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Barrier Factors and Alternative Solutions in Understanding Vertical Addition–Subtraction Concept for Second-Grade Students of MI Ihyaul Islam I

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Abstract

This study aims to examine in depth the factors that cause students' difficulties in understanding mathematical concepts for grade II students at MI Ihyaul Islam I, especially in the material of addition and subtraction, and to compile alternative solutions that are relevant and applicable. The main issues identified included limited understanding of place value, inaccuracies in aligning numbers vertically, the confusing use of term 'borrowing', and students passive responses when encountering difficulties. This study adopted a qualitative descriptive approach with data collection techniques in the form of direct observation, in-depth interviews, and documentation. The findings of this study revealed that students' difficulties in the learning process are influenced by internal factors, such as lack of mastery at basic concepts and low self-confidence, as well as external factors that include a less varied teaching approach and limited use of learning media by teachers. To overcome these obstacles, this study recommends several strategic steps, including the use of concrete aids (manipulatives) to strengthen understanding of place value, the use of more appropriate terms to replace the concept of "borrowing", and the application of interactive and digital technology-based learning, such as Canva. The results of this study are expected to be a practical reference for educators in developing more effective learning methods and encouraging increased understanding of basic mathematical concepts in elementary school students.

Keywords: : *Student Difficulties; Mathematics; Solutions; Elementary School.*

INTRODUCTION

Mathematics is a field of study that cannot be separated from human life and has a highly vital role in fulfilling daily needs. As a fundamental science in the world of education, mathematics holds a strategic position because it can develop structured, analytical, and logical thinking skills, as well as encourage communication skills, critical thinking, creativity, and the ability to argue in the learning process (Nuril Ainularifin &

Mahmudah, 2023). Due to its high urgency, mathematics is taught at almost all levels of education, ranging from elementary school to higher education. The mathematics learning process focuses on conceptual understanding, which becomes the main foundation for mastering the material and greatly helps students in solving problems with greater confidence. If students have strong and in-depth conceptual mastery, they will find it easier to understand other mathematical materials that are interconnected. According to the views of Raharjo, Rasiman, and Untari, learning difficulties can be interpreted as obstacles that hinder the achievement of certain goals in the learning process, so appropriate solutions are needed to overcome them (Tauqifa et al., 2023). Although mathematics has a very important role in human life, in reality many students consider this subject to be difficult. Difficulties in understanding mathematics in educational settings are generally caused by two types of factors, namely internal and external factors. Internal factors include aspects originating from within the students themselves, such as: (1) difficulties in understanding abstract mathematical concepts, (2) low motivation and lack of interest in learning, which cause students to easily feel bored and lose enthusiasm in the learning process, and (3) sensory barriers, in which students who have impairments in vision or hearing tend to experience obstacles in receiving the material. Meanwhile, external factors include conditions outside the students, such as: (1) learning strategies used by teachers that lack variety and do not meet students' needs, (2) limited use of learning media that can help explain abstract concepts more concretely, and (3) a learning environment that is less supportive and weak family involvement in the educational process (Asriyanti & Purwati, 2020).

Based on the results of observations in the second-grade classroom at MI Ihyaul Islam I, it was found that most students placed digits unevenly in vertical operations. This has been confirmed through interviews with the classroom teacher, who stated that such errors often occur, especially among students who have not yet understood place value. This finding is in line with the results of the study by Ulfah et al. (2024), which showed that most elementary school students experience difficulties in placing digits according to place value, particularly in addition and subtraction operations. One of the main challenges faced is students' inaccuracy in arranging numbers based on place value, namely units, tens, and hundreds. Ideally, each number should be aligned according to its position; however, in practice, many students place numbers randomly without paying attention to the proper alignment. As a result, calculations become incorrect and the answers produced are wrong. In addition, it was also found that several students exhibited passive attitudes when facing difficulties, both in



understanding the teacher's explanations and in completing practice problems. Therefore, teachers are required to take a more intensive and personal approach toward students who experience learning obstacles.

Students' misconceptions regarding the term "borrow-carry" used in vertical subtraction can hinder their understanding of the basic concepts of vertical addition and subtraction operations. Many students interpret the term "borrow" literally as the process of taking and returning, rather than as a regrouping procedure within the place value system. This finding aligns with the study by Ulfah et al. (2024), which explained that errors in understanding the regrouping process are one of the indicators of low mastery of place value concepts among elementary school students.

Referring to previous research, in Syarifah's work discussing learning obstacles in addition and subtraction of whole numbers explained that through the Didactical Design Research approach, three main categories of obstacles were identified, namely: (1) Ontogenic obstacles, which relate to students' lack of confidence and mental readiness in facing the learning process; (2) Epistemological obstacles, which arise due to students' limited experience in understanding various forms of mathematical operational situations; and (3) Didactical obstacles, which are challenges originating from the teacher's inaccuracy in delivering the material or concepts being taught (Syarifah & Prabawanto, 2023). Meanwhile, in the study conducted by Syakur regarding students' learning obstacles in mathematics at the second-grade level of elementary school, carried out through a case study approach on a student with the initials AS, revealed that difficulties in completing long-form vertical addition and subtraction operations were influenced by several factors. These include weak memory retention, the student's low interest in mathematics, and the lack of support provided by the family environment in facilitating the student's learning process at home (Syakur et al., 2021). Furthermore, in the study conducted by Wahyuni on students' learning obstacles in understanding vertical addition and subtraction, the research was carried out at SDN Gajahmungkur 04 Semarang using a qualitative descriptive approach and involved 16 second-grade students as subjects. The findings revealed that students faced various obstacles, such as confusion when performing operations involving the number zero, difficulties in understanding and remembering the procedures of "carry" and "borrow," inability to convert word problems into mathematical form, lack of accuracy in reading questions, and weak mastery of basic addition and subtraction techniques (Wahyuni & Suyoto, 2024). Meanwhile, this paper adds the factor of misconceptions arising from the use of terminology, expands by investigating the roles and strategies used by teachers,



and aligns them with practical approaches in the field.

This study aims to systematically identify the factors causing learning difficulties experienced by students, while also formulating relevant alternative solutions that can be applied within the context of mathematics learning, particularly in vertical addition and subtraction material for second-grade students at MI Ihyaul Islam I. The benefits of this research are expected to provide tangible contributions in helping teachers design more optimal learning strategies, as well as supporting students in overcoming learning obstacles, and improving their understanding of vertical addition and subtraction concepts.

METHODS

Based on the problem formulation presented, the method used in this study was the descriptive research method. Descriptive research is a type of study that seeks to depict an event as it actually occurs and in accordance with reality. The approach used in this study was a qualitative approach. The qualitative approach is a method employed by researchers to obtain results, either in oral or written form, from the sources. The subjects of the study consisted of the second-grade teacher of MI Ihyaul Islam I as the primary informant, and the second-grade students as supporting subjects who were observed through their work results and learning behaviors during the mathematics learning process. The teacher provided information regarding the types of difficulties experienced by the students, while the data from the students were used to identify errors in vertical addition and subtraction operations. The data collection techniques used were observation, interviews, and documentation. Interviews were conducted with the second-grade teacher of MI Ihyaul Islam I to explore information regarding the difficulties frequently experienced by students when learning vertical addition and subtraction material, as well as to understand the efforts made by the teacher to overcome them. Furthermore, the researcher used documentation to identify the names of students involved in the study, such as through their work results. The data obtained were then analyzed through three stages, namely data reduction, data display, and conclusion drawing. The research data were also supported by previous studies through a literature review to further strengthen the research findings.



RESULTS AND DISCUSSION

1. Learning Difficulties in Mathematics

Broadly speaking, learning obstacles experienced by students can be categorized into two main groups: those originating from internal factors within the students themselves and those arising from external factors (Alisnaini et al., 2023). In the context of mathematics, learning difficulties can be defined as a condition in which an individual experiences obstacles in acquiring changes in knowledge, understanding, attitudes, behaviors, habits, or other aspects as a result of interaction with the environment. This includes logical processing of forms, structures, quantities, as well as interrelated concepts, covering three main branches, namely algebra, analysis, and geometry (Gaol, 2022). These learning difficulties can be distinguished into two types: first, difficulties originating from cognitive limitations within the child; and second, obstacles triggered by external influences or other problems that do not originate from within the student. According to Carnine, Jitendra, and Silbert, as cited by Van Steenbrugge, individuals who experience learning difficulties do not necessarily have limitations in intellectual capacity, but it can also be caused by the lack of effectiveness in the design or approach of the learning methods used. Based on these opinions, it can be concluded that students' difficulties in understanding mathematics material are generally influenced by disturbances or obstacles in the learning process, which prevent students from achieving optimal learning outcomes (Heryanto et al., 2022).

Based on observations of 25 second-grade students, it was found that 15 of them made errors in arranging digits in the units, tens, and hundreds columns when performing vertical addition and subtraction operations. For example, in the problem "125 + 347," several students placed the digit 5 in the tens column, while in the problem "432 - 158," some students made errors in the 'borrow' stage, such as incorrectly reducing the tens value due to not properly understanding the regrouping concept. Several forms of difficulties identified included: (1) inability to solve vertical subtraction problems, (2) teaching approaches by the teacher with minimal use of instructional media, (3) incomplete understanding of the place value concept, and (4) students' responses that do not support the learning process.

The factors influencing these difficulties were categorized into two, namely internal factors and external factors. Internal factors originate from within the students themselves, encompassing aspects of knowledge, attitudes, and skills. Meanwhile, external factors come from outside the students, such as an unsupportive school



environment. Based on the researcher's observations during the learning activities, it was seen that several students still had difficulty placing the units, tens, and hundreds digits in alignment when performing vertical addition and subtraction operations. The learning of vertical addition and subtraction material in this school still took place monotonously, where the teacher tended to use the lecture method and the "carry-borrow" technique without being accompanied by engaging or contextual learning media. This aligns with the findings of studies conducted by Syakur et al. (2021) and Wahyuni (2024), although this study presented a more systematic mapping of the various causal factors. In addition, the findings also indicated that the quality of interaction between teachers and students plays an important role in enhancing the effectiveness of the learning process. This interaction creates a collaborative space that allows knowledge transfer to occur actively between educators and students. Based on the researcher's observations during the learning activities, many students still misunderstood the concepts of these operations, The concept of "carry-borrow" in subtraction was still widely misunderstood by students as a literal process (borrowing and then returning), rather than as part of a logical and structured mathematical procedure, causing confusion in understanding the operation.

2. The Concept of Carry-Borrow in Mathematics Learning

Based on the interviews conducted, it was found that two second-grade elementary school students, with the initials U and F, experienced difficulties in understanding mathematics material, particularly on the topic of vertical addition and subtraction operations. The selection of these two students was carried out using the purposive sampling technique, which is the deliberate selection of subjects based on characteristics showing the most dominant and consistent difficulties in vertical addition and subtraction operations, thus considered to represent the common error patterns found in the class. Both respondents revealed that they had not fully understood the concepts of the material, thus experiencing difficulties in completing related problems. The findings of this study indicated that students' difficulties in solving long-form vertical addition and subtraction problems were caused by several factors, including: errors in recalling basic facts, random errors, limited mastery of fundamental operational concepts, lack of understanding of the "carry-borrow" technique, and incorrect preconceptions in problem-solving. The use of the term "borrow" in the context of subtraction also led to misunderstandings in meaning, which ultimately affected students' ability to understand the procedure mathematically. This finding aligns with the results of a study by Amaliyah, which showed that this



misconception not only impacts the correctness of final answers but also weakens students' overall number sense (Amaliyah et al., 2021).

3. Place Value in Mathematics Learning

From the observations conducted on second-grade students at MI Ihyaul Islam I, it was found that several students still experienced difficulties in completing addition operations such as $125 + 347$. They became confused when the sum in the units column exceeded 9, and often mixed-up hundreds, tens, and units, indicating misunderstandings of the place value concept. In subtraction problems such as $432 - 158$, students experienced misconceptions with the term "borrow," resulting in errors in the answers. These findings indicated that students tend to memorize procedural steps without understanding the meaning of place value conceptually. The lack of understanding of the place value concept directly impacts students' number sense skills. This aligns with Suryadi's view, which stated that number sense is closely related to sensitivity to numerical value, including understanding of place value (Suryadi et al., 2024). Children who do not understand place value generally perform algorithmic procedures mechanically. As a result, when faced with variations in problem forms that do not match the patterns they have memorized, they become confused. When steps are memorized without knowing the reasoning behind them, the ability to solve problems flexibly or think creatively becomes very limited. This condition becomes an obstacle in developing numeracy skills as well as deep logical and mathematical thinking.

4. Proposed Solutions

Alternative strategies to address problems in mathematics learning on addition and subtraction material for second-grade students at MI Ihyaul Islam I can be formulated by (a) involve the use of concrete media such as counting sticks, base-ten blocks, or colored buttons as visual and manipulative aids; (b) explain the meaning of place value visually, for example, the number 125 is explained as 1 hundred, 2 tens, and 5 units, so that students can distinguish the function of each digit; (c) avoid using the term "borrow," which can lead to misconceptions, and replace it with terms such as "distribute fairly" or "reduce the digit value" to provide a more conceptual understanding; (d) integrate visual and concrete approaches throughout the explanation of place value so that students can more easily understand the relationship between the number and its position; (e) the teacher's monotonous teaching style, which tends to rely solely on lecture methods without supporting media, can be improved Adopting



technology-based learning, for example through interactive digital platforms such as Canva and Word-wall, which are more engaging for students; and utilizing real teaching aids and educational games that support active and enjoyable numeracy understanding.

CONCLUSION

The results of the study conducted at MI Ihyaul Islam I indicated that the majority of second-grade students experienced difficulties in understanding vertical addition and subtraction material. These obstacles were caused by several main factors, including low understanding of the place value concept, misinterpretation of terms such as “borrow,” inaccuracy in arranging numbers in vertical format, limited use of learning media by the teacher, and lack of active student participation during learning activities. These problems stemmed from two main sources: internal and external factors. Internally, difficulties arose due to limited basic knowledge and low student confidence. Externally, causal factors included overly monotonous teaching methods and a less conducive learning environment. One significant issue identified was students’ habit of following calculation steps mechanically without truly understanding the underlying concepts, which ultimately weakened their number sense skills. In response to these problems, this study recommends several solution strategies, including: (1) using concrete (manipulative) tools to visualize place value concepts and vertical operation procedures, (2) avoiding the use of terms that may cause misunderstandings, such as “borrow,” and replacing them with more mathematically accurate terms, (3) integrating digital learning media such as Canva and Word-wall to enhance student engagement and understanding, and (4) applying individualized approaches to students who exhibit passive behavior, as well as creating a classroom environment that encourages students to be more open in asking questions. Through the implementation of these strategies, it is expected that teachers can improve the effectiveness of mathematics learning while also building deeper and more meaningful conceptual understanding for the students

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