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LAW OF CONSERVATION OF NUMBER TO MEASURE STUDENTS' READINESS TO LEARN MATHEMATICS IN GRADE I ELEMENTARY SCHOOL

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Abstract
This study aims to measure the readiness to learn mathematics of grade I elementary school students through understanding the law of conservation of number. This law is an important indicator in assessing children's cognitive abilities in understanding that the number of objects remains the same despite changes in arrangement or visual form. The research approach used was qualitative with an exploratory descriptive design. Data were collected through concrete task-based assessments and interviews with class teachers of 25 grade I students in one of the public elementary schools in Tasikmalaya City. The results showed that 48% of students fully understood the concept of conservation of number, 32% showed partial understanding, and 20% did not show adequate mastery of the concept. The analysis showed that visual changes still influenced the perception of quantity in some students, indicating the dominance of preoperational thinking. The conclusion of this study shows that the law of conservation of numbers can be used as an initial assessment tool to accurately map students' readiness to learn mathematics. The results of this assessment can be the basis for designing learning strategies that are contextual, concrete, and in accordance with the stage of cognitive development of children.
Keywords: *law of conservation of number; learning readiness; mathematics learning; cognitive development*

Abstrak
Penelitian ini bertujuan untuk mengukur kesiapan belajar matematika siswa kelas I Sekolah Dasar melalui pemahaman terhadap hukum kekekalan bilangan. Hukum ini merupakan indikator penting dalam menilai kemampuan kognitif anak dalam memahami bahwa jumlah benda tetap sama meskipun terjadi perubahan dalam susunan atau bentuk visual. Pendekatan penelitian yang digunakan adalah kualitatif dengan desain deskriptif eksploratif. Data dikumpulkan melalui asesmen berbasis tugas konkret dan wawancara dengan guru kelas terhadap 25 siswa kelas I di salah satu sekolah dasar negeri di Kota Tasikmalaya. Hasil penelitian menunjukkan bahwa sebanyak 48% siswa memahami konsep kekekalan bilangan secara penuh, 32% menunjukkan pemahaman parsial, dan 20% belum menunjukkan penguasaan konsep secara memadai. Analisis menunjukkan bahwa perubahan visual masih memengaruhi persepsi kuantitas pada sebagian siswa, yang menandakan dominasi cara berpikir praoperasional. Simpulan dari penelitian ini menunjukkan bahwa hukum kekekalan bilangan dapat digunakan sebagai alat asesmen awal untuk memetakan kesiapan belajar matematika siswa secara akurat. Hasil asesmen ini dapat menjadi dasar dalam merancang strategi pembelajaran yang kontekstual, konkret, dan sesuai dengan tahap perkembangan kognitif anak.
Kata Kunci: hukum kekekalan bilangan; kesiapan belajar; pembelajaran matematika; pengembangan kognitif

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Introduction

Mathematics instruction in the early years of primary education, especially in Grade 1, plays a pivotal role in shaping children's cognitive development and foundational mathematical thinking. One crucial cognitive milestone in this stage is the understanding of number conservation a concept rooted in Piaget's theory of cognitive development. Piaget (1952) described number conservation as a child's ability to recognize that the quantity of objects remains constant despite changes in their arrangement or appearance. Mastery of this concept marks a transition from the preoperational to the concrete operational stage and reflects readiness for more advanced numerical reasoning.

Within the framework of the Merdeka Curriculum, which emphasizes differentiation and learning readiness, assessing children's cognitive preparedness has become increasingly relevant especially during the transition from early childhood education to formal schooling. Learning readiness in mathematics goes beyond number recognition, encompassing mastery of quantitative relationships, number stability, and early numerical intuition that forms the basis of logical reasoning. Research by Cohen shows that children who grasp number conservation perform better in arithmetic operations due to having more systematic and efficient cognitive structures. Baroody further argues that strengthening numerical intuition through manipulative activities supports the conceptual construction of numbers and facilitates the shift toward more abstract symbolic understanding. Aunio and Räsänen also found that early numerical skills, including conservation, are reliable predictors of future academic performance in mathematics, making this aspect crucial in developmental education strategies.

