



Development of Flashcard Media on Reproductive System Material to Enhance Highschool Students' Higher-Order Thinking Skills

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Abstract

The study focuses on the development of Flashcard learning media for the reproductive system, with the aim of improving high school students' higher-order thinking skills (HOTS) through valid, practical, and effective means. The research adopts the Research and Development (R&D) approach, utilizing the 4D development model, which includes the Define, Design, Development, and Dissemination phases. The research participants consist of experts in the field of reproductive system materials, media experts, subject teachers, and grade eleven students, totaling 35 individuals. The research employs interviews, questionnaires, and written tests in the form of pretest and posttest questions, with a focus on higher-order thinking skills, comprising a total of ten questions. The results of the study indicate that the material expert validation attained a percentage of 85.71%, signifying a highly feasible category. Similarly, the media experts obtained a score of 98.43%, also falling under the highly feasible category. The practicality assessment from the teachers yielded a score of 90.90%, indicating high practicality, while the students' practicality assessment achieved a score of 89.74%, also signifying high practicality. The effectiveness of the N-Gain Score was determined to be 0.65, indicating a fairly effective outcome. Based on these findings, it can be concluded that the development of Flashcard learning media is valid, practical, and effective.

Keywords: Flashcard; Reproductive System; Higher-Order Thinking Skills (HOTS)

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INTRODUCTION

Education is an essential aspect of human life, particularly in the 21st century where it is crucial to develop individuals with the necessary skills to navigate the complexities of the modern world (Syarah et al., 2021). Within the field of education, various subjects are taught, including biology, which aims to provide students with a comprehensive understanding of the natural world (Banila et al., 2021).

Teachers play a pivotal role in the teaching and learning process. However, traditional teacher-centered approaches can pose challenges for students, such as a lack of information identification skills, limited ability to ask questions and express ideas, and difficulties in evaluating learning outcomes. These issues ultimately result in a lower quality of graduates. Conversely, the 2013 curriculum emphasizes student-centered learning, which encourages students to actively engage in the learning process, fostering critical thinking skills necessary for problem-solving (Risky & Sari, 2022).

Educators and institutions must recognize the importance of student activity and engagement within the learning environment. Active learning, characterized by student participation, leads to optimal outcomes. Creating a positive and conducive atmosphere greatly

impacts students' creativity and learning development. Furthermore, students also demonstrate activeness when they are able to explain their understanding to others. Therefore, student engagement is vital for successful learning and teaching (Lathif et al., 2023).

Higher Order Thinking Skills involve the application of acquired knowledge and skills to novel concepts and situations. These skills encompass analysis, evaluation, synthesis, and creation, corresponding to the higher levels of the cognitive process (C4, C5, and C6) (Adi & Yulianto, 2018). In research conducted by Wijayanto and Sutriyono (2018), flashcards were identified as an effective tool for supporting classroom learning. This learning medium proves particularly beneficial for high school students, as it aids in harnessing their potential and enhancing critical thinking skills during the crucial stage of adolescence. Learning involves teachers as facilitators and students as learners, both of whom must interact effectively for effective education (Mustaqimah et al., 2023). This interaction can be enhanced through the use of educational media. The term "media" originates from the Latin word *medius*, which means middle, intermediary, or introduction. Therefore, media encompasses not only objects but also activities that assist students in comprehending the material presented by the teacher. Educational media extends beyond tools and includes the use of designed and natural learning environments, as well as deliberately created activities to achieve educational goals (Aghni, 2018).

Educational media is utilized to instruct students, and several principles need to be considered. First, the media must align with the learning material. Second, it must be aligned with the learning objectives to be achieved. Third, effectiveness and efficiency must be taken into account. Finally, the media must be in accordance with the teacher's ability to operate rather than hinder the use of the media (Fitriani et al., 2021).

Based on interviews conducted with biology teachers of class XI at SMAN 11 Medan, several issues were identified in the learning process. These problems primarily stemmed from the infrequent use of media during instruction, leading to student confusion and difficulty in understanding the teacher's explanations. Teacher-dominated instruction and the utilization of unengaging media resulted in passive student participation during lessons. In educational communication, learning media plays a crucial role in enhancing the effectiveness of achieving learning objectives. Effective learning necessitates communication between the message recipient and the message source through the use of media. Furthermore, the absence of higher-order thinking skills (HOTS)-based learning media was observed.

