

## GLASS DESIGN TO HELP LEARNERS' UNDERSTANDING OF THE CONCEPT OF ORDINARY FRACTIONS

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### 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 "KACA" fraction card learning media design developed obtained an overall percentage of 95.25%, categorized as very feasible. This shows that the design of the "KACA" 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 "KACA" 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 by learners should be initiated at the primary school level, as this stage serves as a crucial foundation for their intellectual development. During primary school, students undergo a remarkable period of both physical and cognitive growth, wherein their capacity for learning is at its peak. At this formative phase, learners display traits reminiscent of a tabula rasa, which indicates that their minds are receptive and unmarked by preconceived notions. When an idea is introduced and subsequently processed through the cognitive framework of the learner, that initial state of tabula rasa is transformed into a more profound understanding that can generate new ideas and insights, thereby indicating a significant cognitive shift (Porter, 2011:8-9). It has been observed that when students possess a limited grasp of mathematical concepts, they may respond inconsistently to identical questions, leading to a variety of answers for the same problem (Bjrkland & Pramling, 2017:68). Such discrepancies in understanding should be strategically utilized by educators to instill mathematical concepts effectively within the minds of elementary school students during these critical years of learning.

The concept of fractional learning represents an essential component of mathematics education, profoundly influencing learners' comprehension of numerical relationships and ratios. Fractions play a pivotal role in helping students grasp the intricate relationship between parts and the whole, which is vital for navigating various everyday scenarios and tasks. According to Nafi'an (2015), a standard fraction is defined as a numerical entity consisting of two key components: a numerator and a denominator. The numerator signifies the portion that is being considered from the total, whereas the denominator

denotes the quantity of equal segments that comprise a single unit. In alignment with Sutawidjaja's insights (as cited in Asfuri, 2011), a fraction can be interpreted as a comparison between two enumerated values, with the stipulation that the denominator must never equate to zero. To elaborate, the mathematical expression  $a/b$  is commonly employed to represent ordinary fractions, where both  $a$  and  $b$  are integers, and it is explicitly stated that  $b$  cannot equal zero. The concept of ordinary fractions stands out as a significant topic within the realm of elementary mathematics education. A robust understanding of ordinary fractions is essential for learners, as this foundational concept underpins the comprehension of a variety of advanced mathematical operations, including addition, subtraction, multiplication, and division involving fractions. Nonetheless, numerous studies indicate that learners frequently encounter challenges in grasping the concept of ordinary fractions. Yuswita (2018) articulates that ordinary fractions can be characterized as segments of entire entities, where the numerator pertains to the part of interest and the denominator represents the whole regarded as a singular unit.

Karso (2014:7.4) posits that fractions can be represented in the form of a mathematical expression, where  $a$  is designated as the numerator and  $b$  is termed the denominator, with both  $a$  and  $b$  being integers, and  $b$  is explicitly stated to be non-zero. The expression  $a:b$  can also be interpreted as a division of  $a$  by  $b$ , thereby reflecting the concept of fractions as a portion of a larger whole, as elucidated by Heruman (2008, p. 43). Furthermore, Sukajati (as referenced in Pebrianti A.P, 2018, pp. 23-31) explains that "the term fraction refers to a segment of a whole that maintains uniform size, originating from the Latin term *fractio*, which means to disaggregate into smaller components." Another perspective is provided by Heruman (2017:43), who asserts that fractions can be viewed as parts of a complete entity.

A significant factor contributing to learners' struggles with the concept of ordinary fractions is the inadequate implementation of effective learning media. Many educators continue to rely on traditional pedagogical methods, which primarily involve lectures and the utilization of textbooks, approaches that often fail to concretely visualize the principles of ordinary fractions. Consequently, students encounter difficulties in interpreting visual representations of ordinary fractions, as well as in understanding the intricate relationship between parts and the whole.

