher Data 2025)

The results of the small-group test showed that the flashcard media on the human respiratory system material received excellent student response, with an average practicality percentage of 86%, and was categorized as very practical. Students considered this media not only easy to use but also visually appealing, with the right color combination, a clear understanding of the material, and a systematic arrangement of information. The visual appeal and presentation of the material appropriate to students' level of understanding make them more focused and motivated in the learning process. This finding is supported by research showing that learning media designed with aesthetic aspects, ease of use, and material relevance can increase student engagement and concentration during learning activities. Thus, the flashcard media in the human respiratory system material developed is not only considered appropriate in appearance, but also effective in attracting students' learning interest.

Field Test (Field Test/Practicality Test)

A field test involved eighth-grade students of SMP/MT S from SMP Negeri 1 Siak Hulu and SMP Negeri 4 Siak Hulu. This stage is the final testing process for the *flashcard learning media, following* revisions based on the results of the small-group test (fourth prototype). The field test aims to determine the level of practicality of using the media in actual learning conditions. The media test

focused on the material of the human respiratory system for eighth-grade students of SMP/MTS. The results of implementing the field test or practical test at this stage can be seen in Table 8 below.

Table 8. Results of the Field Test Practicality Questionnaire

No	Indicator	Junior High School 1 Siak Hulu	Junior High School 4 Siak Hulu	Average	Category
Appearance					
1	Product Display Design	98%	89%	94%	Very Practical
2	Text Readability	98%	91%	94%	Very Practical
3	Clarity Presentation	98%	86%	92%	Very Practical
4	Font usage	95%	88%	92%	Very Practical
5	Clarity of image and material display	98%	92%	95%	Very Practical
Average percentage			**93%**		**Very Practical**
Linguistics					
6	Use of language	97%	92%	95%	Very Practical
Average percentage			**95%**		**Very Practical**
Material					
7	sequence	98%	89%	93%	Very Practical
8	Presentation of Material	98%	88%	93%	Very Practical
9	Study Materials	95%	87%	91%	Very Practical
Average percentage			**92%**		**Very Practical**
Presentation					
10	Motivation	97%	88%	93%	Very Practical
Average percentage			**93%**		**Very Practical**

(Source: Researcher Data 2025)

The field test involving 60 students resulted in an average practicality score of 93% (very practical), with SMP Negeri 1 Siak Hulu scoring 97% and SMP Negeri 4 Siak Hulu scoring 89%. These findings demonstrate that flashcard media is highly practical and well-received in real classroom conditions. Students reported that the media helped them understand concepts more easily due to its concise explanations and visual representations. This result aligns with Pasaribu K (2022), who states that well-structured and visually appealing learning media can significantly enhance student engagement and learning effectiveness.

More broadly, the findings demonstrate that the developed flashcard media helps bridge the gap between theoretical recommendations and classroom practice. Although prior literature emphasizes the effectiveness of interactive learning media, their implementation in actual classrooms often remains limited. The present study provides empirical evidence that flashcards can transform predominantly passive learning environments into more interactive and engaging experiences (Paldy et al., 2025; Shofa & Murtono, 2021).

The high level of practicality observed in this study is also consistent with previous research on innovative learning media. For instance, Hadi et al. (2025) reported a practicality score of 97.75% for interactive flipbooks, highlighting their usability and effectiveness in supporting learning. This comparison suggests that the effectiveness of instructional media is not determined solely by format (digital versus printed), but rather by how well key elements, such as visual representation, content clarity, and ease of use, are integrated. In this study, the flashcards demonstrated these characteristics, contributing to their strong usability and positive student responses.

Furthermore, the role of learning media in this study relates to the development of scientific literacy. Scientific literacy is essential for enabling students to understand concepts, interpret

information, and apply knowledge in real-life contexts. However, previous studies have shown that students' scientific literacy levels remain relatively low and require improvement through more effective instructional approaches (Berlian et al., 2021). The use of flashcards in this study represents a strategic effort to address this issue by presenting scientific content in a structured, accessible, and visually supported format.

In addition, the findings reinforce the importance of visual-conceptual learning in science education. The human respiratory system, inherently abstract and not directly observable, becomes more accessible when presented through visual representations. It supports the view that visual media can significantly enhance students' understanding of complex scientific concepts. Moreover, the use of flashcards promotes active recall and repeated exposure, both of which are essential for strengthening memory and facilitating deeper conceptual understanding (Brylliant & Nurcahyanto, 2025).

CONCLUSION

An extensive study was conducted on the development of flashcard learning media specifically designed for the science curriculum, focusing on the sub-material related to the respiratory system. This project received validation from a team of five experts, which included one specialist in the subject matter, one expert in media development, and three professionals in educational methodology. Following this expert validation, the flashcards were tested for practicality in two different schools. The results of these tests were highly positive, indicating that the learning media were effective and well-received by the students. Based on the validation results, the flashcard learning media achieved a feasibility percentage of 94% in the very valid category, indicating that the content, appearance, and presentation meet the standards and learning needs. Meanwhile, the practicality test results showed a 90% rating in the convenience category, indicating that this media is easy to use, enjoyable, and effective in helping students understand respiratory system material. These findings prove that the developed flashcard is an alternative learning medium to increase students' motivation and conceptual understanding.

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