https://doi.org/10.15625/2615-8965/22510406

Theoretical Issues in Mathematics Readiness Preparation for First Grade in Kindergarten Children

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ABSTRACT: *The transition from preschool to primary education entails a critical shift from informal, play-based experiences to structured academic instruction, requiring careful preparation to ensure children's readiness. Within this process, mathematics occupies a central role as both an abstract and practical discipline, characterized by logical rigor and precision while simultaneously offering indispensable tools for reasoning, scientific inquiry, and everyday problem-solving. Mathematical knowledge and methodologies not only support the acquisition of core mathematical competencies but also serve as foundational resources for learning across disciplines. Consequently, fostering mathematical readiness has become a pivotal objective of early childhood education. This article explores both theoretical perspectives and practical challenges associated with preparing kindergarten children for Grade 1 mathematics learning. Special attention is given to the foundational factors that shape children's readiness, including cognitive, affective, and contextual dimensions. Methodologically, the study employs a comprehensive literature review of both national and international research to identify critical factors, highlight existing gaps, and synthesize effective practices. Based on this analysis, the article proposes a set of strategies aimed at equipping young learners to approach Grade 1 mathematics with confidence, curiosity, and enthusiasm, thereby contributing to a smoother and more effective transition into formal schooling.*

KEYWORDS: **Early childhood education, school readiness, elementary mathematics, preschool-to-primary transition, mathematics readiness.**

➔ Received 18/07/2024 ➔ Revised manuscript received 12/12/2024 ➔ Published 12/2/2026.

1. Introduction

The transition from preschool to primary school marks a significant milestone in a child's life. Changes in the learning environment, such as new classmates, new teachers, and new expectations, require children to adapt to a new setting (Margetts, 2004). Children also become familiar with new activities, social roles, and relationships as real students (Tran, 2020). To ensure children are well-prepared to adapt to learning activities in primary school, preschools have implemented programs for the holistic Development of young children for Five-Year-Old Children. These programs aim to promote physical Development, socio-emotional Development, language and communication, cognitive Development, aesthetic Development, and approaches to learning (Ministry of Education and Training, 2024). Among these, introducing children to mathematics is a key aspect of cognitive Development. Assoc. Prof. Dr. Chu Cam Tho emphasizes that mathematics offers vast opportunities to cultivate creative thinking in students through daily activities, visual experiences, and experiential learning (Chu, 2017). Organizing mathematical activities for pre-schoolers also aims to build thinking and cooperative competencies, aligning with the current educational reforms (Ho, 2018). Moreover, thinking is a form of knowledge and skill that can be taught, practiced systematically, assessed, and continuously refined (Chu, 2013). Teaching mathematics therefore aims to enhance intellectual development, cultivate thinking skills, and foster intellectual independence and creativity (Nguyen, 2004). Developing basic mathematical concepts gives children the foundation they need to enter formal schooling and contributes to their holistic personality development (Nguyen, 2023). In primary education, mathematics

accounts for a substantial part of the curriculum and plays an essential role in supporting students' thinking and learning outcomes. Preparing children for Grade 1 mathematics is therefore crucial. However, existing studies often address school readiness broadly, with insufficient attention to mathematical readiness, despite its particular importance in primary schooling. This paper addresses the following question: What preparations are necessary to ensure kindergarten children's readiness for Grade 1 mathematics learning? Based on a literature review, it clarifies the theoretical foundations of mathematical readiness and proposes recommendations to support the development of early mathematical competencies from the preschool stage.

2. Literature Review

According to A.V. Petrovski (1982), psychological readiness for school is the outcome of a child's prior psychological development and reflects the influence of both family and preschool education. Similarly, Dang (2008) emphasized that readiness for Grade 1 represents the convergence of physical, psychological, and social developmental conditions that enable children to meet the demands of primary education. Nguyen (1998) further argued that such preparation must be comprehensive, encompassing children's adaptation to school life as well as readiness for cognitive-based learning activities.

International studies have also reached similar conclusions, asserting that children's school readiness is shaped by multiple interacting factors, not only from the child but also from the family, school, and broader social environment (Torabian, 2019). Vietnamese research has shown that children who lack systematic preparation in terms of physical health, intellectual stimulation, and curiosity may struggle when entering Grade 1, often experiencing anxiety toward learning, teachers, and peers, which in turn negatively affects their academic outcomes (Huynh, 2013). Chu *et al*. (2023) highlighted that supporting children's transition to primary education is a mandatory requirement under the 2019 Education Law to ensure continuity and affirm the role of early childhood education. Other scholars (Tran, 2018; Nguyen, 2005; Bui *et al*., 2008) stressed that preparing children for school should not be limited to teaching literacy and numeracy, but should include the development of psychological prerequisites such as learning motivation, willpower, thinking, language, and essential social skills. Mai (2022) added that this preparation must holistically address children's physical, intellectual, personal, and adaptive capacities to facilitate successful integration into the new learning environment.

In addition to these perspectives, Piaget's theory of cognitive development provides a critical psychological foundation for understanding mathematics readiness. Piaget (1896–1980) identified four developmental stages: the sensorimotor stage (0–2 years), where intelligence is expressed through motor activities and early symbolic understanding; the preoperational stage (2–7 years), characterized by the emergence of language, memory, and imagination, but still dominated by egocentrism and limitations in logical reasoning; the concrete operational stage (7–11 years), when children begin to use logical operations on concrete objects and develop reversibility in thought; and the formal operational stage (11 years and above), marked by abstract reasoning and hypothetical thinking (Huitt & Hummel, 2003). Piaget recommended that early childhood educators should challenge children's abilities without exceeding their current developmental levels, using concrete experiences to foster mathematical understanding. This framework directly informs how mathematics content should be introduced in early childhood curricula, ensuring that teaching approaches align with children's developmental stages and cognitive capacities. Taken together, the literature consistently emphasizes school readiness as a core objective of early childhood education and highlights the multidimensional nature of preparation for primary schooling. However, readiness has often been discussed in broad terms, with limited attention to mathematics readiness, despite the critical role of mathematics in primary education. This gap underscores the need for further research to clarify the theoretical

foundations and practical strategies that can effectively support kindergarten children's readiness for Grade 1 mathematics learning.

3. Methodology

This study employs a structured literature review, guided by the research question: "What preparations are needed for kindergarten children to be ready for learning mathematics in Grade 1?" The review integrates both national and international research on mathematics readiness and early mathematical preparation at school entry. A systematic search was conducted for studies published between 1998 and 2024 using major Vietnamese academic databases and journal repositories, particularly the National Electronic Information Portal for Science and Technology (VISTA) (db.vista.gov.vn), complemented by searches in Google Scholar. The search strategy combined key terms including early childhood education, school readiness, elementary mathematics, preschool-to-primary transition, and mathematics readiness. To enhance completeness, additional studies were identified through reference tracing (snowballing) from highly relevant publications. The identification stage yielded 48 records, which were screened in three steps: (1) title screening, (2) abstract screening, and (3) full-text assessment for eligibility. Studies were included if they: (i) directly examined mathematics readiness or foundational mathematical competencies prior to Grade 1; (ii) focused on preschool-aged children or the preschool–primary transition; and (iii) analysed factors, principles, or strategies supporting children's preparedness for Grade 1 mathematics learning. Studies were excluded if they fell outside the scope, were not related to mathematics readiness, or were duplicates. Eligible studies were then subjected to full-text analysis and thematic synthesis. The included literature was organized into key strands, such as teachers' and parents' perspectives on preparing children for Grade 1 mathematics (e.g., Klein *et al*., 1998; Jung *et al*., 2019), children's early numeracy and mathematical awareness (e.g., Lee *et al*., 2008; Gjelaj, 2013), principles and approaches for early mathematics preparation (e.g., Clements, 2001), and factors influencing mathematics readiness at school entry (e.g., Bhise & Sonawat, 2016; Chere-Masopha, 2022; Segooa & Ntshangase, 2022; Segooa & Ntshangase, 2024). Through this synthesis, the review identifies key preparation components and critical considerations for supporting kindergarten children's readiness for Grade 1 mathematics learning.

4. Research Results

4.1. Key Issues in Mathematics Readiness Preparation for Kindergarten Children in Primary Education

4.1.1. Mathematics Readiness Preparation for First Grade in Kindergarten Children

Research has consistently shown that misconceptions among teachers about mathematics readiness remain a barrier to effective early childhood mathematics education. Some teachers perceive the purpose of introducing mathematics at the preschool level as merely providing children with basic skills in counting or facilitating the ease of addition and subtraction once they enter Grade 1. Others assume that preschool teachers should only introduce children to number recognition, leaving more complex mathematical understanding entirely to primary school teachers. Such limited perspectives oversimplify the nature of early mathematical learning and hinder the development of children's mathematical thinking and problem-solving capacities (Huynh, 2013).

In contrast, international studies highlight the importance of introducing mathematics in a systematic and developmentally appropriate manner. Notari-Syverson and Sadler (2008) argue that early and methodical exposure to mathematical symbols not only enhances children's familiarity with numbers but also builds confidence and psychological readiness to confront the challenges of Grade 1 mathematics. These findings resonate with the theoretical framework of Piaget, who emphasized that children's cognitive development progresses through stages, each providing different opportunities for mathematical exploration. At the sensorimotor and preoperational stages,

children are able to associate numbers with objects, develop early number sense, and begin to grasp fundamental mathematical relationships, though their thinking is still largely intuitive and egocentric (Ojose, 2008).

This theoretical perspective underscores the need for teachers to apply varied instructional strategies—visual, auditory, and kinaesthetic—that accommodate different learning modalities and foster deeper mathematical understanding (Chu, 2015). Equally important is the psychological foundation of mathematics readiness. Children's motivation, interests, and emotions play a pivotal role in how they approach and engage with mathematical tasks. If mathematical content is presented in ways that are overly abstract or disconnected from children's lived experiences, it may create anxiety or disengagement. Conversely, when mathematics is embedded in meaningful contexts—such as storytelling, games, or daily routines—it nurtures positive attitudes and enhances learning outcomes.

Play remains the dominant form of activity during the preschool years; however, as children approach the transition to Grade 1, play gradually gives way to more structured learning activities. This shift marks a critical period in which the integration of mathematics into both play-based and structured contexts becomes essential for ensuring continuity in learning and a smooth transition to formal schooling. Furthermore, mathematics readiness should be understood as part of a holistic approach to child development. The preparation process must not only address cognitive skills such as counting, comparing, and classifying but also foster emotional resilience, social competence, and self-regulation. These dimensions together constitute the readiness profile that enables children to adapt effectively to the demands of primary education. Collaboration between teachers and parents is also indispensable; through direct communication and shared activities, parents can reinforce mathematical concepts introduced at school, creating a consistent and supportive learning environment across contexts.

In summary, preparing children for mathematics learning in Grade 1 requires moving beyond narrow views of early mathematics as merely counting or number recognition. It involves a comprehensive approach that integrates developmental psychology, effective pedagogy, and socio-emotional support. By ensuring that mathematics readiness is approached systematically and holistically, educators can equip children with the cognitive, emotional, and motivational foundations necessary to engage successfully with mathematics in primary education.

4.1.2. Cognitive Characteristics of Kindergarten Children in Mathematics

In Vietnam, numerous studies have examined the cognitive characteristics of preschool children in relation to early mathematics learning, notably the works of Do Thi Minh Lien, Nguyen Anh Tuyet, Nguyen Thi Nhu Mai, Nguyen Quang Uan, Nguyen Van Luy, Dinh Van Vang, and Dinh Thi Kim Thoa, etc. (Do, 2007, Nguyen & Nguyen, 2008, Nguyen *et al.*, 2016; Dinh 2018; Do Thi Minh Lien, 2016; Dinh Thi Nhung, 2018). Collectively, these works provide a comprehensive understanding of the developmental trajectories that shape young children's early engagement with mathematical concepts. Broadly speaking, these characteristics can be categorized into general cognitive traits—including perceiving through actions, relying heavily on sensory input, and progressing from simple to complex—and specific developmental features that emerge in children aged 5–6 years.

With respect to number sense and counting, children gradually expand their understanding of quantity by recognizing that "one" may signify either a single object or a set of multiple objects. This ability reflects an important developmental shift from perceptual to conceptual thinking. At this stage, children are able to identify numbers up to 10, perform simple counting tasks, and solve elementary problems within this range, thereby laying the groundwork for arithmetic operations in Grade 1.

In terms of size and measurement, pre-schoolers develop the capacity to distinguish

objects across three dimensions and begin to use basic measurement tools such as sticks or simple rulers. Although their grasp of standardized units (e.g., centimetres, meters) remains incomplete, they start to establish connections between objects, the tools applied, and the results obtained. This stage of development is critical, as it introduces children to the relational nature of measurement, which will later be consolidated through formal instruction.

Regarding geometric shapes, children show marked improvements in their ability to differentiate forms through coordinated hand–eye activities. By actively manipulating objects with their hands and tracing outlines with their eyes, they acquire a more precise sense of shape properties. The parallel development of language skills further enhances their capacity for memory, classification, and generalization. As a result, children become able to identify solid figures, distinguish between two- and three-dimensional representations, and categorize objects based on boundary or surface features.

The development of spatial orientation represents another important domain. Children begin to conceptualize space as divisible into sub-areas, demonstrate awareness of spatial unity, and identify directional cues such as left–right, up–down, and front–back. Initially, spatial judgments rely on egocentric reference points—using the child's own body as a marker—but gradually evolve toward allocentric perspectives, in which external objects serve as reference points. This progression marks a significant advancement in flexible spatial reasoning, an essential cognitive skill for future problem-solving and geometry learning.

Similarly, time orientation undergoes important refinements during the preschool years. Children increasingly differentiate temporal concepts such as "before," "after," "now," and "earlier," though some confusion may persist. They acquire the ability to identify intervals of the day not only through their own activities but also by observing environmental cues such as sunlight, sky colour, and temperature changes. Concepts of days and weeks become more accurate and meaningful, often linked to routine experiences (e.g., associating Monday with the first day of school or Sunday with family rest). Children also begin to form early notions of seasons, interpreting them through contrasting weather conditions, which represent an initial integration of natural science with temporal reasoning.

Taken together, these findings demonstrate that the cognitive development of preschool children provides a robust and multidimensional foundation for mathematics readiness in Grade 1. However, they also highlight the responsibility of educators to design learning experiences that intentionally connect these developmental characteristics with the requirements of formal schooling. For instance, familiarity with number sets and counting directly supports the acquisition of arithmetic skills, while spatial and temporal orientation underpin learning in geometry and problem-solving within the primary curriculum. Moreover, an effective readiness program must adopt a holistic perspective, integrating cognitive, social-emotional, and motivational dimensions. By doing so, teachers not only equip children with essential knowledge and skills but also foster confidence, curiosity, and resilience—qualities that are indispensable for a successful transition into the mathematics learning journey in primary education.

4.1.3. Standards for Mathematical Familiarization Activities in the Cognitive Development Domain for 5-year-olds

The promulgation of the developmental standards for 5-year-old children under Decision No. 4222/QĐ-BGDĐT (2024) provides not only an essential legal framework but also a pedagogical cornerstone for preparing children's mathematics readiness prior to entering Grade 1. Within the cognitive domain, Standards 15 and 16 are of particular relevance to mathematics education, as they encompass competencies in number skills, measurement, shapes, patterns, and spatial and temporal orientation (indicators 42–49). Collectively, these indicators represent the expected learning outcomes that five-year-old children should achieve as a result of systematic educational influence in preschool

settings. Importantly, these standards do more than outline competencies; they establish a curriculum framework that ensures alignment and continuity between preschool and primary education. For example, indicator 42, which requires children to compose and decompose quantities within 10, is not merely an isolated skill but a developmental milestone that introduces children to the concept of number relations. Mastery of this indicator develops early number sense and lays the foundation for understanding addition and subtraction in Grade 1. Similarly, indicators related to shapes, measurement, and spatial-temporal orientation promote reasoning skills and support the development of problem-solving abilities, which are core components of mathematical thinking.

The developmental levels defined as achieved and unachieved offer clear benchmarks for teachers, enabling them to monitor progress, identify learning gaps, and adjust instructional strategies accordingly. Suggested exercises accompanying each indicator further translate policy into practical pedagogical actions, bridging the gap between theoretical expectations and classroom realities. However, beyond their technical application, these standards reflect fundamental insights from Developmental Psychology. At the age of 5–6, children are transitioning from perceptual forms of counting and classification toward conceptual understanding, making them capable of internalizing numerical relationships, grasping conservation concepts, and applying symbolic reasoning. This is consistent with Piaget's stages of cognitive development as well as contemporary socio-constructivist approaches, which emphasize the role of guided interaction and scaffolding in advancing mathematical competence. Furthermore, the standards highlight the importance of adopting a holistic approach to mathematics readiness. By integrating cognitive, emotional, and social dimensions, the framework ensures that children are not only equipped with mathematical skills but also develop confidence, persistence, and curiosity—key dispositions that sustain long-term engagement with mathematics. This alignment between preschool outcomes and primary education requirements responds to both national priorities and global trends in early childhood education, where continuity and coherence across educational stages are regarded as critical to preventing learning gaps.

In summary, the developmental standards for 5-year-old children provide a legally grounded, pedagogically sound, and developmentally appropriate foundation for mathematics readiness. They function simultaneously as a curriculum guide, an assessment benchmark, and a psychological roadmap, ensuring that all children acquire the knowledge, skills, and dispositions necessary to transition smoothly and successfully into mathematics learning in Grade 1.

4.1.4. Principles for Mathematics Readiness Preparation for First Grade in Kindergarten Children

The principles for introducing mathematics to preschool children emphasize not only scientific accuracy and age-appropriate content but also the integration of learning with practice, the use of visualization, and the creation of systematic, sequential, and developmental learning pathways (Pham *et al*., 2024). These principles reflect a child-centred pedagogical orientation that acknowledges both the cognitive and socio-emotional needs of young learners. Mathematics, at the preschool level, should not be reduced to rote memorization or premature exposure to formal algorithms; instead, it should cultivate curiosity, enhance logical reasoning, and foster problem-solving dispositions through meaningful, age-appropriate activities.

These principles are closely aligned with the 2024 Developmental standards for 5-year-old children issued by the Ministry of Education and Training, which establish 22 standards and 70 indicators across six developmental domains: physical, socio-emotional, language and communication, cognitive, aesthetic, and learning approaches. Within this national framework, mathematics readiness is embedded in the cognitive domain, encompassing number and counting skills, measurement, representation of results, identification of shapes, arrangement of patterns, and orientation in space and time.

The explicit articulation of these skills highlights the role of mathematics as both a

distinct area of knowledge and a cross-cutting competency that supports broader developmental goals. Beyond specifying expected outcomes, the standards provide benchmarks for monitoring and evaluating developmental progress, thereby offering teachers clear criteria for identifying both strengths and areas requiring further support. This evaluative function not only ensures accountability but also allows for the adaptation of teaching methods to children's cognitive characteristics and developmental trajectories. For example, children at age 5–6 are in the transitional stage between intuitive and logical thinking; therefore, instructional strategies must be carefully scaffolded to move them from perceptual experiences (e.g., manipulating objects) to conceptual understanding (e.g., recognizing numerical relations or geometric properties).

A crucial principle of mathematics readiness is the avoidance of premature instruction of the Grade 1 curriculum. Research has consistently shown that teaching beyond children's developmental capacity may lead to stress, demotivation, and misconceptions. Instead, preparation should focus on ensuring that children meet the objectives and expected outcomes of the preschool education curriculum, which has been deliberately designed to align with the developmental profile of five-year-olds. This natural alignment with the primary mathematics curriculum promotes continuity and prevents learning gaps at the transition stage.

Another key principle is the active involvement of families and communities. Family–school collaboration fosters consistency across learning environments, reinforces positive attitudes toward mathematics, and creates opportunities for children to apply mathematical thinking in authentic contexts such as shopping, cooking, or play. Furthermore, organizing visits to primary schools, engaging in joint activities with first-grade teachers, and providing children with gradual exposure to the new learning environment are strategies that significantly reduce anxiety and build familiarity, thereby supporting a smoother transition.

Taken together, these principles and standards establish a holistic and developmentally appropriate foundation for mathematics readiness. They simultaneously serve as curriculum guidelines, assessment criteria, and pedagogical directions. By embedding mathematics within a broader developmental framework, the approach ensures both vertical continuity between preschool and primary education and horizontal integration across domains of development. Most importantly, it cultivates children's confidence, curiosity, and enthusiasm—qualities that not only prepare them for mathematics learning in Grade 1 but also nurture lifelong positive dispositions toward learning and problem-solving.

4.1.5. Factors Influencing Mathematics Readiness Preparation for First Grade in Kindergarten Children

Numerous studies in developmental psychology, both domestic and international, highlight the multi-dimensional factors influencing kindergarten children's psychological growth and their readiness for mathematics learning. These factors can be systematically categorized into biological, familial, educational, social, and individual domains, each contributing in distinctive yet interconnected ways.

From a biological perspective, genetic conditions form the foundation for children's cognitive capacity, temperament, and learning potential. However, this potential is not self-actualizing; it requires interaction with environmental stimuli to be effectively nurtured. Biological predispositions such as attention span, memory capacity, and processing speed provide the raw material for mathematical thinking, but only in supportive environments do these traits evolve into practical competencies.

Family factors exert a particularly significant influence during the preschool years, as the home represents the earliest and most consistent learning environment. Supportive parental involvement, positive attitudes toward mathematics, and the creation of enriched home learning settings—such as engaging in counting activities, playing number-related games, or integrating mathematics into daily routines—substantially enhance children's readiness (Melhuish *et al*., 2008; Missall *et al*., 2015). Conversely, low

parental engagement, early exposure to formal instruction without sensitivity to developmental stages, or excessive academic pressure may not only hinder motivation but also foster negative attitudes toward mathematics.

At the institutional level, schools provide structured curricula, teaching resources, and assessment systems that are indispensable for fostering cognitive and socio-emotional development. Yet, the effectiveness of these elements depends largely on teacher competence, pedagogical strategies, and the degree to which instruction aligns with children's cognitive characteristics (Nguyen, 2007). Deficiencies such as infrequent formative assessment, limited use of problem-based or experiential learning, and curricula that exceed children's developmental readiness can lead to disengagement and anxiety. By contrast, responsive pedagogy that integrates play, inquiry-based learning, and cross-disciplinary approaches can strengthen both competence and enthusiasm for mathematics.

Social and cultural environments also play a vital role in shaping children's dispositions toward learning. Peer interactions, community values, and cultural traditions around education and numeracy all influence how children perceive and approach mathematics. A socially rich environment that values curiosity, collaboration, and problem-solving promotes resilience and confidence, while contexts characterized byy inequality or limited resources may restrict opportunities for mathematical exploration.

Finally, individual factors—including curiosity, intrinsic motivation, learning styles, and prior experiences—are decisive in shaping mathematics readiness. Children who are naturally curious and actively engaged in exploring their environment demonstrate stronger attention, persistence, and enthusiasm for mathematics learning. By contrast, those perceiving mathematics as abstract, tedious, or overly difficult may display avoidance behaviors and reduced readiness (Mai, 2012; Chu, 2017).

These findings reinforce the necessity of designing individualized and differentiated learning experiences that cater to children's diverse cognitive profiles and motivational orientations. Taken together, these findings suggest that psychological readiness for mathematics is not determined by a single factor but rather emerges from the dynamic interplay among genetic dispositions, family practices, institutional quality, cultural environments, and children's personal characteristics. Among these, family engagement and effective school pedagogy appear to exert the most decisive influence, underscoring the importance of a collaborative, child-centered approach. Ensuring continuity between home and school, reducing academic pressure, leveraging play-based and experiential strategies, and fostering intrinsic motivation are essential strategies for building positive dispositions toward mathematics. Ultimately, a holistic and ecologically grounded framework is necessary to ensure that all children enter Grade 1 with the confidence, curiosity, and foundational competencies required for successful engagement with mathematics.

4.2. Recommendations for Supporting Mathematics Readiness Preparation for First Grade in Kindergarten Children

Preparing kindergarten children for mathematics learning in Grade 1 requires a comprehensive approach that integrates environmental design, pedagogical strategies, curriculum continuity, and collaboration across educational levels.

First, it is essential to establish a rich learning environment, both physical and psychological. A well-designed classroom equipped with attractive learning materials, thematic decorations, and interactive toys stimulates children's curiosity, imagination, and creativity. Beyond the physical setting, teachers should foster a positive psychological climate where children feel safe and comfortable to explore mathematical concepts naturally and without pressure. Encouraging children to take part in classroom decoration, organize learning corners, and collect mathematical objects reinforces autonomy and cultivates enthusiasm for learning.

Second, mathematics should be integrated into daily routines and across learning domains. Mathematics is not confined to counting or

shape recognition but is embedded in children's everyday experiences. Teachers can incorporate familiar activities such as measuring ingredients, sorting objects, or identifying shapes during play. Interdisciplinary integration is equally important—for instance, counting characters in a story, using numbers to support rhythm in music, or creating art with geometric forms. This approach connects mathematics to real-life contexts, while simultaneously developing logical thinking, creativity, and cognitive flexibility.

Third, ensuring continuity and coherence between preschool and primary school curricula is vital. Mathematical experiences in preschool should be aligned with primary school requirements, creating a solid foundation for the transition. