Al-Athfaal: Jurnal Ilmiah Pendidikan Anak Usia Dini
Vol.7 No.1 (2024) 90-105
http://ejournal.radenintan.ac.id/index.php/al-athfaal

p-ISSN: 2622-5484
e-ISSN: 2622-5182
June 2024

Analysis of learning implementation according to Jean Piaget's Theory in the context of elementary school children's cognitive development.

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Article Information
Submitted Mei 17, 2024
Revised June 16, 2024
Accepted June 28, 2024

Keywords
Cognitive development;
Jean Piaget;
Elementary school.

Abstract

Background: Learning at the elementary school level plays an important role in forming children's cognitive foundations. One of the prominent theories in understanding children's cognitive development is Jean Piaget's theory. This theory emphasizes that learning must be adapted to the child's stage of cognitive development to achieve optimal results.
Aim: To analyze the implementation of learning according to Jean Piaget's theory in the context of cognitive development of elementary school children
Method: Qualitative research method with *library research type* . The research objects are elementary school students, teaching and learning activities, and teaching materials. Data was collected via Google Scholar , Researchgate , Science Direct , and Semantics . Data analysis uses content analysis .
Results: The cognitive abilities of elementary age children vary at each age level. Piaget in his theory that in elementary age children, children's cognitive development is divided into 2 stages, namely concrete operations which occur at the age of 7 years to 11 years, in this stage children are able to think about things that are logical, rational, scientific and objective at every thing that is real. The KBM process carried out must be contextualized in real life. The second is the formal operational stage, which occurs in children aged 11 to 12 years and over. In this stage, children begin to be able to think about things that will happen in the future and things that are imaginary or imagined. In the teaching and learning process, children can apply constructivist and inquiry learning models which in principle require high levels of reasoning and require students to actively think, think and draw meaning from empirical and abstract things.
Conclusion: The application of Piaget's theory in elementary schools has a positive impact on children's cognitive development. Teachers who adapt learning methods according to students' cognitive development stages are able to help children understand the material better, improve critical thinking skills, and make the learning process more effective and enjoyable.

INTRODUCTION

Humans are living creatures that will continue to experience growth and development at all times (Bujuri 2018; Kambali 2018; Sasmi & Rahman 2022). An educator in carrying out their duties always strives to facilitate students to achieve learning goals optimally through guidance, education, teaching, and training (Agustyaningrum & Pradanti 2022; Indriawati et al. 2022; Purwaningsih 2021). According to Nurfarhanah (Jadidah et al. 2023; Meok 2023),

one aspect that plays a role in the success of the learning process is that educators must have knowledge about student development. The more an educator understands about the development of children or students, the more they will be able to design appropriate and effective learning strategies.

Schunk also expressed the same sentiment (Mitasari 2018) that educators will benefit when they are able to understand the function of students' levels of thinking. Not all students should be expected to learn at the same level. Educators can try to determine the level of students and then direct learning accordingly. Every child or student will experience cognitive development. Huang deep (Fujiarti et al. 2023; Sujana 2021; Zein 2021) states that cognitive development is a field of study in neuroscience and psychology that focuses on how humans think, explore, and solve problems. The growth and development of each individual is different; it can be faster or slower (Azizah & Richval 2018; Istiqomah & Suyadi 2019; Uce 2018). Knowledge about human development is very important to understand as a guide in understanding a person's needs and character.

Children are the next generation of a nation; therefore, children with good qualities are needed to achieve a good future for the nation. To get good quality children, it must be ensured that children grow and develop well. Children will grow and develop according to their respective stages of growth and development. Elementary-age children are in the age range of 7 to 12 years or, in the education system, they can be called children who are at primary school age (Ananda & Fadhilaturrahmi 2018; Hakim 2014; Kristiantari 2014). Generally, elementary-age children's abilities are still concrete and real. For example, children aged 7 or 8 can understand that a mirror can break if dropped on the floor but cannot yet answer this question scientifically. Elementary-age children have limited thinking about abstract things (Sasmi & Rahman 2022). Understanding the development of elementary-age children is a must for parents, teachers, and older people.

The cognitive aspect is crucial because success in developing cognitive aspects can determine success in other aspects. Everything around a person has something very beneficial if humans can use their minds (cognitive) to think about it (Hatip & Setiawan 2021; Imanulhaq & Ichsan 2022; Juwantara 2019; Sansena 2022; Whildan 2021). Without the cognitive domain, it is difficult to imagine a child being able to think. Furthermore, without the ability to think, a child cannot understand, believe, and apply what they capture from their surroundings, whether in the form of subject matter, moral messages from the family environment, or peers. Researchers in brain development have found that cognitive development is closely related to brain development and function (Hatip & Setiawan 2021; Intishar 2023; Oktavia et al. 2021).

This cognitive development has an important role in children's success in thinking, solving problems, and exploring the world around them through the five senses so that with the knowledge they gain, children can live their lives (Noor 2018; Putri & Mansur 2023; Sinaga 2023). The theory of cognitive development was popularized by Jean Piaget, a Swiss psychologist and genetic epistemologist. He is called the pioneer of constructivist theory, which explains that individuals actively construct their knowledge about the world based on the interaction between their ideas and experiences (Sinaga 2023). Jean Piaget divided cognitive development into four stages: sensorimotor, preoperational, concrete, and formal. The quality of a child's future development is largely determined by the stimulation they receive.

Based on the results of research conducted by (Marinda 2020), the benefit of knowing the stages of cognitive development according to Piaget's cognitive theory for teachers is to guide teachers in understanding children's cognitive abilities according to the stage of brain

maturity and their interactions with the environment so that teachers can diagnose learning difficulties that students may experience in the classroom. Other research shows (Nuryati & Darsinah 2021) that the cognitive development of children at the concrete operational age stage (7-12 years) in learning mathematics varies at almost every age phase. Mathematics learning in elementary schools is adjusted to age stages. Further research by (Handika et al. 2022) that children's cognitive levels in learning mathematics have differences at their age stages. A child's development in its stages can change a child's perspective on the importance of knowledge and how to learn. Research by (Magdalena et al. 2023) that the cognitive development of children at the concrete operational age stage (7-12 years) in science learning varies at almost every age phase.

The difference from previous research is that it discusses how cognitive development can influence learning activities, and there are stages in students' cognitive development, whereas this research examines the implementation of learning related to cognitive abilities based on age and class as well as the challenges in implementing Jean Piaget's theory in the context of cognitive development of elementary school children. This research makes a significant contribution to the future of basic education. Through in-depth analysis of how Piaget's theory is applied in learning environments, this research helps teachers understand and apply strategies that are appropriate to children's stages of cognitive development. In this way, teachers can design curriculum and teaching methods that are more effective, stimulating children's critical thinking and problem-solving abilities from an early age. This research also provides a scientific basis for the development of teacher training programs, ensuring that teachers have the knowledge and skills to optimally support children's cognitive development. In addition, the results of this research can encourage educational policies that are more supportive of children's developmental needs, creating a more inclusive and adaptive learning environment. In the long term, the implementation of the findings of this research can improve the quality of basic education, preparing children to face academic and social challenges in the future better. The aim of this research is to analyze the implementation of learning according to Jean Piaget's theory in the context of children's cognitive development elementary school.

METHOD

In this research, qualitative research methods are used with the type of library research. Research activities are carried out by collecting information and data through various literature such as reference books, results of similar research, notes, articles, and various journals related to the problem being studied (Kusmiati et al. 2024; Ridwan et al. 2021; Sari 2021; Subagiya 2023). The research objects are elementary school students' teaching and learning activities and teaching materials. The data in the research was collected through online searches. Researchers utilize various database sources such as Google Scholar, Researchgate, Science Direct, and Semantic Scholar. The results of collecting relevant journals and articles were then analyzed using the content analysis method. First, data analysis is collecting and preparing data from various relevant literature. This data is then read repeatedly to gain in-depth understanding. Second, the data is coded, identifying important units of information and creating codes for each relevant concept or theme. These codes were then grouped into broader categories, such as implementing learning related to cognitive abilities based on age and class, challenges in implementing Jean Piaget's theory in the context of cognitive development of elementary school children. After that, the main themes and more specific sub-themes were identified and analyzed in the context of the research objectives, namely how the implementation of Piaget's theory influences students' cognitive

development. The relationships between themes are also analyzed to see how one theme influences or interacts with other themes and compared with Piaget's theoretical concepts. Third, verification and validation of findings is carried out through triangulation and member checking to ensure consistency and accuracy. Fourth, the main findings are summarized and compiled in a report that includes practical implications, recommendations, research limitations, and suggestions for future research. The following is a picture of the research flow:

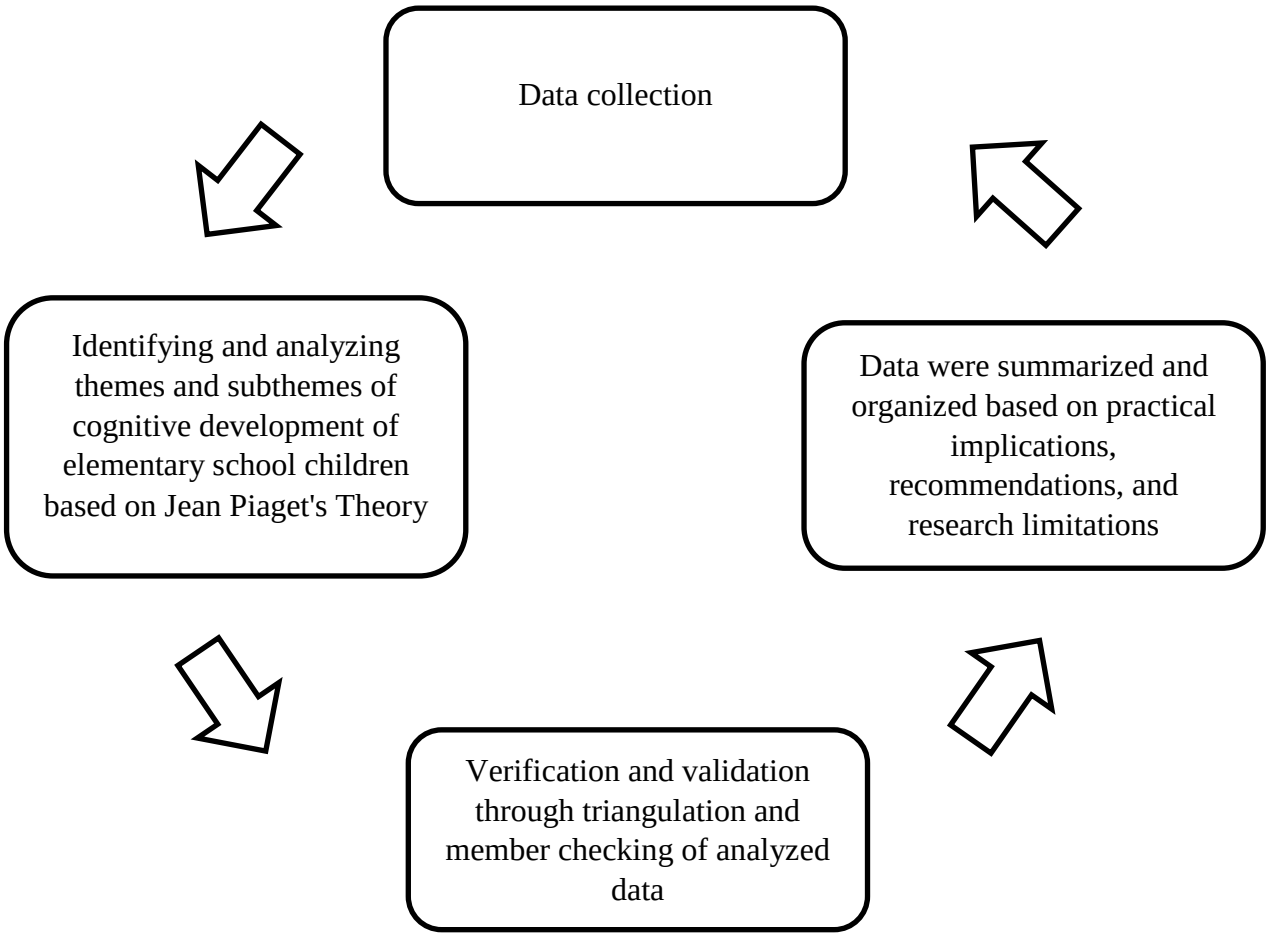

Figure 1. Research Flow Diagram

RESULTS AND DISCUSSION

A. Results

Cognitive development will influence the brain's thinking functions, such as knowing, understanding, analyzing, synthesizing, reasoning, creativity, and acting. Brain development is divided into two parts, namely the left brain and the right brain. Left brain development includes the ability to think rationally, scientifically, logically, analytically, and is related to the ability to learn reading, arithmetic, and language. Right brain development includes the ability to think holistically, non-linearly, non-verbally, intuitively, imaginatively, and creatively. In the elementary childhood phase, children's cognitive development has different levels starting from the age of 7-12 years and above. In this phase, children's cognitive development is in two phases, namely the first concrete operational phase is the phase when the child is between 7 and 12 years old, and the second formal operational phase is the phase

when the child is between 11 and 12 years old and above. Each individual's cognitive development is different; some are fast and some are slow. This difference can occur because it is influenced by various factors, including nutritional intake. A study shows that children who are malnourished (malnourished) have an IQ with an average value of 22.6 points lower than children with good nutritional status. Apart from that, heredity and environmental factors greatly influence children's cognitive development.