However, empirical data indicate that many first-grade students have not fully reached the concrete operational stage, and thus lack the competence to understand number conservation. This lack of readiness directly impacts the effectiveness of mathematics learning. A longitudinal study by Jordan et al. (2019) revealed that weaknesses in early number understanding lead to long-term challenges in acquiring more advanced mathematical concepts. Similarly, Aunio and Mononen (2018) found that early numerical skills, including number conservation, are reliable predictors of future mathematics performance. Therefore, early assessment of number conservation holds not only diagnostic but also strategic value in designing appropriate instructional interventions (Anders et al., 2021). In addition to serving as a measure of readiness, such assessments also help identify students' individual learning needs from the outset. By mapping conservation abilities, teachers can plan differentiated approaches tailored to each child's developmental stage, which is crucial to preventing widening learning gaps, particularly in a subject like mathematics that demands structured and logical thinking.

This study aims to elaborate the number conservation principle as an indicator to assess first-grade students' readiness to learn mathematics. It also focuses on evaluating how students' understanding of basic mathematical concepts influences their readiness to engage in further learning. The study centers on two main aspects: (1) examining the relationship between mastery of number conservation and students' cognitive numerical readiness, and (2) identifying the extent to which this concept predicts engagement and success in early mathematics instruction. Theoretically, this study extends the application of cognitive development theory into the realm of primary education assessment. Practically, its results are expected to support the development of readiness assessment instruments that are sensitive to students' developmental stages. The findings are intended to contribute to curriculum design and instructional strategies that align more closely with students' cognitive needs at the beginning of formal education.

The conceptual foundation of this research is grounded in Piaget's theory of cognitive development, which outlines the mental stages children go through as they construct understanding through active engagement. Children between the ages of five and seven are in a transitional phase from the preoperational to the concrete operational stage, marked by the emergence of conservation abilities and simple classification logic. At this stage, children begin to comprehend that the number of objects remains constant despite changes in their arrangement or visual presentation. Number conservation is a critical indicator because it reflects the capacity to ignore superficial transformations and focus on quantitative essence. This view is enriched by Vygotsky's sociocultural approach, which emphasizes that the development of cognitive abilities like conservation can be facilitated through scaffolding within the zone of proximal development. This process, involving social interaction and the use of concrete media, helps children strengthen and expand their cognitive structures in a more tangible and applicable context.

Previous studies have consistently shown that mastery of number conservation is closely linked to mathematics readiness. Researchers such as Cohen, Aunio and Räsänen, and Jordan et al. explicitly state that number conservation is part of a child's numerical foundation and serves as a predictor of later mathematical performance. Recent studies have supported this, emphasizing that children's early numerical understanding particularly their grasp of invariance significantly predicts their later math achievement (Aunio & Mononen, 2018; Jordan et al., 2019; Sarama & Clements, 2020). Thus, mapping this competence has significant implications for planning adaptive, needs-based learning. The theoretical framework of this study integrates cognitive development theory, the importance of number conservation competence, and its role in readiness assessment. The principle of number conservation is operationalized as a numerical readiness indicator, evaluated through concept-based cognitive tasks. This approach is expected to yield not only theoretical insights but also practical contributions to improving the quality of mathematics assessment in early primary education.

The importance of mastering number conservation is also reflected in classroom practices that rely on concrete activities. At this developmental stage, children tend to grasp concepts through hands-on experience and object manipulation. Therefore, teachers must design learning experiences that allow students to visually and tactually explore numerical concepts. For instance, games involving arranging and grouping objects in different patterns while maintaining the same quantity can help children understand that quantity remains unchanged. Such activities align with the principle of meaningful learning, where students internalize the essence of number concepts rather than merely memorizing them. According to Clements and Sarama (2020), concrete experiences using manipulatives are essential for young children to develop number sense and conservation skills. According to Ghani, in the Merdeka Curriculum, this approach is relevant as it supports adaptive and contextual learning. Experience-based learning also contributes to more enduring conceptual memory. Thus, number conservation can be effectively facilitated through concrete and manipulative teaching strategies.

Moreover, success in early mathematics learning is not determined solely by cognitive factors, but also by affective and motivational aspects. Kristiyani emphasized that students who feel confident in their understanding of numerical concepts are more likely to participate actively in learning. On the other hand, students who have not mastered number conservation may feel anxious or insecure when faced with arithmetic tasks, which can hinder intrinsic motivation and engagement. This is consistent with findings by Nguyen et al. (2020), who reported that students' confidence in their numerical understanding is positively associated with classroom engagement and willingness to attempt challenging tasks. This highlights the need for early assessment to identify students requiring additional support. Scaffolding based on these assessment results can accelerate students' cognitive development. In this case, assessing number conservation serves both diagnostic and preventive purposes to avoid potential future learning failure. This approach reflects the importance of integrating cognitive and affective dimensions in comprehensive instructional planning.

In developing assessment instruments, selecting valid and reliable indicators is crucial to ensure measurement accuracy. Tools used to assess number conservation must be designed with early childhood developmental characteristics in mind. For example, instruments can involve games or tasks where students compare two rows of equally numbered objects arranged differently. Children's responses to questions like "Are there still the same number of items?" indicate their mastery of the concept. Validating such instruments can be done through pilot testing and reliability analysis. Anders et al. (2021) emphasize that age-appropriate, visually supported tasks increase the validity of early numeracy assessments, especially in the transition from kindergarten to primary education. With the right tools, teachers can identify variations in numerical readiness among Grade 1 students, enabling differentiated, data-driven instructional interventions. This study contributes to refining mathematics readiness assessments that are more contextual and applicable.

Teachers' roles in guiding number conservation development are inseparable from their professional and pedagogical competence. Teachers who understand children's cognitive development stages can better select appropriate methods and strategies to support students' transitions from preoperational to concrete operational thinking. Teacher training on number conservation and its instructional applications is essential to bridge the gap between theory and practice. Clements and Sarama (2020) also assert that effective math instruction for early learners requires teachers to understand developmental learning trajectories and apply strategies grounded in cognitive research. Teachers must be empowered to use formative assessments based on observation and reflection to continuously monitor cognitive growth. This approach will lead to more responsive instruction tailored to students' individual needs. Additionally, teacher collaboration within professional learning communities can enrich the teaching of number conservation through shared experience and reflection. With sufficient support, teachers can act as effective facilitators in developing children's early numerical skills. Enhancing teacher capacity is an integral part of systemic efforts to improve mathematics education quality at the primary level.

Although number conservation has been widely studied, most previous research has focused more broadly on cognitive development or developmental psychology, rather than specifically examining its connection to mathematics readiness in Grade 1. Moreover, few studies have simultaneously integrated Piagetian and Vygotskian frameworks in analyzing number conservation as a diagnostic tool in elementary education. This gap highlights the need to position number conservation not only as a cognitive phenomenon but also as a strategic tool for learning planning and readiness assessment. This study contributes novelty by operationalizing number conservation as a numerical readiness indicator within the context of the Merdeka Curriculum and developing concept-based, contextual, and applicable assessment designs. The interdisciplinary approach combining developmental psychology and modern pedagogy adds value by expanding the perspective on early mathematics assessment. Furthermore, this study raises awareness of the importance of learning readiness in Grade 1 an issue that has received limited attention in education policy research. As such, it not only addresses gaps in the literature but also offers concrete contributions toward improving instructional and assessment practices in the early years of elementary education.

Research Methods

This study employed a qualitative approach with an exploratory descriptive design to deeply investigate the mathematics learning readiness of first-grade elementary students through the lens of number conservation theory. This approach was deemed relevant for understanding the internal dynamics of cognitive development in early childhood, particularly concerning logical and invariant numerical principles. Merriam and Tisdell (2016) assert that such an approach is effective in uncovering subjective meaning and complex processes within educational contexts. The participants consisted of 25 first-grade students from a public elementary school in the city of Tasikmalaya, West Java, selected purposively by considering gender diversity and varying levels of academic ability. The selection of the research site also took into account institutional readiness and support from the school administration to maintain contextual validity during the learning implementation.

The research instruments consisted of two components: (1) a mathematics learning readiness assessment tool developed based on Piaget's principle of number conservation, and (2) a semi-structured interview guide for classroom teachers. The assessment tool consisted of a series of concrete tasks, such as comparing two identical rows of counters that are later spatially rearranged, and asking students whether the quantity remains the same. Additional variations included tasks involving pouring equal amounts of liquid into containers of different shapes, and matching sets with different visual layouts. These tasks were designed to elicit students' reasoning about numerical invariance under transformation. The development of this instrument followed several stages: initial drafting based on theoretical frameworks (particularly Piaget's stages of cognitive development), expert validation involving two developmental psychologists and one elementary mathematics educator, followed by small-scale pilot testing on five students outside the main sample to refine item clarity and task structure. For the second instrument, the semi-structured interview guide included questions targeting teachers' observations of students' mathematical readiness, attention span, task persistence, and ability to follow instructions during number-related activities. Interviews also explored the instructional strategies used to teach early number concepts and the teachers' perception of students' challenges. Content validity of both instruments was ensured through expert review, who assessed the items for conceptual relevance, age appropriateness, and alignment with developmental milestones. Experts also gave feedback to improve clarity and ensure cultural-context suitability for Indonesian Grade 1 learners. Reliability of the assessment instrument was tested through an inter-rater agreement procedure. Two independent raters scored the students' responses using a rubric with clear behavioral indicators (e.g., consistent conservation reasoning, partial understanding, or non-conserving answers). The agreement between raters was measured using Cohen's Kappa coefficient, which yielded a value of 0.84, indicating a strong level of agreement (McHugh, 2012). This detailed development and validation process ensured that the instruments were both pedagogically sound and psychometrically reliable for assessing number conservation as an indicator of mathematical readiness.

Data were collected through participatory observation during task implementation, recording of students' numerical reasoning strategies, and interviews with classroom teachers. The focus of the observation was directed at the students' reasoning processes, while interviews served to confirm observational findings and explore external factors such as instructional approaches and the learning environment. Data analysis was conducted using a thematic-inductive method to identify cognitive patterns that reflect learning readiness. Additionally, descriptive analysis was performed to examine the relationship between number conservation scores and other readiness indicators such as attention, instruction-following, and persistence. The findings were then analyzed within a theoretical framework to formulate recommendations for diagnostic assessment aligned with the developmental stages of primary school students.

Result and Discussion

The evaluation of first-grade students' cognitive readiness to understand basic numerical concepts was conducted using an assessment instrument based on the Principle of Number Conservation. This instrument was designed to explore children's ability to maintain quantity despite variations in the form or arrangement of objects. The instrument consisted of five items presented in a concrete and visual manner. Each item was intended to assess students' responses to visual changes such as positional transformations, alterations in shape, and the distance between objects, all of which could influence their perception of quantity. The evaluation results showed that out of 25 respondents, 12 students (48%) demonstrated full understanding of the number conservation principle, as indicated by consistent responses across all items. Meanwhile, 8 students (32%) showed partial understanding, and 5 students (20%) had not yet demonstrated adequate mastery of the concept. These findings suggest that while many students had a basic understanding of conservation, a group of students still required further support and more contextualized teaching approaches.

Response analysis revealed that visual transformations—such as variations in object spacing and changes in orientation from horizontal to vertical or circular patterns—were dominant factors affecting students' numerical perception. These variations often caused confusion in maintaining quantity stability. This indicates that some students still relied heavily on concrete visual perception to judge quantity, a typical characteristic of the preoperational stage in Piaget's cognitive framework. Additionally, in items requiring logical justification (such as the fourth item), many students provided immature reasoning, for example, "because it's longer" or "because the shape is different." These factors highlight the need to strengthen basic conceptual understanding through more structured, experience-based mathematics instruction.

The data support the conclusion that nearly half of the students had entered the early phase of the concrete operational stage, evidenced by their ability to understand that quantity remains constant despite changes in visual representation. However, the proportion of students who had not yet acquired this competence indicates that early numeracy instruction must be attuned to the limitations of students' developmental logic. These limitations underscore the necessity of more concrete and contextual teaching strategies, such as using manipulative media to help children grasp quantity concepts more directly. Teachers should also apply a gradual scaffolding approach to support students in transitioning toward logical thinking (Haryono et al., 2024). Furthermore, formative assessments based on classroom observations can be used to map individual learning readiness and design appropriate interventions (Kartini et al., 2023). With this approach, mathematics instruction not only conveys knowledge but also builds strong thinking structures from an early age.

These findings are reinforced by in-depth interviews with three first-grade teachers, who reported that most students exhibited cognitive readiness gaps in understanding formal mathematical concepts. The teachers noted that a major challenge for students was grasping abstract and complex concepts, which could not be fully understood without reinforcement through concrete experience. They also emphasized the importance of concrete instructional media to support comprehension of abstract concepts and identified limited facilities and teacher training as obstacles in the teaching process. Additionally, most teachers expressed that the use of visual and manipulative aids should be increased to make mathematics learning more accessible to students, especially during the early stages of formal instruction. T eachers further observed that students demonstrated better engagement when learning involved real objects and hands-on tasks. They also suggested that incorporating diagnostic activities at the start of instruction could help identify readiness levels more accurately. One teacher noted that without sufficient scaffolding, students tend to rely heavily on visual cues rather than logical reasoning. These insights affirm the need for instructional strategies that align with students' developmental stages. The following is Table 1 , which presents the distribution of students' readiness categories:

Table 1. Distribution of Students' Readiness Categories

Readiness Category	Number of Students	Percentage (%)
Very Ready	16	64.0
Not Ready	7	28.0
Ready	2	8.0

In-depth interviews with three Elementary School teachers with experience teaching in grade 1 provided significant contributions to the theoretical and practical understanding of basic mathematics education at the early stage of formal education. They revealed that although students have been introduced to basic mathematical concepts, more structured and developmentally-based teaching is still required to maximize students' understanding. These findings highlight the complex dynamics between pedagogical, psychological, and curricular factors that influence the effectiveness of learning concepts such as addition, numbers, and the law of conservation of number. The teachers also emphasized the need for more practice using concrete and manipulative media to support the understanding of these concepts. The qualitative data obtained was organized into conceptual themes that highlight the need for reflective, contextual, and developmentally-based instructional approaches.

Teaching Experience and Understanding of Student Characteristics. The variation in teaching experience, ranging from five to fifteen years, reflects different levels of reflective competence among the three teachers. The teachers with more experience (Teacher 1 and Teacher 3) demonstrated a deeper understanding of the cognitive development stages of young children, particularly that grade 1 students are at the concrete operational phase according to Piaget's theory. They emphasized the need to present material through multisensory approaches that rely on concrete and visual representations. Meanwhile, Teacher 2, although relatively newer to the profession, showed openness to exploring innovative methods and approaches suitable for the dynamic learning needs of students. All three teachers shared a common understanding that the concrete thinking characteristic of 6–7-year-old children demands the selection of relevant and cognitively accessible pedagogical strategies.

Significance of Understanding the Law of Conservation of Number. The teachers reached a consensus that the law of conservation of number is a fundamental concept that cannot be overlooked in early mathematics education. The phenomenon of misinterpreting numbers due to visual variations in object arrangement indicates cognitive limitations in the process of number conservation. All three teachers emphasized that understanding the principle of invariant number is an early indicator of logical thinking development and a prerequisite for learning more complex arithmetic operations. This shows the importance of systematically designed conceptual scaffolding in the learning process.

Students' Readiness to Construct Initial Concepts. Disparities in students' conceptual readiness were influenced by factors such as preschool experience and family environment. Teacher 1 and Teacher 3 noted that many students showed limited readiness to grasp concepts of addition and numbers at the start of grade 1, which required interventions in the form of gradual familiarization and repeated reinforcement. Teacher 2 believed that readiness was relatively conditional, depending on the continuity of learning experiences from kindergarten to elementary school. These findings emphasize the importance of curricular continuity between early childhood education (PAUD) and primary school as the foundation for successful early mathematics learning.

Response to the Curriculum Structure. In general, the three teachers believed that the national curriculum has moved toward meaningful learning, but it still requires improvements in terms of classroom implementation. Teacher 1 and Teacher 3 assessed that the curriculum design tends to include abstract elements that are not yet aligned with the cognitive capacity of early learners. They suggested integrating the curriculum with concrete experience-based activities. Teacher 2 emphasized the importance of contextualizing the curriculum to local conditions and the unique characteristics of students. The implication of this finding is the need for curriculum differentiation and flexibility in the implementation of the national curriculum at the micro level.

Challenges in Learning Number Concepts. Various instructional challenges emerged from the interviews. Teacher 1 identified that student boredom and distractions were significant issues when the teaching methods lacked variety. Teacher 2 highlighted the limitations of instructional media that were appropriate for the developmental age of students, especially related to visual appeal and the functionality of self-made media. Teacher 3 emphasized that repetitive and non-contextual learning tends to reduce students' intrinsic motivation. The overall data suggests that effective teaching requires adaptive instructional design, based on differentiation and incorporating strong motivational elements.

Preferences and Practices in Media Usage. All three teachers reported using concrete media such as buttons, colorful blocks, educational toys, and contextual objects from the surrounding environment as the main tools for teaching numbers. Teacher 2 and Teacher 3 more frequently used handmade teaching aids, although they recognized their limitations in terms of aesthetics and effectiveness. The selection of media that is familiar to students was shown to increase engagement and facilitate the transition from concrete to semi-abstract concepts. These findings indicate the importance of developing media that align with constructivist learning theories and are based on the developmental needs of children.

Effectiveness of Concrete and Digital Media. The three teachers regarded concrete media as excellent tools for control and connection with students' direct experiences. Meanwhile, digital media—such as interactive applications and educational games—have great potential to increase student engagement, but present new challenges in terms of supervision and focus during learning. Teacher 3 emphasized that the use of digital media without guidance could disrupt learning objectives. Therefore, digital media integration should be done pedagogically, selectively, and with a structured blended learning approach.

Affective and Cognitive Responses of Students to Media. Students showed high enthusiasm for learning media, especially those designed to be interactive and engaging. Teacher 1 observed that student involvement increased when media were used appropriately, although the potential for distraction arose when media were not varied. Teacher 2 reported that some students became confused when the media were too symbolic or unfamiliar. Teacher 3 pointed out that simply playing with media does not guarantee concept acquisition, making the teacher's role in conceptual mediation crucial. This suggests that media design should consider not only aesthetic dimensions but also didactic and cognitive implications.

Contribution of Media to Conceptual Understanding. All informants agreed that learning media designed specifically to support the understanding of the law of conservation of number have high educational value. Teacher 1 emphasized the role of direct experience in building a stronger conceptual framework. Teacher 2 stated that meaningful media encourage the formation of logical thinking patterns from an early age. Teacher 3 emphasized the importance of gradual reinforcement through concrete practice to achieve concept internalization. These views underscore the urgency of developing media based on research that meets the criteria of cognitive development, aesthetics, and the social-cultural context of students.

Structural Challenges in the Implementation of Learning Media. The main challenges identified by the teachers in the implementation of learning media include limited educational tools, insufficient exploration time within the teaching schedule, and a lack of institutional support in the form of training and provision of facilities. Teacher 1 highlighted the lack of time as a barrier to media innovation. Teacher 2 noted difficulties in aligning media with the diverse learning styles of students. Teacher 3 mentioned that the limited capacity of teachers due to inadequate training also hindered the effectiveness of media use. These findings suggest that optimal use of learning media requires systemic intervention, including reformulating teacher training policies and investing in educational infrastructure that supports active and meaningful learning.

The following table 2 is related to the Transcript of Interview with Teachers, namely:

Table 2. Transcript of Interview with Teachers

No	Interview Question	Teacher 1	Teacher 2	Teacher 3
1	What is your experience in teaching mathematics in 1st grade?	Has 10 years of experience. Believes that 1st grade students need a concrete and visual approach because they are not yet able to think abstractly.	Has taught for 5 years. Still exploring effective methods to make sure students understand basic concepts in an enjoyable way.	Has 15 years of experience. States that experience is an important factor in understanding the characteristics and learning needs of early-grade students.
2	How important is it for children to understand that the number of objects remains the same even if arranged differently?	Very important. Early childhood children often get caught up in visual perception, so this understanding is crucial in mathematics learning.	This is a very important foundational understanding. Children need to understand that numbers are fixed to be able to move on to more advanced mathematical concepts.	This understanding is very critical to avoid misconceptions. Children often misunderstand if they rely solely on visual forms.
3	Are students ready to understand the concept of quantity and numbers at the beginning of 1st grade?	Many students are not fully ready due to differences in background experiences.	Relatively ready if given an approach suitable for their age and prior	Most students are not fully ready. Consistent guidance and

