

The Role of Initial Abilities in Mathematics Learning for Elementary School Students

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Abstract

Initial ability is one of the abilities that students must have before participating in learning and is needed to continue the next lesson. However, often learners are at a low level of initial ability, so they cannot connect relevant prior knowledge with what they are dealing with spontaneously. This study aims to analyze how the role of initial ability in mathematics learning. The research method used in this research is library research, which is research by collecting information and data from various existing sources such as reference books or previous research results that are relevant to the problem to be solved. The inclusion criteria in this study, namely research subjects, namely elementary school students, research results related to mathematics lessons, and reference sources published within the last 10 years. Based on the results of the study, it was found that initial ability is based on information processing theory. Initial ability plays an important role in learning, especially mathematics learning, because mathematics is a hierarchical subject, that is, new knowledge is a continuation of previous knowledge. Based on the findings, teachers are advised to identify students' initial abilities, strengthen basic math concepts, and provide simple guidelines for parents to support learning at home.

Keywords: *ability, initial, learning, math*

Abstrak

Kemampuan awal adalah salah satu kemampuan yang wajib dimiliki peserta didik sebelum mengikuti pembelajaran serta diperlukan untuk melanjutkan pelajaran selanjutnya. Namun, seringkali peserta didik berada pada tingkat kemampuan awal yang rendah, sehingga tidak dapat menghubungkan pengetahuan awal yang relevan dengan apa yang mereka hadapi secara spontan. Penelitian ini bertujuan untuk menganalisis bagaimana peran kemampuan awal dalam pembelajaran matematika. Metode penelitian yang digunakan dalam penelitian ini adalah studi pustaka (library research), yaitu penelitian dengan cara mengumpulkan informasi dan data dari berbagai sumber yang ada seperti buku referensi atau hasil penelitian terdahulu yang relevan dengan masalah yang akan dipecahkan. Adapun kriteria inklusi dalam penelitian ini, yaitu subjek penelitian yaitu peserta didik sekolah dasar, hasil penelitian berkaitan dengan pelajaran matematika, dan sumber referensi dipublikasikan dalam kurun waktu 10 tahun terakhir. Berdasarkan hasil kajian diperoleh hasil bahwa kemampuan awal dilandasi oleh teori pemrosesan informasi. Kemampuan awal berperan penting dalam pembelajaran, khususnya pembelajaran matematika, karena matematika adalah subjek yang hierarki, yaitu pengetahuan baru merupakan kelanjutan dari pengetahuan sebelumnya. Berdasarkan hasil temuan, maka guru disarankan untuk mengidentifikasi kemampuan awal peserta didik, menguatkan konsep dasar matematika, serta memberikan panduan sederhana kepada orang tua untuk mendukung pembelajaran di rumah.

Kata kunci: *kemampuan, awal, pembelajaran, matematika*



INTRODUCTION

Mathematics as one of the basic subjects has an important role in students' cognitive development, especially at the elementary school level (Dewi & Saharuddin, 2024). Skills such as counting, problem solving, and logical thinking are skills that are also useful in everyday life. These abilities can also be developed through learning mathematics (Annisa Riyanto, 2024). Therefore, it is important for students to have a strong understanding of mathematical concepts from an early age. However, many studies show that there are still many students who experience difficulties in learning mathematics, especially at the elementary school level.

Learning mathematics in elementary schools, in its application there are several challenges, including the lack of students' ability to understand mathematical concepts, the low achievement of students in the field of mathematics. The low achievement of students in mathematics is reflected in the results of national and international studies, such as TIMSS and PISA. In addition, there is also a gap in initial ability between students. Initial ability is a set of attitudes, experiences, knowledge, and even beliefs that a person already has obtained from experiences throughout his life which are used to form new knowledge (Hasanuddin, 2020).

Initial math skills which include mastery of basic concepts, numeracy skills, and simple problem solving skills are the foundation for further mathematics learning. Initial ability is one of the most important factors because, first, strong initial ability will greatly affect students' success in learning more complex mathematics material at the Hasanudin level (Hasanudin, 2020). This is indicated by previous studies that show a positive correlation between initial ability and mathematics learning achievement. One of them is Hasibuan's (2022) which shows the effect of initial mathematical ability (high, medium, low) on students' mathematical reasoning ability. Another study mentioned that individuals with low initial abilities were unable to solve problems according to Polya's steps (Nurhayanti et al., 2020). Anggraini's research results also show that initial ability has an important role in students' computational ability (Angraini et al., 2020). Second, weak initial ability can be an obstacle for students in understanding abstract mathematical concepts. As a result, students may experience learning difficulties and lose interest in mathematics. The teacher's task is to facilitate students' prior knowledge and experiences that need to be changed and modified to construct students' new knowledge or experiences (Hasanudin, 2020).