In order to effectively tackle the issue at hand, it is essential to embark on the development of an innovative learning medium that possesses the capacity to assist learners in visualizing and comprehending the intricate concepts associated with ordinary fractions in a manner that is both concrete and tangible. One promising avenue for such a learning medium is embodied in the concept of the "GLASS" fractional card, which serves as a sophisticated visual aid specifically designed for the purpose of presenting ordinary fractional values in an accessible format through the use of carefully crafted images or symbols. As indicated by Shamsudin (2012:62), these fractional cards function as valuable props that encapsulate a visual representation of a fractional image corresponding to a particular object, complete with the relevant fractional notations. Furthermore, Yuanita (2010) asserts that the implementation of fractional cards during mathematics instruction has been shown to significantly enhance learners' mathematical performance, particularly

with regard to their grasp of the fundamental concept of fractions. In addition, research conducted by Emilie A. Naiser et al. (2017) highlights that fractional cards play a pivotal role in facilitating interactive learning experiences, thereby enabling learners to engage actively with the material and substantially deepen their understanding of fractional principles.

The anticipated application of the “GLASS” learning tool in educational settings is expected to markedly improve learners' comprehension of ordinary fractions by providing them with a unique opportunity to interact with the medium in a meaningful way. Through their engagement with the “GLASS” cards, learners are afforded the chance to visually observe representations of fractions, articulate fractional values through imagery, and carry out fundamental operations involving fractions, such as addition and subtraction, in a seamless manner. This interactive process has the potential to significantly enhance learners' conceptual understanding, thereby equipping them with the necessary skills to apply ordinary fractional concepts in increasingly complex mathematical scenarios.

In light of the aforementioned considerations, the primary objective of this study is to meticulously design a fractional card that will serve as an effective educational tool to bolster learners' comprehension of the concept of ordinary fractions. This research endeavor is anticipated to make a substantial contribution to the advancement of mathematical learning resources, particularly in the domain of ordinary fractions, while simultaneously working towards the enhancement of the overall quality of learning experiences and the depth of understanding achieved by learners in this critical area of mathematics.

## **B. RESEARCH METHODS**

The methodology employed in this comprehensive research endeavor is characterized as research and development, often abbreviated as R&D. The primary objective of R&D is to innovate and create specific educational products while simultaneously evaluating their effectiveness and applicability, ensuring they can be efficiently utilized by the wider population, as elucidated by Sugiyono in 2010, page 407. In this particular scholarly investigation, the target population, as well as the sample selection, consisted exclusively of the third-grade classes from Eastern Sukadana SDN. The actual execution of this study took place on the fourth day of October in the year 2024.

This research specifically emphasizes the development of innovative learning media in the form of fractional cards that are designed to facilitate the understanding of fractional concepts, with a particular focus on ordinary fractions. To achieve this objective, the study employed a two-dimensional model that is systematically divided into two distinct phases for clarity and organization. The first phase, referred to as the define phase, encompasses a thorough curriculum analysis, an in-depth needs assessment, and a comprehensive material analysis. The second phase, designated as the design stage, involves the meticulous process of crafting the learning media and producing the fractional card materials. To gather relevant data, the research employed a structured questionnaire aimed at educators within the target population. The resources and tools utilized in the

creation of this educational medium included the Canva application for design purposes and luster photo paper for the physical production of the cards.

In terms of data processing methodology, the research team meticulously undertook the analysis of primary data derived from the completed questionnaires submitted by each validator associated with the learning media at East Sukadana SDN. Following this, the collected data was subjected to rigorous analysis, leading to the formulation of conclusions concerning the overall feasibility and effectiveness of the designed fractional card learning media tailored for instructional use in understanding fractional concepts, particularly ordinary fractions, within the mathematics curriculum for third-grade students in primary education.

The process of data collection was executed by distributing questionnaires to the designated validators, whereby the information obtained was subsequently analyzed with precision. A thorough feasibility analysis of the learning media design was conducted to extract insightful data from the evaluative assessments provided by the validators. The resulting data from these assessments were primarily quantitative in nature, which allows for a transformation into qualitative data that can be represented in the form of intervals through the application of a specific formula designed for this purpose.

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

**Description:**

P = Percentage of validation

$\Sigma x$  = Total number of answers in all items

$\Sigma xi$  = Total number of ideal values in all items 100 = constant

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

**Table 1.** Learning Media Feasibility Category.

Presentase	Feasibility Level
81% - 100%	Highly Suitable
61% - 80%	Suitable
41% - 60%	Fairly Suitable
21% - 40%	Not Suitable
≤20	Highly Unsuitable

**C. RESULTS AND DISCUSSION**

Research on fraction card learning media for fraction material, especially ordinary fractions in mathematics subjects was carried out through distributing questionnaires, at SDN Sukadana Timur.

The stage of making Fraction Card Learning Media "GLASS" is as follows:

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

After the learning media design was completed, the next step was to have the fraction card media design validated by validators from SDN Sukadana Timur. The validator's role is to provide an assessment of the media in terms of design and material made by the researcher.

**Table 2:** Results of Feasibility Test of Learning Media Design "GLASS" on Fraction Materials, Especially Ordinary Fractions by Educators

No	Assessment Aspect	V1	V2	V3	V4	Total Skor	Skor Maks	%	Kategori
1.	Learning Media is relevant to the material studied by students	24	26	25	23	98	100	98	Very Feasible
2.	Learning Media can be used for individual, small group, and large group learning	9	9	10	8	36	40	90	Very Feasible
3.	Learning Media uses images that are easy to understand	18	15	17	19	69	70	98	Very Feasible
4.	Learning Media makes the material easy to remember	26	23	20	24	93	100	93	Very Feasible
5.	Clarity of instructions for using the media	8	10	8	12	38	40	95	Very Feasible
6.	Appropriateness of display and background colors	13	11	12	11	47	50	94	Very Feasible
<b>Total Overall Aspect</b>		<b>98</b>	<b>94</b>	<b>92</b>	<b>97</b>	<b>381</b>	<b>400</b>	<b>95,25</b>	<b>Very Feasible</b>

The feasibility of the "GLASS" fraction card learning media design on fraction material, especially ordinary fractions, is carried out using a validation questionnaire validated by the validator. The feasibility test of the "GLASS" fraction card learning media design by validators (educators) is explained as follows:

The feasibility test of the "KACA" fraction card learning media design on fraction material, especially ordinary fractions by educators was carried out to test the feasibility of the learning media design that had been made. Validators are educators from SDN Sukadana Timur.

The assessment aspects used for validation by educator validation consist of aspects of learning media relevant to the material studied by students, learning media can be used for individual, small group, and large group learning, learning media using images that are easy to understand, learning media makes the material easy to remember, clarity of instructions for using the media, suitability of display and background colors. The feasibility of the "GLASS" fraction card learning media design on fraction material, especially ordinary fractions can be seen from the results of the assessment conducted by validators (educators) in table 2 below. The feasibility test conducted by educators aims to obtain results as well as suggestions and comments from validators (educators) so that the "GLASS" fraction card learning media design developed becomes a quality product and is suitable for use in the learning process.

The feasibility test conducted by validators (educators) on the design of fraction card learning media "GLASS" can be seen based on table 2 which shows that Validator 1 obtained the highest score of 26 for the aspect of learning media making the material easy to remember, while the lowest score is 8 on the aspect of clarity of instructions for using the media. In the 2nd validator, the highest score was 26 for the aspect of learning media relevant to the material studied by students, while the lowest score was 9 for the aspect of learning media that can be used for individual, small group, and large group learning. In the 3rd validator, the highest score was 25 for the aspect of learning media relevant to the material studied by students, while the lowest score was 8 for the aspect of clarity of instructions for using the media. In the 4th validator, the highest score was 24 for the aspect of learning media making the material easy to remember, while the lowest score was 8 for the aspect of learning media can be used for individual, small group, and large group learning.