		Gradual reinforcement and familiarization are needed.	experience in kindergarten.	repetition are needed.
4	What is your opinion on the current curriculum in terms of number recognition?	The curriculum is helpful but still too abstract. It needs to be integrated with concrete activities for students to better understand.	The curriculum is good enough, but it needs adjustments to fit local context and the characteristics of the students.	The curriculum does not provide enough room for exploring concepts through concrete experiences.
5	What challenges do you usually face when teaching the concept of quantity and numbers?	Students get bored quickly and have trouble maintaining focus, especially if the method is not varied.	Limited teaching media that suit the children's age. Self-made media are often less engaging.	Students are easily distracted, especially when activities are too repetitive or not applicable.
6	What media do you usually use to help students understand the concept of quantity?	Uses concrete objects like buttons, colorful blocks, and simple teaching aids.	Relies on picture cards, paper teaching aids, and self-made objects.	Uses real objects like plastic toys, replica food, and items from the surrounding environment.
7	What is your opinion on the use of concrete or digital media in teaching the conservation of number?	Concrete media are very effective, especially for visual learners. Digital media are also attractive but must be used under supervision.	Concrete media are easier to control, while digital media can be useful if used selectively and with guidance.	Digital media attract children's attention, but without guidance, they may cause students to lose focus on the learning objectives.
8	Do students show interest or difficulty when learning with these media?	Students show high interest if the media are interactive, but distractions can occur if digital media are used for too long.	Most students are enthusiastic, but some get confused if the media are unfamiliar or too abstract.	Children tend to enjoy playing with media, but are not always focused on understanding the concept.
9	In your opinion, what are the benefits of developing specific media for the conservation of number?	It helps deepen understanding as children learn from direct experiences, not memorization.	It makes the learning process more meaningful and provides a logical	It reinforces concepts through practice, allowing children to

			foundation from an early age.	build understanding gradually and contextually.
10	What is the biggest challenge you face in implementing mathematics learning media in 1st grade?	Limited teaching aids and time for exploration in the classroom. Lack of resource support.	Difficulty in adjusting media to meet the diverse learning needs of students.	Lack of teacher training and school facilities are the main obstacles in using effective learning media.

The conservation of number law is a key indicator of a child's cognitive readiness to access and develop formal mathematical concepts. A child’s ability to recognize that the quantity remains unchanged despite changes in the arrangement of objects indicates that they have reached the logical readiness to understand basic arithmetic operations. Students who possess this understanding are generally more prepared to grasp the concepts of addition, subtraction, and numerical representation strategies. In contrast, students who have not yet grasped the conservation of number law tend to rely heavily on sensory perception and are not yet able to think logically on their own. Therefore, an assessment of number conservation can serve as an early diagnostic tool to map students’ readiness to engage with mathematics learning, as well as a foundation for designing developmentally appropriate teaching approaches.

These findings are consistent with Jean Piaget’s (1977) theory of cognitive development, which classifies children aged 6-7 years as being in the transitional phase from the preoperational stage to the concrete operational stage. In this phase, children begin to apply the logic of conservation in concrete contexts through exploration and manipulation of real objects. A study by Siegler and Alibali (2014) confirmed that a child’s success in conservation tasks correlates positively with their ability to perform basic arithmetic tasks logically. Research by Sarama and Clements (2009) further emphasizes the importance of using manipulative media in early childhood mathematics education. They found that interventions based on concrete activities significantly enhance children’s understanding of numerical concepts and number structures. Thus, learning focused on direct experience and manipulation of real objects becomes crucial in building the foundation for mathematical thinking. Therefore, assessments based on the conservation of number law not only serve as diagnostic tools but can also be used as a basis for designing adaptive, contextual teaching strategies that align with the child’s developmental stage.

Conclusion

Based on the research findings, it can be concluded that the conservation of number law is a valid and meaningful indicator for measuring the mathematical learning readiness of first-grade students. The understanding that the quantity of objects remains constant despite changes in shape or arrangement serves as a key measure of early cognitive readiness in mathematics learning. The results show that not all students at the beginning of primary school have reached the concrete operational stage of development, with many still relying on visual perception to determine quantity. This underscores the essential role of teachers in developing concrete, contextual, and experience-based teaching strategies to support students in gradually building logical thinking skills. Assessments grounded in the conservation of number principle not only help map individual readiness but also inform the design of instructional approaches aligned with students' developmental stages. This study highlights the importance of using manipulative media and hands-on experiences in supporting foundational mathematical understanding. As a follow-up, future research will focus on the development of standardized, developmentally appropriate assessment tools, and the implementation and evaluation of concrete-experience-based learning models to enhance students' readiness for more complex mathematical concepts.

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