This initial ability in learning mathematics plays an important role in shaping the basic concepts of mathematics. This is because mathematics is a cumulative discipline, namely learning new concepts is highly dependent on understanding previous concepts (Radiusman, 2020). Initial ability in mathematics learning acts as a bridge between the knowledge that students already have and the new material to be learned (Fitria, 2024). Mathematics learning has a connection between new and previously understood concepts so it is very important to ensure students can understand the material holistically and deeply (Andini, 2024).

Based on the importance of initial ability in learning mathematics. However, there are still gaps that need to be studied further. Most of the previous studies focused more on the effect of initial ability on learning achievement in general, without elaborating further on the mechanism of how initial ability affects the learning process. Departing from the aforementioned thoughts, the following authors will examine comprehensively how initial abilities play a role in building new knowledge in mathematics learning.

METHOD

The research method used in this research is library research. Library research is a research activity carried out by collecting information and data with the help of various kinds of materials in the library such as reference books, similar previous research results, articles, notes, and various journals related to the problem to be solved (Sari, 2020). Data collection in this study was processed by collecting, analyzing, and organizing sources from articles, books, and previous research (Surahman, 2020: 49-58). The data obtained is then analyzed using descriptive analysis methods, data analysis is carried out inductively, namely drawing a conclusion or conclusions from concrete circumstances to abstract matters, or from a specific understanding to a general understanding. This article analyzes the role of initial ability in learning mathematics in elementary school students. Inclusion and exclusion criteria in this study include:

Inklusi	Ekklusi
1. Research subjects are elementary school students	1. The research subject is outside the elementary school level.
2. The study was conducted in elementary school and related to initial ability	2. Research is not related to early ability learning
3. Article or reference source published within the last 10 years	3. Reference sources are not available in a language that can be accessed by researchers (not available in English or Indonesian)

RESULT AND DISCUSSION

Initial Ability

Information processing theory makes an important contribution to learning design by providing a foundation of prior knowledge, in the view of this theory, prior knowledge has an influence in shaping new knowledge and skills (Zulfah & Mukhoiyaroh, 2022). Especially for mathematics learning, because mathematics is a subject that is hierarchical, that is, new knowledge is a continuation of previous knowledge (Radiusman, 2020). Therefore, in understanding new knowledge, students need to use pieces of information from previous knowledge (Radiusman, 2020). This knowledge is initial ability. The stages in understanding new knowledge are in line with the information processing theory by Robert. M. Gagne (Setia Budi, 2022).

The information processing process described by Gagne above is divided into several stages. The first stage is information received by the five senses then sent to the nerve center. The information is then processed in the form of information or called receiving the stimulus situation. The second stage is the storage or filtering process, where the information that has been processed will then be stored in short-term memory, long-term memory, or may not be stored and wasted. The third stage is retrieval. The information received will be combined with pre-existing memory, so that it can be accessed again after undergoing processing (Noer & Muhid, 2023).

There are several definitions of initial ability, such as Brahmana, Brahmana argues that initial ability is a collection of knowledge and experiences that a person has gained from various experiences in his life. This initial ability is carried and used for new experiences or new knowledge. Initial ability has a significant impact on a person's learning process (Zulkarnain, 2020). Prior knowledge is the relevant knowledge and skills that students already have. This knowledge affects what they learn (Lubis, 2018). According to the constructivist perspective, learning is a

process in which a person interprets or applies the surrounding environment, including the socio-cultural environment, physical environment, and intellectual environment, to produce new knowledge and old knowledge (Sugrah, 2019).

The concept of initial ability, as explained above, is a combination or set of experiences, knowledge, attitudes, and even beliefs that individuals gain from experiences throughout their lives. The combination is then used to construct new knowledge and experiences. The combination is called initial ability. Initial ability in the learning process has an important role.

Common challenges related to initial ability

Initial ability generally serves to facilitate new knowledge. However, there are four common conditions that can impede learning. First, inadequate prior knowledge. Learners who do not have relevant or sufficient background knowledge or initial skills will find it difficult to identify new terminology and link their existing knowledge with newly acquired knowledge (van Riesen et al., 2022). Second, inaccurate prior knowledge (misconceptions), misconceptions are common and can interfere with new knowledge. Third, inappropriate prior knowledge or learners using inappropriate or irrelevant prior abilities to interpret their new knowledge. For example, terms in statistics that have different meanings between everyday life and mathematical topics will encounter confusion in interpreting their meaning. Fourth, inactive prior knowledge, where learners may have relevant prior knowledge, but are unable to use it when needed. The inability of learners to use the required initial skills can be a significant obstacle in learning (Dong et al, 2020).

Initial ability in math learning

Initial ability in mathematics learning is the skills or knowledge that students already have before starting mathematics learning at a certain level or topic (Awaluddin et al., 2024). This ability plays an important role in determining how quickly and easily students can understand new mathematics material (Zulkarnain, 2020). However, because the initial ability and level of intellectual development during learning varies among students, it is very important for teachers to understand the situation. Teachers can explain and use varied strategies to understand and summarize the differences in learners' achievement levels (Mustikaati et al., 2023).

In the context of learning, learners bring their beliefs, experiences, and knowledge into the classroom that influence what and how they learn (Ginanjari & Darmawan, 2019). Prior knowledge can help students understand mentally faster and become the foundation for learning learning concepts (Situmeang, 2018). However, sometimes learning or introducing new concepts is hampered by students' preexisting misinformation. Therefore, the role of students' prior knowledge becomes opposite, prior knowledge can help and hinder learning (Payung et al., 2016) Therefore, teachers must prepare strategies to identify students' prior knowledge. Similarly, prior knowledge can facilitate learning and at the same time be biased mainly because individuals do not pay attention to new information and do not make prior knowledge part of solving new problems (National Academies of Sciences Engineering and Medicine, 2018).

Prior knowledge should be used as an entry point to start learning (Situmeang, 2018). So, teachers should start learning activities by asking, exploring, and summarizing what knowledge and experiences students already have and what students already understand. Teachers should use this way prior

knowledge to help students construct their new knowledge. With this treatment, for students, learning will be easier to understand, absorb and more meaningful learning (Rahmah et al., 2022). In line with this, that prior knowledge or what he calls background knowledge plays an important role in student achievement (Smith et al., 2021). So that teachers carry out learning in the classroom by making students' prior knowledge as a bridge in implementing learning strategies in the classroom.

Conventionally, in the process of identifying and activating students' prior knowledge, teachers carry out initial activities in the form of giving diagnostic tests, namely giving tests related to the abilities that students must achieve, this activity is carried out at the time before learning begins. By knowing students' initial abilities, teachers can adjust learning materials and strategies based on students' initial ability levels. For example, if the majority of students already understand basic number operations, the teacher can focus on more complex concepts. Conversely, if many students still have weaknesses in certain basics, the teacher needs to repeat or strengthen the basic material.

In a lesson, there are often differences in concepts caused by differences in experience and prior knowledge possessed by students. It is also due to errors in using appropriate learning techniques and materials used by the teacher (Turhusna, 2020). Therefore, teachers should understand students' prior knowledge and misconceptions that occur as part of the process of determining the most appropriate learning approach.

Ideally, individuals have a strong and accurate prior knowledge building that can connect their prior knowledge with new knowledge so that they can build their knowledge structure. However, individuals are often unable to make relevant prior knowledge connections to what they encounter spontaneously. In other words, if prior knowledge is not active, it cannot facilitate the integration of new knowledge. Similarly, when learners' prior knowledge is insufficient and inappropriate to the learning situation and context, it will disrupt and impede learning. In other words, in principle, learners' prior knowledge can help or hinder learning (Mokganya & Zitha, 2023).

So from the description above, it can be stated that students' prior knowledge can help and hinder learning. So the effort that must be made is how to identify, activate and know the extent to which students' prior knowledge is relevant in learning. This is in line with Mokganya's opinion (Mokganya & Zitha, 2023), namely knowing or identifying prior knowledge can help in learning, including overcoming difficulties and grouping students according to their initial abilities. Inactive, inadequate, and inaccurate Prior Knowledge can hinder learning, as a result the knowledge gained by students is inaccurate and causes misconceptions (Dong et al., 2020; Mokganya & Zitha, 2023; van Riesen et al., 2022). Whereas good prior knowledge can aid learning, as it reduces cognitive load leading to better learning engagement (Yang, 2018).

CONCLUSION

Information processing theory forms the concept of prior knowledge. Initial ability is a collection of attitudes, experiences, knowledge, even beliefs that a person has during his life that are used to create new knowledge and experiences. The prior knowledge that students have is very important in learning. Initial knowledge is very important for learning because if students have good initial abilities, especially in learning mathematics because mathematics is a hierarchical subject, that is, new knowledge is a continuation of previous knowledge. So with good initial ability, learning becomes easier for them and they can achieve learning objectives. Prior knowledge also helps teachers create effective materials, strategies and learning

designs. Therefore, its influence on learning, teachers should understand the importance of students' prior knowledge and how students' prior knowledge can be properly used in the design and form of learning. However, teachers should strive to identify and activate students' prior knowledge so that it can be used as a starting point in learning design. In addition, students' prior knowledge can be used to determine the level of learning difficulty.

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