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GLASS DESIGN TO HELP STUDENTS UNDERSTAND THE CONCEPT OF COMMON FRACTIONS

Annisa Nurul Puteri[1], Della Pratiwi [2], Eni Tri Sundari[3], Marissa Dewi Meilani[4], Sabna Laila Fitri[5]

[1,2,3,4,5] Pendidikan Guru Sekolah Dasar, Universitas Lampung, Indonesia

annisanptr@gmail.com[1], dellapratiwi098@gmail.com[2], enitrisundari@gmail.com[3], marissadewi92@gmail.com[4], sabnalailafitripgsd@email.com[5]

ABSTRACT

Proper fractions are one of the important topics in elementary school mathematics education. A strong understanding of the concept of proper fractions is very important for learners, as this concept serves as the foundation for understanding various advanced mathematical operations, such as addition, subtraction, multiplication, and division of fractions. This research aims to determine the design of fraction card learning media on the topic of simple fractions and to measure how far this media can help in understanding the concept of fractions. This research uses Research and Development (R&D) aimed at helping students understand the concept of fractions. The subjects of this research are several educators from Sukadana Timur Public Elementary School. The data analysis technique used is a questionnaire as a design feasibility test. The results of the research on the "GLASS" fraction card learning media design developed obtained an overall percentage of 95.25%, categorized as very feasible. This shows that the design of the "GLASS" fraction card learning media is suitable for use as a learning media design for fraction material, especially simple fractions. Therefore, it can be concluded that the "GLASS" Fraction Card learning media is very suitable for use as a learning media for fraction material, particularly simple fractions in mathematics subjects for third-grade elementary school students.

Keywords*: *design, fractions, fraction cards

A. INTRODUCTION

The comprehension of mathematical principles and concepts is a fundamental aspect of educational curricula that should commence at the elementary school level, as it lays a crucial foundation for future academic endeavors. During this formative stage of their education, elementary school students undergo a remarkable period characterized by significant physical and cognitive development, which is often referred to as a golden age in their growth trajectory. At this juncture in their intellectual maturation, these young learners possess a tabula rasa, or blank slate, thereby allowing for the introduction and assimilation of new ideas and concepts without preconceived notions or biases. When a particular mathematical idea is introduced into the cognitive framework of these students, it has the potential to evolve into a profound understanding that subsequently fosters the generation of new ideas; this transformative process signifies the gradual erosion of their tabula rasa state, as highlighted by Porter (2011:8-9). The observed deficiency in students' comprehension of mathematical concepts can lead to a perplexing scenario where individuals provide divergent responses to identical mathematical inquiries, thereby underscoring the necessity for educators to address these discrepancies in understanding (Bjrklund & Pramling, 2017:68). Such a pedagogical challenge presents an invaluable

opportunity for educators to actively engage with students, aiming to instill accurate mathematical concepts and frameworks within the minds of elementary school learners.

The process of learning fractions emerges as a critical component of mathematics education, wielding considerable influence over students' grasp of the fundamental concepts associated with numbers and ratios, which are indispensable in various practical contexts encountered in everyday life. Fractions serve as a pivotal tool that enables students to comprehend the intricate relationships that exist between parts and wholes, which is essential for their ability to navigate and interpret numerous real-world scenarios they encounter on a daily basis. Nafi'an (2015) articulates that a proper fraction is defined as a numerical representation consisting of two distinct components: the numerator, which signifies the specific part taken from the entire whole, and the denominator, which denotes the total number of equal parts that comprise one complete unit. In further elucidation, Sutawidjaja (as cited in Asfuri, 2011) asserts that a fraction can be characterized as the ratio of two whole numbers, with the stipulation that the denominator cannot assume the value of zero. To encapsulate this notion succinctly, the expression a/b serves as a conventional representation of a proper fraction, wherein both a and b are integers with the condition that b is not equivalent to zero. The understanding of proper fractions constitutes one of the fundamental topics within the realm of elementary school mathematics education, as it serves as a cornerstone for learners to build upon in order to grasp increasingly complex mathematical operations, including addition, subtraction, multiplication, and division of fractions. However, empirical research has consistently indicated that a significant number of students encounter substantial difficulties when attempting to comprehend the concept of proper fractions. According to Yuswita (2018), a proper fraction can be elucidated as a segment of a whole entity, whereby the numerator represents the specific part that is being considered, while the denominator corresponds to the entirety that is conceptualized as a singular unit.

