



Meta-Analysis of the Effect of Learning Fractions Using Assistants Media on Student's Motivation and Concepts Understanding

Nurul Astuty Yensy¹, Saleh Haji^{1(✉)}, Dina Apriyani², and Hidayatulloh³

¹ Universitas Bengkulu, Bengkulu, Indonesia
salehhaji@unib.ac.id

² UIN Fatmawati Sukarno, Bengkulu, Indonesia

³ Universitas Muhammadiyah Pringsewu, Lampung, Indonesia

Abstract. The purpose of this study was to ascertain the impact of teaching fractions to students utilizing assistive media or teaching aids on their motivation and conceptual understanding. The impact is assessed using data from earlier studies. Meta-analysis is the method used in this investigation. A meta-analysis is an examination of numerous research findings on related issues. The written documents regarding fractional learning research employing media in the form of journal articles and research reports were chosen purposefully based on their fit with the research theme as the unit of analysis in this study. The researcher was the primary research instrument, with the documentation guide as support. Quantitative data analysis using percentages is employed, and qualitative data analysis is used for data from the narrative studies of the studies that were used. The findings indicated that employing media or instructional tools to teach fractions could improve students' motivation to learn and conceptual understanding. Learning is more engaging for pupils, and they have more fun while playing media games that require them to solve fractional problems. The concepts of equivalent fractions, addition, and subtraction of fractions are better understood.

Keywords: Concept Understanding · Fraction · Meta-Analysis · Motivation · Props

1 Introduction

Mathematics is studied by students from elementary school to college because it plays a very important role in supporting other subjects. At the elementary school level, mathematics is given a basic concept to make it easier for students to learn at the next level. For example, learning mathematics on the concept of fractions is also given in elementary schools because this material is continuous at the junior high school level, namely algebra [1]. Next [2] argues that according to the cognitive level of elementary school students, namely, they tend to think concretely, it is necessary to directly interact with real objects or everyday life as a medium of learning. For example, in the form of board games, manipulative objects, and so on.

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[3] said that the use of media in learning mathematics will reduce the occurrence of misconceptions such as wrong concept definitions, incorrect classification of examples, and incorrect hierarchical relationships of concepts. Various difficulties for elementary school students in learning fractions include the difficulty of converting common fractions into mixed fractions, percent or decimals, and the difficulty of adding and subtracting two fractions if the denominators are different. Furthermore, [4] said that through media, or teaching aids, we can present material that was abstract to be more concrete because students directly practice or the learning media can be seen, held or changed so that learning is more fun and easier to understand. [5, 6] also added that fractional media using interactive media is very effective and practical to be applied in learning. Through fractions props, students can visualize various fractions, and both with the same or different denominators, both with the same or different numerators, so that they can find patterns of fraction comparison, which are larger, and which are smaller. Thus, teaching fractions material should be realistic.

Teaching fractions involves more than just passing along mathematical principles, techniques, and ideas; it also involves defining fractions as a (gradual) process of emergence, occurrence, and development. Beginning with a connection between a mathematical concept and actuality, or what we may now include in the contextual genesis paradigm, Students develop original mathematical ideas. The beginning point must be a significant scenario, and assignments and difficulties must be realistic in order to encourage students, given the significance of emphasizing conversation and reflection. The school of constructivism recommends the following strategy: mathematics instruction at all levels should give students the chance to gain practical and concrete experiences, investigate and find relationships, find patterns and solve problems, talk about mathematics, write about their activities, formulate results and solutions, and train students in reasoning, knowledge, and procedures [7]. If this instruction is “set” in a way that is enjoyable and promotes student learning, such as by teaching students how to use teaching aids, it will be more effective.

Many previous studies have used teaching aids or assistive media in learning fractions such as paper media or manipulative objects, fractional comics media, fractional blocks, fractional triangle game cards, fractional board media and geometry to software-based media such as *Adobe Flash* and *GeoGebra*. However, from the various articles studied, it is not known how much the contribution of teaching aids or media to the understanding of concepts and student motivation. Most articles only focus on increasing student activity and learning outcomes or only look at the validity and effectiveness of the media used. Some of the fractional media used are also not able to improve understanding of concepts and students’ learning motivation.