The presence of learning media is highly significant as it profoundly impacts the success of the learning process. It enables changes in the learning process by allowing students to engage more effectively and enjoyably according to their individual learning needs. Consequently, educational media holds particular importance in teaching abstract subjects like natural science, where visual aids and interactive tools can enhance students' understanding (Hayati, 2022). Flashcards were first introduced by Glenn Doman, a brain surgeon from Philadelphia, Pennsylvania. They consist of picture cards accompanied by text or words. The purpose of using flashcards is to enhance the right brain's ability to remember images and words. Flashcards also have various benefits such as improving memory, fostering independence, and expanding vocabulary.

The steps for using flashcards are as follows: first, the teacher holds the flashcards at chest level and faces the students. After explaining each card, the teacher presents them one by one. Once explained, the cards are given to students closest to the teacher, who observe the cards before passing them on to others. This process ensures that all students have the opportunity to see each card. Alternatively, if a game method is used, the cards are placed randomly in a box away from the students. Then, the teacher instructs the students to find cards that match specified pictures, texts, or symbols.

Various studies have demonstrated the positive impact of flashcards on students. For example, Ummah and Nuraida (2021) successfully developed flashcards as a biology learning media, which received favorable assessments from material experts, linguists, media experts,

and practitioners. The average score percentage was 79.75%, indicating its suitability as a learning media for high school students.

Based on the aforementioned issues and descriptions, the researchers developed flashcard learning media with the primary objective of student-centered learning to enhance critical thinking skills in the Reproductive System topic. The development of materials and questions in this media was based on critical thinking indicators such as recall thinking, basic thinking, critical thinking, and creative thinking. Furthermore, this study aims to evaluate the validity, practicality, and effectiveness of flashcards as a learning media.

METHOD

This research was conducted at SMAN 11 Medan in June 2024 using a Research and Development (R&D) approach. The focus of this research was to develop flashcard learning products through a systematic research and development process (Fitriani et al., 2021). The research and development model used in developing the Flashcard media was the 4D model, which consists of four stages: Define, Design, Development, and Disseminate (Amir & Parumbuan, 2019).

During the Define stage, several activities were carried out by the researchers, including front-end analysis, learner analysis, concept analysis, and task analysis. In the Design stage, researchers designed the learning media in the form of flashcards. This stage involved media selection, format selection, and initial design. In the Development stage, researchers conducted product validation followed by revision, as well as product trials. Lastly, the Dissemination stage was implemented.

The instruments used in this study included interview sheets for front-end analysis, questionnaires for media and material expert validation to assess media feasibility, teacher response questionnaires and student response questionnaires to measure media practicality, and pre-test and post-test questions to measure media effectiveness.

The data in this study consisted of qualitative and quantitative descriptive data. Qualitative descriptive data refers to a research method that uses a descriptive approach to describe and explain events or phenomena based on the situation and conditions during the research (Septiani et al., 2020). In this study, the qualitative data consisted of suggestions and comments from media and material experts. On the other hand, quantitative descriptive data refers to a research approach used to describe, examine, and explain phenomena or research objects by collecting measurable or calculable data (Wahyudi, 2022). In this study, the quantitative data were obtained from the feasibility test, practicality test, and effectiveness test. The data were collected from the assessments of material experts, media experts, Biology subject teachers, and students of class XI IPA. Data analysis was conducted using a Likert scale, as shown in Table 1.

Table 1. Likert Scale Rating (Erianti et al., 2023)

Score	Qualification
4	Very Agree
3	Agree
2	Disagree less
1	Disagree

The data analysis techniques in this study are feasibility analysis, practicality analysis, and effectiveness analysis. The feasibility and practicality of the Flashcards researchers developed were analyzed with the following formula (Risky & Sari, 2022).

$$\% = \frac{\text{score obtained}}{\text{maximum score}} \times 100$$

After being assessed by the validators, the data was calculated and then the results of the collected data will be presented in Table 2.

Table 2. Product Eligibility Criteria (Aulia et al., 2022)

Category	Score Percentage (%)
Very Feasible	75 - 100
Feasible	50 - 75
Less Feasible	25 - 50
Not Feasible	0 - 25

The practicality test analysis was collected through the responses of biology teachers and students, then categorized with the practicality category in Table 3.