Karso (2014: 7.4) posits that a fraction can be expressed in the form of a/b, in which a is designated as the numerator and b is designated as the denominator, with both a and b being categorized as integers and the stipulation that b cannot equal zero. Furthermore, the representation of a/b can be interpreted as the mathematical operation a : b, which signifies the division of a by b. A fraction can be effectively defined as a segment or portion of a complete entity, as articulated by Heruman (2008, p. 43). In a detailed discourse on the nature of fractions, Sukajati (as referenced in Pebrianti A.P, 2018, pp. 23-31) elaborates that the term "fraction" signifies a segment of a whole that possesses equal size, deriving its etymological roots from the Latin term "fractio," which translates to the act of breaking into smaller components. Additionally, another perspective is offered by Heruman (2017, p. 43), who similarly contends that a fraction can be delineated as a part of an entire whole, thereby reinforcing the multifaceted understanding of fractions as essential elements within the broader framework of mathematical education.

One of the primary factors contributing to the challenges that students face when attempting to grasp the fundamental concept of simple fractions can be attributed to the insufficient availability of effective and engaging learning media. A significant number of educators continue to depend heavily on traditional pedagogical approaches, which

predominantly involve lecturing and the utilization of conventional textbooks, both of which are often inadequate in their capacity to provide a tangible and concrete visualization of the concept of common fractions. Consequently, this reliance on outdated methodologies leads to a situation where students struggle to comprehend the visual representation of proper fractions, as well as the intricate relationship that exists between parts and wholes in a mathematical context.

In order to effectively address this pressing issue, it is imperative that there is a concerted effort toward the development of innovative learning media that can facilitate students in visualizing and comprehending the concept of simple fractions with greater clarity and concreteness. One promising form of learning media that has the potential to significantly enhance students' understanding is the "GLASS" fraction cards, which serve as a visual aid designed specifically for the representation of common fractions through the use of illustrative images or symbols. According to the research conducted by Shamsudin (2012: 62), fraction cards are employed as effective teaching aids that contain images depicting the fractions of various objects alongside their corresponding numerical values. Furthermore, as pointed out by Yuanita (2010), the incorporation of fraction cards during mathematics instruction has been shown to markedly improve students' academic performance and learning outcomes concerning their grasp of the concept of fractions. Additionally, the research by Emilie A. Naiser et al. (2017) highlights that fraction cards can be utilized within an interactive learning framework, thereby enabling students to engage in active participation, which ultimately enhances their understanding of the fractional concepts being taught.

The implementation of "GLASS" within the learning environment is anticipated to significantly aid students in developing a deeper understanding of the fundamental concept of simple fractions. Through their interaction with "GLASS," students will have the opportunity to directly observe visual representations of fractions, see fractions illustrated in the form of images, and engage in basic operations involving fractions, such as addition and subtraction. This interactive approach not only serves to bolster students' conceptual understanding but also empowers them to apply their knowledge of proper fractions in more complex mathematical situations and problem-solving scenarios.

In light of the aforementioned discussion, this research endeavor is fundamentally aimed at the development of a fraction card design that is specifically tailored to assist students in attaining a more profound understanding of the concept of simple fractions. It is the expectation of this research that it will make a meaningful contribution to the advancement of mathematics learning media, particularly in relation to the topic of simple fractions, while simultaneously enhancing the overall quality of the educational experience and fostering improved comprehension among students.

B. RESEARCH METHOD

The research methodology employed in this academic inquiry is characterized as research and development, commonly abbreviated as R&D, which is a systematic approach aimed at the creation and subsequent evaluation of a particular product, with the ultimate objective of establishing its efficacy so that it may be made available for use

within the broader community and society at large (Sugiyono 2010: 407). The specific demographic population and the representative sample utilized for this scholarly investigation consist of the third-grade students enrolled at the educational institution known as SDN Sukadana Timur, and it is noteworthy that this research was conducted on the date of October 4, 2024, which is significant in establishing the temporal context of the study.