The concepts are mental abstractions that represent a class of stimuli. Concepts organize important ideas from general ideas. Concepts can help someone in explaining, analyzing, and connecting a material being studied, so that understanding the concept of a material can make it easier for students to understand the next material [8]. Students who are at the level of instrumental understanding, cannot adjust their mental structure to solve new or non-routine problems. Whereas students who have a relational understanding can build conceptual networks that are many interrelated, enabling them to apply general mathematical concepts [9]. However, in reality, there are still many students

who have difficulty understanding the concept of fractional material as stated [10] and [11] those elementary students have difficulty understanding the concept of equivalent fraction comparison and fractional operations and the use of teaching aids or media can improve students' understanding of concepts because students are more motivated and enthusiastic about learning. Thus, understanding the concept is important in studying because it is also related to students' motivation when learning fractions. Therefore, in this paper, we will examine in more depth the effect of teaching aids-assisted fraction learning on students' motivation and conceptual understanding based on studies from various research articles and other literature.

2 Methods

In this study, a meta-analytical design, or analysis of the analysis, was adopted. A meta-analysis was a review of many research findings on related issues. The Human Instrument was employed in this investigation as the instrument. A straightforward research instrument will be created after the study's objectives are clear, and it will be used to compile the data and contrast it with earlier findings. Using documentation procedures, data collection methods. All written materials pertaining to research on teaching aids-assisted fraction learning made up the study's population. The written materials included books, journal papers, and research summaries. Purposive sampling was used to collect the research sample. This is due to the fact that the data or information to be gleaned from the sample is chosen depending on how well it fits the study's overall theme. For the data from the narrative study of the studies encountered, which are related to conceptual understanding and student motivation in learning fractions with the help of visual aids, quantitative data analysis using percentages and qualitative data analysis were utilized.

3 Results and Discussion

The studies on learning fractions assisted by teaching aids were 19 research articles, namely 15 international journals, and 4 national journals. Here are the results of the meta-analysis of the research:

3.1 Meta-Analysis Based on Research Objectives

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data about the research objectives were obtained as follows:

Based on Table 1, it can be seen that the purpose of the fraction learning research based on the articles reviewed at least is to describe as much as 21.05%.

3.2 Meta-Analysis Based on Research Design

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data on the research design were obtained as follows:

Based on Table 2, it can be seen that the fractional learning research design based on the articles reviewed at least a survey of 21.05%.

Table 1. Research Objectives Learning Fractions

Research purposes	Frequency	Percentage (%)
Testing impact (influence)	5	26.32
Improve learning outcomes	5	26.32
Describe	4	21.05
Developing Fractional Media	5	26.32
Amount	19	100

Table 2. Fractional Learning Research Design

Research design	Frequency	Percentage (%)
Experiment	5	26.32
Research & Development	5	26.32
Survey	4	21.05
Classroom Action Research (CAR)	5	26.32
Amount	19	100

Table 3. Research Sample of Fractional Learning

Research Sample	Frequency	Percentage (%)
Elementary school students/equivalent	17	89.47
Middle school students/equivalent	2	10.53
Amount	19	100

3.3 Meta-Analysis Based on Research Sample

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data on the research sample was obtained as follows:

Table 3 shows that the fractional learning research sample was dominated by elementary school students as much as 89.47%. This is because fractions are learned more in elementary school.

3.4 Meta-Analysis Based on Data Collection Techniques

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data on research data collection techniques were obtained as follows:

Table 4. Fractional Learning Research Data Collection Techniques

Data Collection Technique	Frequency	Percentage (%)
Test	6	31.58
Observation	5	26.32
Questionnaire	6	31.58
Interview	2	10.53
Amount	19	100

Table 5. Learning Model of Fractions

Learning model	Frequency	Percentage (%)
Realistic Mathematics Education	1	5.26
Problem Based Learning	2	10.53
Adventure Based Learning	1	5.26
Demonstration	2	10.53
Cooperative Learning	5	26, 32
Inquiry	1	5.26
Live Learning	7	36.84
Amount	19	100

Table 4 showed that the least fractional learning research data collection technique the interview, which is 10.53%. While most are using tests and questionnaires as much as 31.58%.

3.5 Meta-Analysis Based on Learning Model

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data were obtained about the learning model used:

Based on Table 5, it can be seen that the majority of the fractional learning model used was direct learning, which is 36.84%. While the least are the inquiry model, Realistic Mathematical Education, and the Adventure Based Learning model as much as 5.26%.

3.6 Meta-Analysis by Type of Props

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data were obtained about the types of media or fractional learning teaching aids used:

Table 6 showed that most fractional learning media used is game card media by 36.84%. Media card games such as dominoes, Media Fraction Cipher, Minecraft, Triangle Game Cards, and others.

Table 6. Fractions Learning Media

Learning Media	Frequency	Percentage (%)
Fractional Comic Media	1	5.26
Media Board/ Block Shards	3	15.79
Manipulative Media	2	10.53
Media Concrete Objects	2	10.53
Game Card Media	7	36.84
Interactive Media	3	15.79
Bamboo Media	1	5.26
Amount	19	100

3.7 Meta-Analysis Based on Data Analysis

Based on a study of 19 studies on fractional learning assisted by media or teaching aids, data on the analysis of research data used:

Based on Table 7, it can be seen that most fractional learning data analysis uses quantitative descriptive as much as 47.37%. The quantitative descriptive referred to here is in the form of a percentage, without any further inferential testing.

Various media used in learning fractions in general can improve student learning outcomes, especially on equivalent fractions, and fractional operations. One of the media that is often used was manipulative media, namely in the form of manila paper that can be folded and cut, can be pasted and drawn, students can practice on their own using manipulative media, find their fraction concept. However, this media is not yet interactive, so students' motivation is not optimal. Interactive media such as Geogebra can foster student learning motivation because students practice directly so that they can change the denominator and numerator, get patterns or find their concepts related to fraction material. The results showed that students were enthusiastic about learning fractions by using the media of fraction cards. In addition, the use of fractional cards also has an

Table 7. Analysis of Fractional Learning Data

Learning Media	Frequency	Percentage (%)
ANOVA	1	5.26
Independent sample T-test	4	21.05
Paired sample T-test	1	5.26
N-Gain test	1	5.26
Quantitative descriptive	9	47.37
Qualitative Descriptive	3	15.79
Amount	19	100

impact on satisfactory learning outcomes and scores above the minimum completeness criteria.

The lack of media used was mostly unable to measure students' motivation and conceptual understanding, because the media is not yet very concrete, but in flash-based and interactive media, students' conceptual understanding and student motivation are higher than in non-interactive media. Although interactive media has advantages, the disadvantage was that it cannot be applied to all fractional materials.

The media of fractional cards in the form of game cards was generally the most preferred by students, such as dominoes. They were more motivated because they play while learning fractions. This is following what was stated by [12] that learning media in the form of game cards such as Fraction Triangle Cards are effective and suitable for use in learning multiplication of fractions in fifth-grade elementary school. Students were more enthusiastic and better understand fractions material and more focused on learning. Finally, the understanding of students' learning concepts was also increased, as seen from the results of the post-test. Furthermore, [13] also said that teaching aids in the form of game media, especially digital games, greatly influenced students' understanding of concepts in learning fractions. The average value of students who used fractional game media was higher than students who didn't use game media.

Furthermore, [14] also added that students' difficulties in understanding fractional number material were also caused by teachers who did not use concrete learning media so students were more easily bored and less enthusiastic in participating in the learning process. Through fractional block media, students' conceptual understanding ability increased. [15] said that the use of learning media in the teaching and learning process can generate new desires and interests for students, generate motivation to learn, and bring psychological influence to students. In addition, the use of media can also improve students' understanding of lessons, such as domino card media for example. This card was in the form of a domino game for the material of equivalent fractions. The domino game was almost the same as the bridge card game, but the domino card only has 28 cards. The shape was a rectangle that is divided into two halves, namely, the bottom, and the top and contains 1–6 red circles in each hemisphere, but the number between the top of the card and the bottom of the card was different. Through this card media, students become more understanding of the material of equivalent fractions.

[16] express the ability to understand students' concepts, one of which is seen in problem-solving abilities. To help students develop their capacity in solving mathematical problems, in addition to using appropriate learning models, such as the Problem Based Learning model, it must also be supported by learning media to facilitate understanding of the material for students, and attract students' interest and interest in solving problems. For example, using Grocery Shopping media based on interactive media can help students succeed in delivering and understanding fractions by introducing and operating various forms of fractions that can be encountered in everyday life problems. In the Grocery Shopping media, there were shopping materials and games, so students were more enthusiastic about learning fractions. As a result, students' understanding of concepts increased.

This is also supported by research results [17–19] that is, using fractions teaching aids or fractional learning media can improve students' understanding of concepts, especially

multiplication of fractions and the concept of equivalent fractions. [20] and [21] also agrees that the material for fractions is quite difficult material to teach to elementary school students because students must master the whole number material first before learning fractions. So it is necessary to consider the learning media used so that students can understand the concept of fractions well.

Based on the description above, it can be said that learning fractions assisted by teaching aids were very influential on students' motivation and understanding of concepts. The dominant influence was using props or media in the form of games and interactive media. The understanding of the concept of equivalent fractions, addition and subtraction of fractions was increased by using these props.

4 Conclusion

The results showed that learning fractions using media or teaching aids could increase students' learning motivation and understanding of concepts. Students were more enthusiastic and learning became more fun, especially when using media games that challenge students to solve fraction problems. The understanding of the concept of equivalent fractions, addition and subtraction of fractions was increased.

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