The total score obtained from validator 1 is 98 with a percentage of 98% with a very feasible category, the total score obtained from validator 2 is 94 with a percentage of 94% with a very feasible category, the total score obtained from validator 3 is 92 with a percentage of 92% with a very feasible category, and the total score obtained from validator 4 is 97 with a percentage of 97% with a very feasible category. The average percentage of the assessment of the 4 validators is 95.25% with a very feasible category. The results of the feasibility test conducted by the validator on the design of the "GLASS" fraction card learning media developed obtained an overall percentage of 95.25% with a very feasible category. This shows that the design of the fraction card learning media "GLASS" is feasible to use as a learning media design on fraction material, especially ordinary fractions. This is because from the aspect of learning media relevant to the material studied by students, learning media can be used for individual, small group, and large group learning, learning media uses images that are easy to understand, learning media makes the material easy to remember, clarity of instructions for using the media,

the suitability of the display color and background is very good so that it will facilitate educators and students in the learning process.

\*\*\* Translated with [www.DeepL.com/Translator](http://www.DeepL.com/Translator) (free version) \*\*\*

1. From the aspects assessed which can be seen in Table 2. the validators agreed on the feasibility of using the "GLASS" fraction card learning media design as follows:
  1. Learning media is relevant to the material that students learn: "GLASS" fraction card learning media design is an effective tool to help learners understand the concept of fractions in an interactive way. By using cards that depict various fractions, learners can more easily visualize and associate the material learned with concrete examples. This approach not only improves learners' understanding, but also makes the learning process more interesting and fun. "KACA" fraction cards are relevant to the material because they allow learners to practice calculating, comparing, and composing fractions in a context that is in line with the curriculum being taught.
  2. Learning media can be used for individual, small group, and large group learning: "KACA" fraction cards, as an interactive learning tool, help learners understand the concept of fractions. Learners can more easily see and relate the material learned with concrete examples by using cards that depict various fractions. By using fraction cards "GLASS", learners practice calculating, comparing, and composing fractions and improve learners' understanding and make learning more fun and interesting.
  3. The learning media uses images that are easy to understand: The design of the "GLASS" fraction card learning media that researchers have designed uses images that are easily understood by students, this can be seen from the use of images of pizza, watermelon, oranges and so on that researchers use in making "GLASS" fraction card learning media. Researchers use images that are easy to understand so that students are easier to remember the concept of fraction material, especially fractions that have been studied well and can make learning more interesting.
  4. Learning media makes the material easy to remember: The "GLASS" fraction card learning media that the researcher has designed uses an attractive design such as the use of attractive and colorful images in the "GLASS" fraction card, so that this can help students remember information better and the learning process can also be more fun.
  5. Clarity of instructions for using the media: The "GLASS" fraction card learning media design has clear and easy to understand instructions for using the media. Researchers have included the steps for using the "GLASS" fraction card learning media design on the gdrive that can be accessed by validators.
  6. Appropriateness of display color and background: The design of fraction card learning media "GLASS" has attractive colors and background. Researchers also use traditional ornament typical of Lampung region which is on the edge or made as a card frame.

Indikator keberhasilan dalam penelitian ini, yakni terselesaikannya desain media pembelajaran Kartu Pecahan "KACA". Media pembelajaran telah selesai karena telah melalui dua tahap penelitian pengembangan, yaitu tahap *define* dan tahap *design* dengan memenuhi kriteria keberhasilan. Adapun kriteria keberhasilannya, yakni penilaian validasi ahli minimal dapat dinyatakan dengan kategori "Layak". Oleh sebab itu, dapat disimpulkan bahwa media pembelajaran Kartu Pecahan "KACA" sangat layak digunakan sebagai media pembelajaran pada materi pecahan, terutama pecahan biasa dalam mata pelajaran matematika di kelas III Sekolah Dasar.