The primary focus of this research is directed towards the development of educational media in the form of fraction cards that facilitate the learning of fraction concepts, particularly emphasizing the understanding of proper fractions, which are a critical component of mathematical education at this level. To achieve this aim, the research adopts a two-dimensional model that encompasses two distinct yet interrelated stages of development. The initial phase, referred to as the define stage, comprises various analytical activities, including an in-depth curriculum analysis, a comprehensive needs assessment, and a thorough analysis of the relevant educational materials. The second phase, known as the design stage, involves the intricate processes of designing the educational media and the actual creation of the fraction card media itself, which are crucial for effective learning experiences.

In terms of data collection, this research employs educator questionnaires as the primary instrument for gathering information, allowing for the systematic collection of valuable insights from educators regarding the instructional media. The tools and materials that were utilized to create this educational media are notably the Canva application, which is a graphic design platform that facilitates the creation of visually engaging content, as well as luster photo paper, which is known for its high-quality finish and durability in educational materials.

The technique employed for data processing involved meticulous handling of primary data derived from the questionnaires that were completed by each learning media validator associated with SDN Sukadana Timur. Following the collection of this data, a thorough analysis was conducted, allowing for the derivation of conclusions related to the overall feasibility and appropriateness of the fraction card learning media design intended for use in teaching fraction concepts, specifically focusing on simple fractions within the mathematics curriculum for third-grade students in an elementary school setting. Data collection was systematically executed by distributing questionnaires to the identified validators, ensuring a structured approach to gathering feedback.

The information obtained through this process was then subjected to rigorous analysis, where a detailed examination of the feasibility test of the learning media design was undertaken. This analysis aimed to extract pertinent data from the evaluations conducted by the validators, ensuring that the feedback was both reliable and valid. The data resulting from these assessments is categorized as quantitative data, which provides measurable insights into the effectiveness of the learning media. Furthermore, this quantitative data can be transformed into qualitative data represented in the form of intervals through the application of a specific analytical formula, underscoring the methodological rigor of this research endeavor.

$$\mathbf{P} = \frac{\mathbf{\Sigma x}}{\mathbf{\Sigma xi}} \times \mathbf{100}$$

Explanation:

P = Validation percentage
Σx = The total number of answers across all items
Σxi = The total sum of ideal values in all items
100 = constant

The results of the above calculations are then used to determine the feasibility of the learning media. The feasibility categories can be seen in Table 1.

Table 1. Category of Learning Media Eligibility.

Presentase	Eligibility Level
81% - 100%	Very Worthy
61% - 80%	Worthy
41% - 60%	Somewhat Worthy
21% - 40%	Not Worthy
≤20	Very Unworthy

C. RESULTS AND DISCUSSION

An extensive investigation into the efficacy of fraction card learning media as an educational tool specifically tailored for the comprehension of fraction concepts, particularly focusing on simple fractions within the context of mathematics curriculum, was meticulously carried out through the systematic distribution of structured questionnaires at the elementary institution known as SDN Sukadana Timur.

The stages of creating the "GLASS" Fraction Learning Card Media are as follows:

1. Enter the Design menu in the Canva application.
2. Prepare a blank A4 paper template in the Canva design menu.
3. Divide the paper into 4 equal parts.
4. Each part is framed and adorned with traditional Lampung motifs.
5. Use a white background.
6. Insert fraction image elements such as pizza, watermelon, orange, etc.
7. Provide fraction answer options from the image elements.
8. Print out the design using luster photo paper.
9. Cut according to the shape of the fraction card design.
10. The "GLASS" Fragment Card is ready to use.

After the learning media design is completed, the next step is to validate the fraction card media design by validators from SDN Sukadana Timur. Validators play a role in assessing the media in terms of design and content created by the researcher.

Table 2. Results of the Feasibility Test of the

No	Assessment Aspects	V1	V2	V3	V4	Total Score	Skor Maks	%	Category
1.	Learning media relevant to the material studied by students	24	26	25	23	98	100	98	Very Worthy
2.	Learning media can be used for individual learning, small group learning, and large group learning.	9	9	10	8	36	40	90	Very Worthy
3.	Learning media using easily understandable images	18	15	17	19	69	70	98	Very Worthy
4.	Learning media makes the material easy to remember.	26	23	20	24	93	100	93	Very Worthy
5.	Clarity of media usage instructions	8	10	8	12	38	40	95	Very Worthy
6.	Color harmony between the display and background	13	11	12	11	47	50	94	Very Worthy
	Total Overall Aspects	**98**	**94**	**92**	**97**	**381**	**400**	**95,25**	**Very Worthy**

The investigation into the viability of the educational media design known as the GLASS fraction card, which is specifically focused on the topic of fractional mathematics, particularly simple fractions, has been meticulously conducted by employing a validation questionnaire that has been rigorously assessed and validated by a panel of qualified validators. The potential of the GLASS fraction card learning media design has been articulated and elucidated in the following manner: the assessment of the feasibility of the GLASS fraction card educational media design, which addresses the subject of fractions, with an emphasis on basic fractions, has been carried out in order to evaluate the practicality of this learning tool. The validators participating in this endeavor include an educator affiliated with SDN Sukadana Timur, who brings a wealth of experience and insight into the validation process.

