
LEARNING PROCESS OF FRACTION OPERATIONS IN STUDENTS WITH INTELLECTUAL DISABILITIES

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Abstract

This study examines the learning process of fractional number operations in students with intellectual disabilities. Using a qualitative descriptive method, the study focuses on students and teachers in grade IX. Data collection is conducted through observation, interviews, and documentation techniques. The research instruments include observation guidelines and interview protocols.

The results of the study indicate that: (1) students experience difficulties in understanding the concept of fractions, particularly in adding fractions using the concept of regrouping and in subtracting fractions by borrowing; (2) the learning process of fractional number operations for students with intellectual disabilities reveals that teachers have not prepared Individual Learning Programs (ILPs) to guide individual learning during the teaching preparation stage; (3) during the implementation of lessons, teachers have not fully utilized available learning media, and the methods employed tend to be monotonous; and (4) although evaluations are aligned with the lesson plan, the time allocated for conducting evaluations needs to be maximized. A suitable variety of learning methods and media can assist students with intellectual disabilities in understanding the material.

Keywords: *learning, Fraction Operations, intellectual disabilities*

Abstrak

Penelitian ini mengkaji proses pembelajaran operasi bilangan pecahan pada siswa dengan hambatan intelektual. Menggunakan metode deskriptif kualitatif, studi ini berfokus pada siswa dan guru di kelas IX. Pengumpulan data dilakukan melalui teknik observasi, wawancara, dan dokumentasi. Instrumen penelitian mencakup pedoman observasi dan pedoman wawancara. Hasil penelitian menunjukkan bahwa: (1) siswa mengalami kesulitan dalam memahami konsep pecahan, terutama dalam menjumlahkan pecahan dengan menggunakan konsep pengelompokan dan dalam mengurangi pecahan dengan cara meminjam; (2) proses pembelajaran operasi bilangan pecahan untuk siswa dengan disabilitas intelektual mengungkapkan bahwa guru belum menyiapkan Program Pembelajaran Individual (PPI) untuk membimbing pembelajaran individu selama tahap persiapan

pengajaran; (3) selama pelaksanaan pembelajaran, guru juga belum memanfaatkan media pembelajaran yang tersedia secara maksimal, dan metode yang digunakan cenderung monoton; dan (4) meskipun evaluasi sudah disesuaikan dengan rencana pelajaran, waktu yang dialokasikan untuk melaksanakan evaluasi perlu dimaksimalkan. Variasi metode dan media pembelajaran yang sesuai dapat membantu siswa dengan hambatan intelektual dalam memahami materi.

Kata kunci : *pembelajaran, operasi pecahan, hambatan intelektual*

1. INTRODUCTION

Mathematics is fundamental to human life, playing a significant role in developing cognitive abilities across various disciplines [1], [2]. Equipping individuals with mathematical skills from an early age is essential for future success. Mathematics fosters logical, systematic, meticulous, objective, and open thinking [3], [4]. Through mathematics education, students develop critical thinking, numeracy, and the ability to apply mathematical concepts both within the subject and to other fields [5], [6].

The extant literature has consistently documented the challenges encountered by students, including those with intellectual disabilities, in mastering foundational mathematical concepts, particularly in the domain of fractions [7]-[10]. Researchers have emphasized that fractions should not be viewed merely as part-whole relationships, but rather as complex measurement concepts that require a more nuanced understanding [11], [12].

Mathematics instruction is provided to students with intellectual disabilities within special education settings. However, the findings of the present study align with the existing research that has highlighted the difficulties encountered by students with intellectual disabilities in grasping the essential concepts of fractions and their associated operations [13], [14]. The acquisition and retention of abstract symbols is particularly challenging for learners with intellectual disabilities. Recognizing these challenges, researchers have advocated for the implementation of multisensory learning approaches that engage multiple sensory modalities, including visual, auditory, and kinesthetic, to facilitate the understanding

of mathematical concepts, particularly fractions, among students with intellectual disabilities [15]-[17].

A fraction is a number that takes the form $\frac{a}{b}$, where a and b are integers with the condition that b is not equal to 0 ($b \neq 0$). The numerator is represented by a , and the denominator is represented by b [18]. Fractional numbers are divided into three fundamental concepts [19]. Fractions can be understood with the meaning of a part of the whole, in the form $\frac{a}{b}$, where b is in the lower position and represents the number of equal parts of a whole, and a , which is located above, indicates the number of parts being considered. The second meaning can be understood as the concept of a ratio, where fractions can be used to compare quantities, for example, Andi's age is $\frac{1}{2}$ of his brother's age, and if the brother is 20 years old, then Andi is 10 years old. The third meaning can be understood as the concept of division, for example, a child has 10 friends, and on one occasion, they have 5 pieces of bread. How can the child distribute the bread evenly to their friends? The child can divide the 5 pieces of bread among the 10 friends, which is equivalent to $(5 \div 10) = \frac{1}{2}$, meaning that each of the child's friends receives $\frac{1}{2}$ a piece of bread [20].