Table 3. Product Practicality Criteria (Samitra & Harmoko, 2021)

Category	Score Percentage (%)
Very Practical	90 - 100
Practical	80 - 89
Less Practical	60 - 79
Not Practical	0 - 59

The effectiveness test analysis was carried out to see the achievement of flashcard development goals. The effectiveness of flashcard media was analyzed by the following formula (Oktavia et al., 2019).

$$N \text{ Gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{skor pretest}}$$

The effectiveness test analysis was conducted on the data collected through the students' pre-test and post-test results. The collected data was taken and then categorized with the practicality category in Table 4.

Table 4. N-gain score range (Nora et al., 2013)

Score Range	Criteria	Enelevel Of Effectivss
N-gain > 0.7	High	Effective
$0.3 \leq \text{N-gain} \leq 0.7$	Medium	Effective Enough
N - gain 0.3	Low	Less Effective

RESULTS AND DISCUSSION

The media developed in this research is Flashcard media. The type of research used in this research is Research and Development (R&D), with the 4D development model. Where in this development consists of 4 stages, namely from Define, Design, Development, and Disseminate. However, the dissemination stage is only carried out with limited distribution, namely the product developed is introduced to class XI students of Gema Buana Private High School.

Define Stage

There are several main steps, namely the front end analysis stage, the learner analysis stage, concept analysis, and task analysis (Agestiana, 2019). At the task analysis stage, the researcher conducted an interview using an interview sheet to the Biology teacher whose aim was to see the obstacles in the learning process. Then the researcher conducted a learner analysis to assess the understanding of students through the student needs sheet, it was found that students had difficulty understanding the material explained by the teacher and no teacher had used flashcard media. Furthermore, the researcher conducted a concept analysis where at this stage the

researcher determined the learning material that would be presented on flashcards. Furthermore, researchers carry out task analysis which at this stage researchers determine learning objectives in accordance with the KI / KD of the selected material.

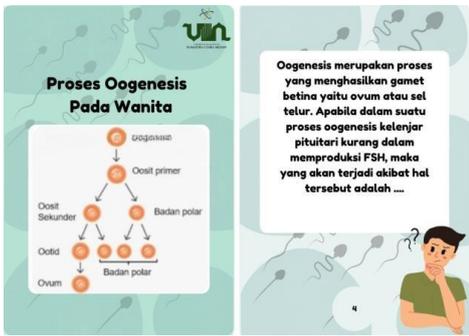
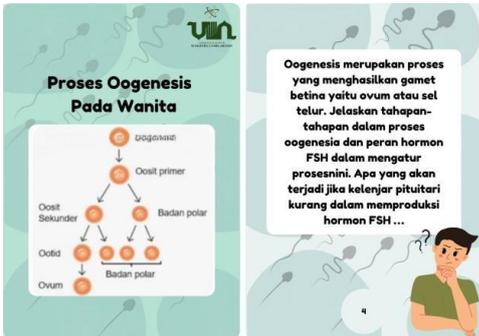
Design Stage

In the development process this stage is used to realize flashcard media (Zahara et al., 2024). The stage consists of media selection, format selection and initial media design. In the media selection stage, the researcher chooses flashcard media with reproductive system material designed using the Canva application. At the format selection stage, researchers format flashcard media based on the presentation of images, colors, shapes, identities, the size of the flashcard media writing to be developed and the box used as a flashcard storage container. Furthermore, the last stage at the design stage is the initial design of the media before being submitted to the media expert lecturers and material experts.

Development Stage

This stage consists of product validation by media experts and material experts before the media is tested. The comments and suggestions of media experts and material experts can be seen in Table 5. In the table, the revision of the developed media is the display of images that were originally not bright changed to bright and changes to the questions.

Table 5. Before Revision and After Revision

Before Revision	After Revision
	
<p>Before the revision, the images were unclear and needed revision.</p>	<p>After revision, the picture looks clearer and easier to read.</p>
	
<p>Before the revision, the questions on the cards did not meet the category of hot questions.</p>	<p>After revising the questions, they have met the category of hot questions.</p>

Material Expert Feasibility Analysis

Flashcard content design will be assessed by material expert validators while the aspects assessed include: learning design, material content, and language. After development with some suggestions from the validator during revision, the results of the flashcard feasibility

conclusion were obtained. The results of the material expert's feasibility can be seen in Table 6.