Under normal conditions, the cognitive development of elementary age children will occur periodically. While in the previous period, children still thought egotistically, subjectively, and always imagining things, at this stage when they enter school, their thinking has improved, they are able to think about something concrete, and slowly their egoic nature will decrease. When looking at something in front of them, children begin to use their minds to think rationally and objectively and can solve problems logically. At the concrete operational stage, children have a better understanding than preoperational children (2-7 years) regarding spatial concepts, cause and effect, grouping, inductive and deductive reasoning, conservation, and number/mathematical concepts. Children who think in the concrete operations phase, when required to solve a problem, will quickly explore the problem. In contrast to children who think formally (11 years and over), they will first think theoretically, then identify or classify, then look for solutions and move to solve the problem. This ability to manage numbers differentiates it from abilities in other scientific disciplines, which generally require real objects to be presented. At each age level or grade level, children have different mathematical abilities; the higher the grade level, the better their mathematical abilities. At each age level, children certainly have different abilities, including the ability to reason, think logically, remember, memorize, understand, and analyze. Children have the ability to think about things with different levels of difficulty, and these differences are the basis for determining the level of difficulty of teaching materials, strategies, models, and learning methods in SD/MI. Children's cognitive abilities will increase over time. For example, the higher the class, the more difficult or complex the material studied will be. Increased cognitive power can occur because it is influenced by many factors, such as brain volume, food, education, experience, and environment. However, in the context of cognitive development of a process, what influences the most is past lessons and the surrounding area. As stated by Piaget, active humans continuously make adjustments (adaptation) in the process of interacting with the environment. The next logical reason is that when children have gone through various educational activities or processes, the child's knowledge and insight increases. When children encounter more complicated things, children are ready to think about that something in terms of studying it or solving an existing problem. Based on the results of the author's analysis, the following is a description of the cognitive abilities possessed by children according to age/class and their application to learning activities:

The cognitive abilities of seven-year-old children (first grade SD/MI).

The cognitive abilities of children at this age are still at the stage of limited knowledge and understanding, even though the child has entered the concrete operational phase. In the educational context, referring to Bloom's Taxonomy theory, in this phase children enter the lowest level, namely C1 (remembering) and the beginning of level C2 (understanding). Operational words (verbs) in this phase include compiling lists, remembering, mentioning, recognizing, rewriting, repeating, naming, grouping objects, and being able to differentiate between simple things (Nuryati & Darsinah 2021). Children are able to recite what the teacher said in the form of letters, words, and simple sentences. The vocabulary that must be given is vocabulary that is often used in daily activities and is likely to be heard frequently by

children. Children cannot yet grasp scientific vocabulary which is difficult and is rarely used in daily activities. The appropriate method for learning Indonesian is by using the spelling method. The spelling method is an introduction that starts from the smallest elements (letters) and words to meaningful sentences. Appropriate at the concrete operations stage. The method used in learning mathematics at this stage should use tools such as manual calculating machines, fingers, detailed drawings, and using objects such as fruit, stones, paper, and so on. At this stage, children can also be introduced to types of colors and simple symbols such as symbols, flat shapes, and objects found in the surrounding environment. Furthermore, in this phase, learning should use contextual learning strategies, namely relating the material to real conditions and relating to everyday life. Children can be invited outside the classroom to learn so they don't feel tired because children aged 6 to 7 years feel tired more quickly when thinking. In teaching and learning activities, teachers should educate and teach them intensively because at this stage children are in a play period that requires fun. Children cannot yet learn in a formal manner, so teachers must be creative in designing fun learning such as by singing, using story texts, telling stories, and role-playing.