Research related to the understanding of fractions has been extensive. For instance, Kurniawan et al. [21] and Lobato & Ellis [22] investigated the understanding of fractions among elementary school students using limited interventions. Lobato & Ellis [22] noted that understanding fractions can be facilitated through the use of concrete objects, and that fractions serve as the foundation for learning ratios and comparisons.

Similarly, mathematical concepts are most effectively taught to students with intellectual disabilities through a gradual, consistent approach using appropriate teaching methods [23]. Tailoring mathematics education to their needs can improve adaptive behavior skills in students with intellectual disabilities by enhancing their problem-solving abilities and conceptual understanding [15].

Students with intellectual disabilities (ID) face unique challenges in educational settings. Intellectual disability is characterized by significant limitations in intellectual functioning (e.g., reasoning, problem-solving) and adaptive behavior (e.g., social, practical skills), which manifest during the developmental period[24]. These students often require tailored instructional strategies and support to access the curriculum and achieve academic success. This article explores the characteristics of intellectual disabilities, challenges in education, and evidence-based strategies to support these learners.

Characteristics of Intellectual Disabilities

Intellectual disabilities are marked by:

1. **Cognitive delays:** Difficulties with memory, attention, and abstract thinking [25].
2. **Adaptive behavior limitations:** Challenges in communication, self-care, and social interactions [26].
3. **Developmental onset:** Symptoms must appear before age 22[27].

Students with intellectual disabilities (ID) exhibit characteristics that vary in severity, ranging from mild to profound, which significantly impact how they engage with learning materials. In educational settings, these students face several challenges, including access to the curriculum, where traditional teaching methods often fail to align with their learning pace. For instance, abstract concepts like fractions may require concrete, hands-on instructional strategies to enhance comprehension[28].

This challenge is particularly critical because difficulties in grasping foundational concepts such as fractions can hinder the mastery of more advanced mathematical topics. If fractions are not well understood, misunderstandings may impede the learning of subsequent mathematical principles, as fractions serve as a cornerstone for complex ideas like algebra and proportional reasoning[29][30]. Additionally, social inclusion poses difficulties, as students with ID may struggle with peer interactions,

leading to social isolation and reduced participation in collaborative activities[32].

Lastly, assessment barriers arise because standardized tests frequently lack accommodations tailored to their learning needs, resulting in evaluations that inaccurately reflect their capabilities [33]. Addressing these challenges—ranging from curriculum adaptation to inclusive assessments—is critical to fostering equitable and effective educational experiences for students with ID.

This study was motivated by the need to explore the *Learning Process of Fractional Number Operations in Students with Intellectual Disabilities*. The research aims to: (1) **Identify** students' conceptual understanding of addition and subtraction operations, (2) **Examine** how teachers design and implement lesson plans for teaching these operations, and (3) **Analyze** evaluations provided to students to determine the causes of errors in understanding fraction operations among students with intellectual disabilities."

2. RESEARCH METHODS

This study is a qualitative descriptive research [34]. The researcher is the key instrument. The purpose of this study is to describe, depict, explain, answer, and explain in more detail the problems that will be the focus of the research. This research took place in one of the Special Schools in Bandar Lampung on the material of fractional number operations. The research was conducted for three months. The research was carried out in two stages, the first stage was the observation stage about the teaching and learning process in the classroom and the second stage was the interview stage with the classroom teacher. The subjects of this research were students and teachers in one of the Special Schools in Bandar Lampung.

The data collection techniques in the research were carried out through interviews, observations, and documentation. Observations were made using non-participant observation, because the researcher did not

directly participate in the student activities in the implementation of learning and independent guidance for students with intellectual disabilities who were used as research data sources. Meanwhile, the interviews conducted were structured interviews, where the interviewer made an interview guide in advance to facilitate the interview process. Furthermore, the researcher used the documentation method to complement the previous techniques. The documentation used is in the form of videos, photos during the learning process, and other sources needed to strengthen the results of the interviews and observations that have been carried out. The research flow can be seen in figure 1