Table 6: Material Validator Results

Aspect	Percentage (%)	Category
Learning Design Content Linguistics	85.71	Very Feasible

Media experts validate aspects in terms of graphical coverage, and flashcard presentation. The results of the media expert validation calculation can be seen in Table 7.

Table 7. Media Validator Results

Aspect	Percentage (%)	Category
Graphics Presentation	98.43	Very Feasible

Based on Table 6 and Table 7, it is known that the percentage score of the material expert obtained a value of 85.71% can be concluded that the reproductive system flashcards to improve students' hot skills are very feasible. While the percentage score from the media expert obtained a value of 98.43% which also shows that the reproductive system flashcards to improve students' hot skills are said to be very feasible. Suggestions and responses from validators aim to determine the feasibility of flashcards that have been developed before field trials. Validity assessment can be seen from several aspects such as content, presentation, language and visual appearance (Saragih & Tanjung, 2023).

Practicality of Flashcard Media

Data on the practicality of using flashcards was obtained through a response questionnaire from biology teachers and students in class XI SMA after flashcards were used in the learning process. As according to Lisnawati & Rukmi (2023) in their research that the practicality of flashcard media is obtained from the results of questionnaire responses from students and educators. The practicality of flashcard media can be seen in learning activities using flashcard media shows practical results. This is that each media has advantages. The teacher response practicality data is shown in Table 8.

Table 8. Teacher Response Results

Respondent	Percentage (%)	Category
Biology Study Teacher Class XI	90.90	Very Practical

Based on the biology teacher response questionnaire, it is known that flashcards are very practical to use in learning with a percentage score of 90.90%. Flashcards are said to be very practical because they can be used in the learning process and can be used as independent learning media by students. In addition, flashcards are used by students to learn, therefore student responses will be needed in the development of flashcards. The number of students who became respondents amounted to 35 people who would then fill out a response questionnaire to the flashcards developed. After obtaining the results of the response questionnaire scores from 35 students, the percentage of practicality was calculated and the results were obtained in Table 9.

Table 9. Student Response Results

Number of Respondents	Percentage (%)	Category
35 Students	89.74	Very Practical

Based on Table 9, it is known that flashcards have been categorized as very practical because they get a score of 89.74%. In addition, the study also found that flashcards are very helpful in learning because they have goals that are directed according to the KD.

Effectiveness of Flashcard Media

According to Lisnawati & Rukmi (2023) that the effectiveness of flashcard media is obtained through student test results and the results of learning effectiveness sheets. The tests used in the trial were pretest and posttest. The pretest was given to students before using flashcard media. The purpose of the pretest is to determine the initial ability of students. Posttest is given after using flashcard media. In this study, the flashcard effectiveness test was carried out by giving questions before and after the use of flashcards to 35 students. This effectiveness test was conducted to test the use of flashcards to improve student hot. In this effectiveness test used indicators C4, C5, and C6 with a total of 10 questions. The effectiveness test data before and after by students will be analyzed using the N-Gain calculation, can be seen in Table 10.

Table 10. N-Gain Results

N	Pre-test	Post-test	N-Gain	Category
35 Students	50.85	83.08	0.65	Effective Enough

Based on Table 10, it can be seen that the N-gain results that have been carried out at the Senior High School get a total score of 0.65 which is then categorized as quite effective. The results of the pretest and posttest scores that have been tested also show an increase in scores.

CONCLUSION

Based on the results of the study, the percentage of material expert validation was obtained at a value of 85.71% with a very feasible category, while the percentage of media experts obtained a value of 98.43% with a very feasible category. The results of teacher practicality obtained a value of 90.90% with a very practical category, while for student practicality obtained a value of 89.74% with a very practical category. The results of the effectiveness of the N-Gain Score obtained a value of 0.65 with a fairly effective category. Based on the results of the study, the development of Flashcard learning media can be said to be valid, practical and effective.

RECOMMENDATION

Based on the results of the research and development of Flashcard learning media that has been carried out, the following suggestions from researchers: Flashcard media can be used in the learning process so that it can create a fun and interesting learning atmosphere for students, so as to increase student interest in learning which will have an impact on student learning outcomes, for example, as done by researchers to improve students' hot skills.

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