The cognitive abilities of eight-year-old children (2nd grade SD/MI)

The cognitive abilities possessed in this phase are no worse than the previous phase. In the world of education, children begin to climb the C2 level, namely understanding something, and move towards C3, namely applying something better and more skillfully. Children are able to read stories smoothly, distinguish groups of colors that have similarities, and can complete tasks in the form of columns and rows. Children also begin to be able to understand the message in a text, such as a short story or fairy tale, and are also able to work on questions related to reading. At this stage, children's abilities have also reached the level of grouping types and ordering objects correctly and swiftly. According to the results of research conducted by Piaget, when aged 7 to 8 years, children are able to understand the correlations that exist in groups of levels and are able to arrange them based on size (Alhaddad 2012; Mifroh 2020; Sansena 2022). For example, in a lesson, a child is given chocolate bars, and then he is able to sort the chocolate bars from smallest to largest, but when faced with the same question without presenting the object, he will find it difficult to answer the question. In this phase, children are not yet capable of multiplication and decimal division operations. However, outdoor learning outside the classroom is very suitable in this phase because children need learning outside the classroom at one time to anticipate boredom that may occur. Apart from that, learning activities in the open can also present existing objects directly so that children can easily understand them. So, in this phase, children can actually be invited to formal learning but occasionally need fun learning activities such as game-based learning.

Cognitive abilities of nine-year-old children (third grade SD/MI)

In this phase, cognitive abilities increase. Children can now solve more complicated problems because children already have enough knowledge, insight, and experience from previous processes. Children have entered level C3, namely applying. If at the previous stage, the material provided tended to be related to objects that are often found in everyday life, at this stage, children are starting to be invited to think further in imagining an object depicted. Children can understand the causes and effects of something happening and can find solutions to solve a problem, but they still need help from teachers or peers. Children's intelligence in mathematics has increased; children not only know flat shapes but can calculate the area of flat shapes and can recognize spatial shapes. In this phase, a learning system with group discussions can be implemented. However, teachers still have to control and pay attention to

implementation activities because children's ability to discuss is still limited; their ability to think and work together still needs to be developed. Apart from that, children's attention is also easily distracted; therefore, full control is needed from a teacher (Mifroh 2020; Nuryati & Darsinah 2021). At the age of 8 to 9 years, children are able to focus on learning for 3-4 hours a day.

Cognitive abilities of ten-year-old children (fourth grade elementary school/MI)

In this phase, children have increasingly better critical powers; children can examine a problem in depth with various dimensions. Cognitive abilities in the C3 realm, namely applying this phase is better than the previous age; children are not only able to calculate and change but can already compare existing objects. At the age of 9 years to 10 years, children begin to enter level C4, namely analyzing, where children are able to decompose situations according to more specific parts and are able to understand correlations related to one part with another. Children can analyze, contrast, and connect theories with facts to draw conclusions. Children can draw conclusions about the good and bad values contained in it. Children can receive material about history (religion, kingdoms, colonial times, and others). Basically, at the age of 10, children have entered the realm of synthesis (C5) but are still at a very simple level, such as being able to categorize and combine many objects logically. In science learning, children can learn about intangible objects, such as air and gas, and can understand changes in the form of objects. His mathematical abilities also improved; he was able to solve more difficult problems. Can operate multiplication and division in solving problems in the form of narratives or stories. In this phase, in learning, children can apply the cooperative learning system (Mifroh 2020). The cooperative model that is considered appropriate for this phase is Student-Teams-Achievment Divisions. This method is one of several types of cooperative learning and is implemented in small groups of 4 to 5 children; each group is given a task to discuss and then continues with a quiz or question and answer (Rifa'i 2014). This learning model can train children in communicating (sharing), exchanging ideas, and opinions with friends to solve problems. Children can be invited to reason critically about objects they have not previously known about.

Cognitive development of children aged eleven to twelve years and over (grade five and grade six SD/MI)

At an earlier age, children can think logically and systematically, which refers to empirical (real) objects that can be captured by the senses. In contrast to the childhood phase aged 11 to 12 years and above, children are starting to be able to think about things that might happen. This phase is called the formal operational phase. According to William Crain (Mifroh 2020), children can now think about abstract objects. For example, children are asked questions such as: If Joe is not taller than Bob and Joe is not lower than Alex, who is the tallest of them? Then the child will be able to answer it well without having to present these people in front of him. This kind of thinking process requires thinking at a higher level, for example, understanding each variable as well as the relationship between variables. The cyclical model for hypothetical deductive learning is best used in order to develop children's critical powers, which in turn have an effect on increasing understanding of concepts (Adnyana 2012). Children are able to think critically when faced with a problem; children will understand the cause and effect first, then develop steps to solve it. Children see an object not only in one dimension but in various dimensions. The results of this research show that the cognitive competence of children at this age is able to think systematically and strategically. Children's mathematical abilities are increasingly complex; if previously they could only