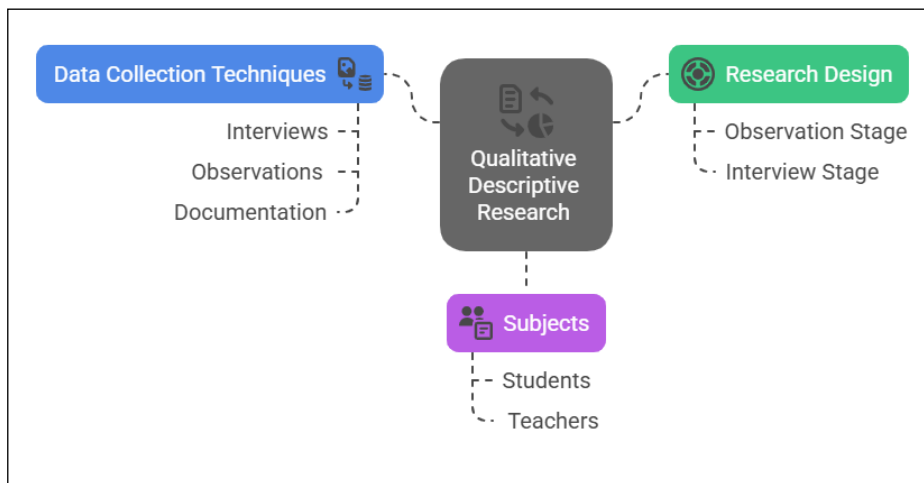


Figure 1. Research Flow

3. RESULTS AND DISCUSSION

The mathematics learning process at one of the special education schools (SLB) in Bandar Lampung consists of three stages, including:

1. Early Learning Activities

Early learning activities are designed to create an effective foundation for learning, enabling students to engage with lessons successfully. As a part of establishing basic initial knowledge, teachers should identify and assess the individual differences among students, which will inform learning management strategies, including planning, organizing, implementing, and supervising [35]. The duration of these initial learning

activities is relatively short, so teachers are expected to create a positive environment that supports student learning outcomes. The steps for learning are outlined in the lesson plan. One of the initial activities involves the teacher setting the classroom atmosphere by starting with a prayer and a song. A lesson plan (RPP) is a document that describes the organization of learning and the procedures to be followed. It should include at least the materials, methods, sources, assessment of learning outcomes, and learning objectives. However, in practice, the lesson plans created by teachers are sometimes not aligned with their implementation in the classroom due to the varying abilities of students. This discrepancy can limit students' understanding of the material being taught, resulting in suboptimal learning experiences. The lesson plan also specifies the learning objectives.

The Individual Learning Program (PPI) is important because the characteristics and abilities of students within a single class can vary significantly. The Individual Learning Program is a valuable tool for promoting personalized learning and supporting the diverse needs of students [36]. By carefully assessing student needs, setting personalized goals, and implementing effective instructional strategies, teachers can use PPI to help all students achieve their full potential. As one teacher at SLB Bandar Lampung stated, "So far, we only have the RPP and syllabus; PPI is primarily for therapy. For SLB, we only use the RPP. Thank God, he can follow the book". However, preparing the PPI is very beneficial for teachers, as it helps them provide instruction that allows students to absorb learning according to their individual abilities.

2. Core learning activities

The core process of the learning activity describes the media, approaches, The core process of the learning activity involves the strategies, methods, and approaches utilized by the teacher. In the core learning activities, the teacher follows a systematic process. First, the teacher provides an overview of the material to be learned and the objectives of the learning. Then, the teacher communicates the alternative activities that the students will engage in. Next, the teacher delivers the

learning material, which in this case focuses on fractional operations. Two key misconceptions experienced by the students are the concepts of addition and subtraction of fractions.

Students with intellectual disabilities often exhibit difficulties in fraction addition, leading to misconceptions about the underlying concepts. The errors observed in their work on fraction addition problems are indicative of these challenges, as illustrated in Figure 2.