Hasil desain, diharapkan dapat membantu pendidik dalam kegiatan belajar dan mengajar serta diharapkan dapat membantu peserta didik dalam memahami materi pecahan, khususnya pecahan biasa di kelas III SD. Selain itu juga diharapkan media Kartu Pecahan "KACA" dapat menambah referensi media pembelajaran pada materi pecahan, khususnya pecahan biasa. Untuk itu perlu adanya pemilihan media pembelajaran yang sesuai dengan materi yang akan diajarkan, karena motivasi belajar peserta didik dan minat peserta didik dalam proses pembelajaran merupakan salah satu indikasi dari tersampainya informasi serta berhasilnya tujuan intruksional dalam proses pembelajaran (Sukmanasa dkk 2017: 172).

Pertimbangan lain yang diperlukan pendidik saat memilih media pembelajaran adalah kesesuaian media dengan tahapan perkembangan kognitif peserta didik. Merujuk pada teori perkembangan kognitif Jean Piaget, perkembangan kognitif (intelektual) individu berlangsung dalam 4 tahap, yakni (1) tahap sensorimotor, tahap ini berkembang dari mulai 0 - 2 tahun; (2) tahap praoperasional, mulai dari 2 - 7 tahun; (3) tahap operasional kongkrit, tahap ini berkembang dari 7 - 11 tahun; (4) Operasi formal, yakni dimulai dari 11 tahun sampai dewasa (Nursalim 2007 : 26).

Merancang media pembelajaran bagi seorang pendidik ialah salah satu bagian dalam kegiatan perancangan dan pelaksanaan pembelajaran, hal itulah yang disebut kompetensi pedagogik yang dimiliki pendidik. Berdasarkan pasal 28 ayat 3 PP tahun 2005 tentang Standar Nasional Pendidikan dalam Nur (2014: 68) menyatakan bahwa yang dimaksud dengan kompetensi pedagogik adalah kemampuan mengelola pembelajaran peserta didik yang meliputi a. pemahaman terhadap peserta didik; b. perancangan dan pelaksanaan pembelajaran, evaluasi hasil belajar, dan pengembangan peserta didik untuk mengaktualisasikan berbagai potensi yang dimilikinya. Oleh karena itu, setiap pendidik harus senantiasa meningkatkan kompetensi pedagogik ini, salah satunya dengan mengembangkan sebuah media pembelajaran.

#### **D. KESIMPULAN**

Penelitian ini menggunakan model 2-D, yang terdiri dari dua tahapan. Tahap *define* yang terdiri atas kegiatan analisis kurikulum, analisis kebutuhan, dan analisis materi adalah tahap pertama. Tahap *design*, yang terdiri dari mendesain media dan pembuatan media kartu pecahan adalah tahap kedua. Penelitian ini mengumpulkan data melalui angket pendidik. Alat dan bahan yang digunakan untuk pembuatan media ini adalah aplikasi canva dan kertas *luster photo paper*.

Hasil uji kelayakan yang dilakukan oleh validator terhadap desain media pembelajaran kartu pecahan "KACA" yang dikembangkan memperoleh persentase keseluruhan yaitu 95,25% dengan kategori sangat layak. Hal ini menunjukkan bahwa desain media pembelajaran kartu pecahan "KACA" layak digunakan sebagai desain media pembelajaran pada materi pecahan, khususnya pecahan biasa. Hal ini dikarenakan dari aspek media pembelajaran relevan dengan materi yang dipelajari peserta didik, media pembelajaran dapat digunakan untuk pembelajaran individu, kelompok kecil, dan kelompok besar, media pembelajaran menggunakan gambar yang mudah dipahami, media pembelajaran membuat materi mudah diingat, kejelasan petunjuk penggunaan media, kesesuaian warna tampilan dan *background* sudah sangat baik sehingga akan memudahkan pendidik dan peserta didik dalam proses pembelajaran.

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