calculate the area of flat shapes, at this stage, children begin to be able to calculate the area, perimeter, and volume of geometric shapes. Children can work on complex problems such as root operations and operating with high nominal numbers (thousands and millions). In this phase, student-centered learning can be implemented, or what is called a student center; among these models is the inquiry model, namely teaching and learning activities with a pattern from observation to understanding. As research shows, the scientific attitude of fifth-grade children in science learning is significantly related to the inquiry learning model, meaning that children's scientific attitudes improve when this model is applied (Santiasih et al. 2013). From this research, we can see that it is true that 11-year-old children, namely children who are still in grade 5 of elementary school, are already capable of implementing learning models which in principle require high levels of thinking ability and critical thinking skills. The level of thinking ability of children at this age can use cooperative or inquiry methods in their teaching and learning activities but can already be applied with the constructivist learning model. Constructivism in learning is something that is the basic basis of a paradigm where the process of forming knowledge in individuals does not simply result in the transfer of knowledge but rather is the fruit of mental activity supported by long experience to build individual understanding (Mifroh 2020). A study proves that a model in teaching and learning activities, constructivism can improve student activity and learning outcomes for the better in the sixth grade at SD 6 BPK Penabur in Bandung (Bujuri 2018). This method is very compatible with Piaget's thinking that knowledge is obtained by students in the area around the objects they are studying. In the world of education, it is known as operative learning, namely a learning process that requires students to be active in understanding the concepts. According to the author, the constructivist learning model cannot be applied to all age levels or to children who are still in a low cognitive realm, such as children aged 7-9 years because learning with this model requires children to have high levels of reasoning to interpret something they have never known before and towards things whose nature is not yet clearly real. Also, at this stage, students are able to make considerations about a condition and decide for themselves which one is good based on their scientific knowledge. Students begin to be able to innovate or create something new based on previous knowledge. Children can compose poetry texts, and speeches, create fairy tales, and can begin to create their own works of art. In the capacity of mathematical knowledge, children can create thought maps and find their own ways of working on problems.

The following is an explanation of the implementation of learning based on Piaget's stages of cognitive development

Table 1. Learning Implementation Based on Piaget's Stages of Cognitive Development

Stages of Cognitive Development	Age	Main Characteristics	Learning strategies
Preoperational Stage	2-7 years	a. Symbolic thinking b. Egocentrism c. Intuitive thinking.	a. Use pictures and concrete objects b. Role playing and simulation c. Stories and fairy tales to develop imagination

Concrete Operational Stage	7-11 years old	a. Think logically about concrete objects b. Classification and series capabilities c. Understanding of conservation concepts	a. Experiments and practical activities b. Use visual aids c. Group discussions and collaboration
Formal Operational Stage	11 years and over	a. Abstract thinking and hypotheses b. Deductive reasoning c. Understanding of complex concepts	a. Systematic problem solving b. Abstract discussion and debate c. Research projects and exploration of ideas

B. Discussion

Elementary age occurs when children enter the age of 6 years until they are 12 years old, which is called late childhood, and at this age, they are marked as having entered school at the elementary level. Children have begun to mature in preparing skills in formal school, having previously completed kindergarten. According to Robert Havighurst (Awwad 2024; Jannah 2015; Sriyanto & Sutrisno 2022), elementary age children have the following basic characteristics: Have the urge to play outside the home and socialize with a group of friends their own age; Physical conditions that have the potential to encourage children to enter the world of play and activities that require physical skills, such as jumping rope, running, and other similar games; Have the desire to enter the realm of concepts, symbols, logic, and communication in the free world.

A process experienced by individuals who experience progress or increased maturity in psychological and physical aspects is called development (Latifah 2017). Meanwhile, cognitive can be said to be a psychological part in which there are mental actions related to the ability to understand, consider, process information, solve problems, beliefs, and intentionality. In other words, cognitive can be interpreted as a person's psychology in relation to the knowledge they have (Arifin 2017; Mifroh 2020). Thus, the cognitive development of elementary age children is a change in the progress experienced by humans towards maturity in the aspect of knowledge experienced by elementary school age children, namely the age range of 6-12 years. The process of cognitive development begins when the individual is born. The use of human cognitive abilities can begin when the individual's sensory and motor skills begin to be used.