The criteria used for the validation by these educators encompass a variety of factors, such as the relevance of the educational media to the subject matter being taught, the effectiveness of the learning medium, the clarity and comprehensibility of the instructional guidelines for media usage, as well as the overall user-friendliness of the interface and background design of the media. The feasibility of the GLASS fraction card learning media design, particularly in relation to the topic of fractional materials and specifically simple fractions, is thoroughly illustrated through the outcomes of the assessments conducted by the validators, as detailed in Table 2 presented below. The purpose of the feasibility testing undertaken by the educators is to gather comprehensive feedback, including constructive suggestions and critical comments from the validators, in order to ensure that the GLASS fraction card learning media design evolves into a high-quality educational resource that is suitable for implementation in the instructional process.

The results of the feasibility assessment performed by the various validators, as illustrated in Table 2, indicate that Validator 1 achieved the highest score of 26 points in terms of the learning media's effectiveness in making the material memorable for students, while the lowest score recorded was 8 points concerning the clarity of the instructions for using the media. In the case of the second validator, a top score of 26 was also reached in relation to the learning media's relevance to the educational material pertinent to the learners, whereas the lowest score noted was 9 points for the learning media's applicability in individual, small group, and large group learning scenarios. For the third validator, a commendable score of 25 was attained for the aspect of the learning medium's relevance to the educational content being studied by the students, with the lowest score observed being 8 for the clarity of the media usage instructions. Meanwhile, the fourth validator recorded a high score of 24 points in relation to the learning media's capacity to facilitate memorable learning experiences, while the lowest score of 8 was noted for the media's adaptability for use in individual, small group, and large group learning contexts.

The overall scores from Validator 1 amounted to 98, with Validator 2 achieving a score of 94, which translates to an impressive 94% evaluation rating, followed by Validator 3, who garnered a score of 92, corresponding to a 92% appraisal. The average percentage of evaluations across all four validators stands at an impressive 95.25%, categorizing the GLASS fraction card learning media design as highly feasible and effectively suitable for educational purposes.

The findings derived from the feasibility assessment carried out by the validator regarding the design of the GLASS fraction card learning media revealed an impressive overall score of 95.25%, which is classified as exceptionally feasible and reflects a high level of approval. This remarkable percentage indicates that the design of the GLASS fraction card learning media is indeed appropriate and effective for implementation as a learning resource specifically tailored for the concept of fractions, with a notable emphasis on the understanding of proper fractions, which are a critical component of fractional mathematics. The relevance of this learning media is underscored by its alignment with the educational material that students are currently engaging with, thereby enhancing its utility in the learning environment. Furthermore, the versatility of the learning media allows for its application across various instructional settings, accommodating individual learners, small collaborative groups, as well as larger classroom assemblies, which broadens its applicability and effectiveness. The design is characterized by the incorporation of visually appealing and easily comprehensible images, which serve to simplify the learning material, making it more memorable for students, while also providing clear and concise instructions for usage that facilitate ease of implementation. Additionally, the thoughtful selection of color schemes that harmonize the display with the background contributes significantly to the overall aesthetic and functional quality of the learning media, thereby promoting a conducive atmosphere for both educators and learners alike throughout the educational process. As evidenced by the evaluation criteria presented in Table 2, the validators reached a consensus regarding the practicality and

effectiveness of utilizing the GLASS fraction card learning media design, which is articulated in the following summary:

1. The relevance of the learning media to the educational content being addressed by the students is of paramount importance, and in this regard, the design of the GLASS fraction card learning media emerges as an exceptionally effective pedagogical instrument that significantly aids students in their comprehension of the intricate concept of fractions in a manner that is not only interactive but also deeply engaging. By employing a series of cards that visually represent a diverse array of fractions, students are afforded the opportunity to more readily visualize the mathematical concepts they are encountering and to draw connections between the abstract material they are studying and tangible, concrete examples that resonate with them on a personal level. This multifaceted approach not only serves to deepen the students' understanding of the subject matter at hand but also contributes to rendering the entire learning experience considerably more engaging and enjoyable, thus fostering a more profound enthusiasm for mathematics among the learners. The GLASS fraction cards are deemed to be particularly relevant to the curriculum content because they provide students with the practical tools necessary to engage in the essential mathematical operations of calculating, comparing, and arranging fractions within a context that is in harmony with the educational objectives outlined in the curriculum they are following.
2. The versatility of learning media, such as the GLASS fraction cards, allows them to be utilized effectively across various educational settings, whether it be for individual study, small group activities, or even large group learning environments, thereby maximizing their potential as an interactive learning resource that facilitates a comprehensive understanding of the concept of fractions among students. By leveraging the illustrative nature of the cards that depict a multitude of different fractions, students are not only able to visualize the material more effectively but also find it easier to relate their theoretical studies to real-world, concrete examples that enhance their comprehension. Through the practical application of the GLASS fraction cards, students engage in the vital mathematical processes of calculating, comparing, and arranging fractions, which significantly boosts their conceptual understanding while simultaneously making the overall learning experience more enjoyable and engaging for all participants involved in the educational process.
3. The design of the GLASS fraction card learning media, which has been meticulously crafted by the researcher, incorporates a selection of imagery that is not only visually appealing but also easily comprehensible for students, thereby facilitating a more effective learning experience. This is evidenced by the deliberate choice to utilize images of familiar items such as pizza, watermelon, oranges, and other relatable objects in the creation of the GLASS fraction card learning media, which serve to bridge the gap between abstract mathematical concepts and students' everyday experiences. By utilizing easily understandable images, the researcher aims to enhance students' retention of the fraction concepts being taught,

particularly those fractions that have already been well established in their prior learning, ultimately contributing to a more engaging and memorable educational experience.

4. The GLASS fraction card learning media, as designed by the researcher, employs an aesthetically pleasing and captivating design that features an assortment of interesting and colorful images, all of which work in concert to aid students in their ability to remember and retain information more effectively while simultaneously making the learning process substantially more enjoyable and fulfilling. The incorporation of visually stimulating elements into the learning media not only captures the attention of the students but also enhances their engagement levels, thus fostering an environment conducive to effective learning and long-term retention of mathematical knowledge.
5. An essential aspect of the GLASS fraction card learning media is the clarity of the usage instructions that have been meticulously crafted and included within the design, ensuring that they are both comprehensive and easily understandable for users. The researchers have taken great care to provide detailed steps for utilizing the GLASS fraction card learning media, making this information readily accessible via Google Drive, where it can be conveniently accessed by validators and other stakeholders involved in the educational process, thereby enhancing the overall usability and effectiveness of the learning tool.
6. The design of the GLASS fraction card learning media is characterized by an aesthetically pleasing combination of colors and backgrounds that not only attract the eye but also create an inviting learning atmosphere. Furthermore, the researchers have thoughtfully incorporated traditional ornaments that are emblematic of the Lampung region, artfully placing them along the edges or utilizing them as decorative frames for the cards, which serves to enrich the visual appeal of the learning media while also instilling a sense of cultural relevance and identity in the educational materials being presented.

The primary metric of success in this particular research endeavor is fundamentally rooted in the thorough completion and subsequent validation of the GLASS Fraction Card learning media design, which serves as an innovative educational tool. The completion of this learning media has been achieved after meticulously navigating through two distinct yet critical phases of development research, specifically the define stage, which involves identifying the core needs and objectives, and the design stage, where the actual construction and formatting of the learning materials take place, thus fulfilling the established success criteria. In terms of these success criteria, it is imperative that the assessment conducted by experts in the field must yield a categorization that is at least deemed "Feasible," which essentially ensures that the educational tool is functional and effective for its intended purpose. Consequently, it can be conclusively asserted that the GLASS Fraction Cards learning media is not only appropriate but also highly suitable for implementation as an instructional medium aimed at enhancing the understanding of fraction concepts, particularly simple fractions, within the framework of the third-grade

mathematics curriculum. The outcomes of this design endeavor are anticipated to provide significant assistance to educators during their instructional activities and to facilitate a deeper comprehension of fraction-related material, especially simple fractions, among the students in third-grade elementary school settings. Furthermore, it is the aspiration of this initiative that the GLASS Fraction Cards media will contribute positively to the existing body of resources available for teaching fraction concepts, particularly focusing on simple fractions. To achieve this goal, it is critical to meticulously select learning media that are congruent with the specific material being taught, as the motivation and engagement levels of students during the learning process serve as key indicators of the successful transmission of knowledge and the attainment of educational objectives within the instructional framework. (Sukmanasa dkk 2017: 172).

In addition to the aforementioned considerations, it is crucial for educators to take into account the appropriateness of the selected learning media in relation to the cognitive developmental stages of the students, which can have profound implications for their learning experiences. Drawing upon Jean Piaget's well-established theory of cognitive development, it becomes evident that an individual's cognitive (intellectual) progression unfolds through four distinct stages, which include (1) the sensorimotor stage, characterized by sensory experiences and motor activities, which develops from birth to approximately 2 years of age; (2) the preoperational stage, which spans from 2 to 7 years and involves the development of language and symbolic thinking; (3) the concrete operational stage, which occurs between the ages of 7 and 11 years and is marked by the emergence of logical thought processes concerning concrete objects; and (4) the formal operational stage, which commences at around 11 years of age and continues into adulthood, wherein individuals begin to engage in abstract reasoning and hypothetical thinking. (Nursalim 2007: 26).

The process of designing effective learning media constitutes a fundamental aspect of the planning and implementation phases of educational activities, which is intrinsically linked to the pedagogical competencies that educators must possess in order to facilitate successful learning environments. According to Article 28, paragraph 3 of the 2005 Government Regulation pertaining to National Education Standards, as elaborated upon by Nur (2014: 68), pedagogical competence encompasses a wide array of abilities that enable educators to manage student learning effectively, which includes various components such as a comprehensive understanding of students' needs; the design and execution of learning experiences; the evaluation of learning outcomes; and the fostering of students' diverse potentials to ensure their holistic development. Consequently, it is imperative that every educator engages in a continuous process of enhancing their pedagogical competence, one of the most effective methods of which is through the deliberate development and refinement of innovative learning media.

D. CONCLUSION

This scientific research aims to use a two-dimensional model that is systematically structured into two distinct yet interconnected stages, thereby facilitating an in-depth exploration of the educational phenomenon being studied. The initial stage, aptly called

the definition stage, encompasses a comprehensive series of analytical activities including, but not limited to, curriculum analysis, needs analysis, and material analysis, which collectively serve to outline the fundamental requirements and objectives of the educational framework being studied. Moving on to the second phase, known as the design stage, this segment is marked by the complex process of conceptualizing media and the actual implementation of creating fragmented media cards, which are an integral component of the methodological approach of this research. To collect relevant data that informs the study's conclusions, this research employs a systematic data collection method that incorporates educator questionnaires, allowing for a robust assessment of the educational tools being developed. Innovative tools and materials that have been strategically used in the creation of this educational media include the user-friendly Canva application, renowned for its design capabilities, as well as the use of high-quality luster photo paper that enhances the visual appeal and durability of the produced educational materials.

Furthermore, the meticulous feasibility assessment conducted by the validator panel on the GLASS fraction card learning media design resulted in an impressive overall percentage of 95.25%, which is categorically classified as very feasible, thereby emphasizing the effectiveness and suitability of this educational resource. This remarkable percentage not only reflects the high-quality design inherent in the GLASS fraction card learning media but also affirms its suitability to be applied as an educational media design specifically tailored for teaching fraction materials, especially in the context of simple fractions. The relevance of this learning media to the curriculum content studied by students significantly enhances its pedagogical value, ensuring that this media aligns with the established educational goals. Furthermore, the flexibility of this learning media is noteworthy, as it is designed to accommodate various learning environments, making it applicable for individual students, small groups, or even large group instructional settings. This design incorporates visually accessible images that facilitate understanding, making the material not only easier to comprehend but also easier to remember for the students involved. In addition to its visual appeal, this media is accompanied by clear and concise usage instructions, which are crucial for maximizing its effectiveness in an educational context. Lastly, the carefully chosen color scheme and background design positively contribute to the overall aesthetic quality of the learning media, thereby enhancing engagement and the learning experience for educators and students during the teaching process.

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