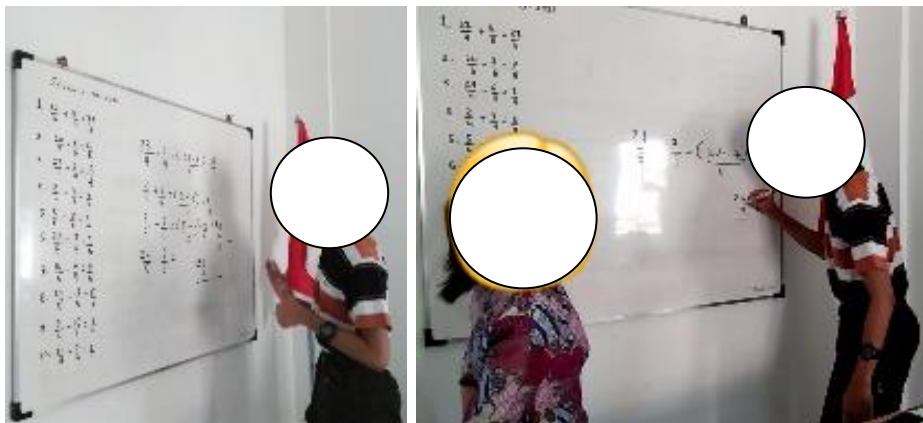


Figure 2. Problem Work by Students on the Whiteboard

In the picture, the teacher gives a problem of adding two numbers, but the student's response does not exceed 10 due to a lack of understanding of the concept of place value. Similarly, when working on fraction subtraction problems, students often forget crucial steps, particularly when dealing with tens. For example, in the problem $\frac{22}{5} - \frac{7}{5}$, the correct answer should be 3, but the student answers 5, forgetting to subtract the value of the tens. Although the student knows the principle of borrowing, they sometimes forget to adjust the tens accordingly. Additionally, they may neglect to write

down the denominator. Despite these challenges, the student has a grasp of the overall concept of reduction and borrowing. However, teachers must frequently remind them to attend to the tens place and to include the denominator. Adapting the teaching methods to the students' specific needs and abilities is crucial for their learning progress.

3. Closing Activities

The closing activities play a vital role in the learning process. They offer a chance to review and summarize the lesson, consolidate key information, and allow students to voice any concerns, ask questions, and clarify their understanding [37]. During this closing activity, the teacher is expected to provide a conclusion based on the material taught and assign questions for students to complete, both as homework and in-class work. However, the observation revealed that the teacher often failed to conclude the lesson based on the learning outcomes achieved. While the lesson plan outlines the final steps, including the teacher summarizing the material, this crucial step is sometimes overlooked due to time constraints, preventing the teacher from conducting a thorough evaluation at the end of the class.

Evaluation is the final step in the learning process, crucial for determining the extent to which learning objectives have been achieved[38]. Through this evaluation, teachers can measure students' progress and inform plans for future learning improvement. Evaluation is based on indicators of learning success. By having students write their answers on the board, teachers can assess their understanding of the taught material and ability to absorb the content. A common form of evaluation used by teachers is providing descriptive questions, as illustrated in Figure 3:



Figure 3. Assignment by Teachers

The learning process encompasses objectives, materials, methods, sources, and assessments of learning outcomes. Teachers have implemented methods in accordance with the lesson plan, although some methods have

not been utilized. The learning objectives align with the prepared lesson plan, and the materials and resources provided correspond to the thematic book. However, the learning media, particularly the teaching aids used by teachers, remain quite simple, and teachers have not incorporated objects from around the classroom to convey fractional concepts.

The appropriate use of props can significantly aid students in understanding concepts correctly, while improper use can lead to misconceptions. Learning media is a crucial element in the teaching and learning process[39]. Engaging learning media can enhance students' motivation to learn[39].

Additionally, teachers need to provide positive motivation to students with disabilities and create a supportive learning environment. Motivation and engagement in mathematics are vital for academic success, yet they can be compromised in students with disabilities who have experienced frustration and failure[40]. When the learning media used is both interesting and effective, students can grasp concepts more easily, leading to better retention of the subject matter[41]. Therefore, the selection of learning media must be tailored to the material being taught to facilitate students' understanding and improve learning outcomes [39].

Mastery of mathematics through learning should be structured with instruments that are adjusted to the students' abilities, taking into account their characteristics and strengths, so that teachers can effectively maximize and adapt to their students' needs [42][43].

4. CONCLUSIONS AND RECOMMENDATION

The results of the study indicate that: (1) students experience difficulties in understanding the concept of fractions, particularly in adding fractions where they struggle with the concept of regrouping, and they have a weak understanding of subtraction involving borrowing; (2) the learning process of fractional number operations for students with intellectual disabilities reveals that teachers have not prepared Individual Learning Programs (PPI) to guide individual learning during the teaching

preparation stage; (3) during the implementation of learning, teachers have not fully utilized the available learning media, and the methods employed tend to be monotonous; and (4) although the evaluation aligns with the lesson plan, the time allocated for conducting the evaluation needs to be maximized.

Based on the conclusions drawn from the results and discussion, the researcher offers the following suggestions:

1. The use of diverse methods and appropriate learning media can assist students with intellectual disabilities in learning fractional number operations.
2. The difficulties in understanding concepts that students face are exacerbated by the absence of Individual Learning Programs (PPI), which means teachers rely solely on the lesson plan to deliver material without adapting it to the individual abilities of students. The diverse abilities of students with disabilities make teaching challenging, and the creation of Individual Learning Programs (PPI) can serve as a guide to tailor learning to meet the individual needs of students.
3. The use of suitable teaching aids can facilitate students' understanding of concepts correctly; conversely, when inappropriate teaching aids are used, they can lead to misconceptions among students.

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