In Elementary School (SD) or Madarasah Ibtidaiyah (MI) education units, understanding the cognitive development of elementary age children is very important as a reference for educating and teaching in the concrete operational stage, children's understanding (7-12 years) is different from the views of parents or more mature, so educators must be able to encourage children to form appropriate concepts because it affects students' ability to solve problems in different ways. Choosing a learning method is crucial because science is increasingly developing and advancing. The way of learning in the past may be outdated and no longer relevant to apply today. Learning is an activity carried out in an effort to produce new

knowledge in learning activities. The characteristics of learning include: (1) Learning can be said to teach children; therefore, the criteria for the success of the learning process are not measured by the extent to which children are able to master the subject matter but are measured by the extent to which children have carried out the learning process; (2) The learning process can be done anywhere, so students can use all learning places based on their needs and the nature of the material to be taught; (3) The orientation of learning is on achieving goals where learning not only has the goal of mastering the subject matter but is a process of children's behavior change according to the desired goals (Andayani 2021; Cahdriyana & Richardo 2017; Janawi 2019; Meri & Mustika 2022; Rahman 2009).

There are many views about learning in cognitive theory. Behavioral theory says that all events in the surroundings have a big influence on individual behavior and definitely leave their own impression. Therefore, according to this theory, learning is an improvement in behavior as an impact on a person's relationship with the environment in which they are present. This relationship produces conditioning through stimulus-response. Humans are said to have carried out learning activities if they show changes in behavior from the knowledge they receive. Humans are not said to be learning if there has not been a change in their behavior. This is different from cognitive theory, which reveals that learning is not just a discussion of the relationship between incoming knowledge and subsequent action; learning is essentially related to the digestion of a very broad mind. Learning is an effort to associate things that have just been discovered with things that were previously known, thus creating a new, more mature cognitive structure as a result of learning. The assumptions of cognitive theory and individual behavior are always based on cognitive meaning that an individual's behavior is determined by how he understands himself and everything he wants to achieve. The principle of learning activities is to obtain different points of view and a better understanding that it is not always possible to know that the behavior is definite behavior. But the emphasis is more on the fact that learning is an activity of change that takes place in a person's thinking. From a number of definitions mentioned, it can be said that learning, as expressed by cognitive theory, is an effort in which there are mental activities that occur in a person which are the result of activities to increase active relationships with the environment in which they exist to obtain a change in terms of understanding, cognition, skills, and behavior. For example, observations that someone makes about something while traveling. From these observations, it means that someone has mental activity. Then he told his friend what he experienced. When he told about the events he had experienced, he was unable to present the objects he saw to his friends, so he carried out learning activities, and the most important improvement was in his knowledge and understanding. If knowledge and understanding result in improved behavior, it means that there has been an increase in better attitudes and so on continuously (Mifroh 2020).

Cognitive development also experiences stage by stage towards maturity; according to Piaget, development takes place through four stages, namely: (1) Sensori-motor stage (0-2 years): At this age stage, babies use response and motor skills to understand the world. Starting from reflexes and ending with a complex combination of sensorimotor abilities; (2) Pre-operational stage (2-6 years): At this age stage, children have mental images and are able to pretend; children begin to recognize symbols; (3) Concrete operational stage (7-12 years): At this age stage, children not only describe symbols but can manipulate symbols logically; (4) Formal operational stage (12 years and above): At this age stage, the operational style of thinking involves the use of logic and absolute.

According to Piaget, all children will go through these four stages in their cognitive development, although each stage tends to be passed at different speeds or ages for each child.

However, the sequence of cognitive development is the same for all children; the structure for the previous level is integrated and included as part of the next level (Ilhami 2022). Each stage is entered when the child's brain is mature enough to rise to the level of the stage above. Knowledge about human development is very important to know and understand as a guide in understanding a person's needs and character, including elementary age children. Elementary age children are children who are in the age range of 7-12 years and above or in the education system can be called children who are at primary school age. Understanding the development of elementary school age children is a must for parents, teachers, and older people (Bujuri 2018). As for cognitive development for elementary school age children, it is included in concrete operations.

In implementing learning based on Jean Piaget's theory in the context of elementary school children's cognitive development, there are challenges facing this, which include: (1) Lack of Teacher Understanding, One of the main challenges is the teacher's lack of understanding and knowledge about Piaget's theory and the best way to apply it in teaching. Without adequate understanding, teachers may have difficulty recognizing students' stages of cognitive development and designing appropriate learning strategies; (2) Lack of Resources, Limited resources, both in terms of learning materials and administrative support, can be an obstacle in implementing a learning approach that emphasizes active exploration and social interaction. Lack of access to concrete learning materials or interactive learning tools can hinder optimal learning experiences; (3) Individual Differences in Cognitive Progress, Each student has different cognitive progress, and not all students will be at the same stage of development at the same time. This creates challenges in adapting instruction to suit each student's individual needs and developmental level; (4) Limitations of Curriculum and Assessment, A curriculum that is too structured and focuses on test-based teaching can be an obstacle in implementing a learning approach that emphasizes exploration and problem-solving. Assessment systems that do not take into account qualitative aspects of learning can also ignore the cognitive development that students may have achieved; (5) Time Limitations, In busy learning environments where instructional time is often limited, teachers may find it difficult to create adequate opportunities for students to explore concepts in depth and engage in challenging learning activities; (6) The role of parents and the surrounding environment, Not all students have consistent support from parents or the surrounding environment to support learning based on Piaget's theory outside the school environment. This can be an obstacle to the consistency and continuity of children's learning experiences inside and outside the classroom; (7) Inadequate Teacher Training, Teacher training that does not cover Piaget's theory and appropriate learning strategies can lead to gaps in the implementation of effective learning practices. Investment in ongoing teacher training is required to ensure a deep understanding of Piaget's theory and the ability to integrate it into daily teaching practice.

Implications of this research underscore the importance of adapting teaching methods to the cognitive development stages of children as outlined by Jean Piaget. Teachers who are trained to understand and apply Piaget's developmental stages can significantly enhance the learning experience for children, promoting better comprehension and critical thinking. This highlights the need for continuous professional development for teachers, ensuring they are equipped with the knowledge and skills to implement Piagetian principles effectively. Furthermore, curriculum development should be responsive to these cognitive stages, incorporating age-appropriate learning materials and activities. Educational policymakers should consider these findings when formulating policies to create more inclusive and adaptive learning environments. **The research contributions** of this study are significant for

early childhood education by providing empirical evidence on the effectiveness of applying Jean Piaget's cognitive development stages in elementary school settings. It offers practical insights for teachers on implementing constructivist and inquiry-based learning models that align with children's cognitive abilities, enhancing critical thinking and problem-solving skills. The research also strengthens the theoretical framework of Piaget's theory within elementary education, offering a foundation for future educational practices and research. Additionally, it supports the need for tailored educational strategies, considering the cognitive stages of children, and informs teacher training programs, curriculum development, and educational policy-making. **Limitations** of this study include several factors. Firstly, the research is based on qualitative analysis with a limited sample size, which may not represent the broader population of elementary school children. This restricts the generalizability of the findings to other settings or larger populations. Secondly, the contextual relevance of the findings is primarily limited to the specific educational and cultural environment of the regions studied in Indonesia. This means the results may not fully apply to different cultural or educational contexts. Lastly, the study's short duration limits the ability to capture long-term effects of implementing Piaget's theory on cognitive development. **Future research** should focus on several key areas to build on this study's findings. Longitudinal studies are needed to assess the sustained impact of Piagetian approaches on cognitive development over multiple years, providing deeper insights into the long-term benefits and challenges. Expanding the research to different cultural and educational contexts would help explore the generalizability of the findings, offering a broader understanding of how Piaget's principles can be adapted globally. Incorporating quantitative methods alongside qualitative analysis could provide a more robust and comprehensive understanding of the effects of Piaget's theory on children's learning outcomes.

CONCLUSION

Understanding and supporting the cognitive development of elementary age children is crucial in educational activities. According to Piaget, children's cognitive development is divided into two stages: concrete operational (7-11 years) and formal operational (11 years and older). In the concrete operational stage, children think logically about real, tangible concepts. Thus, teachers should provide empirical, real-life learning materials and activities. In the formal operational stage, children develop the ability to think abstractly and hypothetically, requiring more complex, constructivist, and inquiry-based learning models.

Teachers who adapt their methods to these cognitive stages help improve children's understanding, critical thinking, and engagement. This highlights the need for teacher training in Piaget's theory and the importance of a curriculum that aligns with children's developmental stages. This research shows that applying Piaget's theory positively impacts cognitive development and offers insights into effective educational strategies and policy development. However, limitations include sample size, contextual relevance, and time duration, which may affect the long-term impact analysis. Overall, adapting teaching strategies to cognitive development stages enhances children's learning experiences, engagement, and critical thinking, providing a strong foundation for curriculum development and educational policies.

AUTHOR CONTRIBUTION STATEMENT

YY prepared the discussion; NH prepared the conclusion and abstract; DR and M prepared the introduction; RE, SZ and ANU prepared the research methods and references.

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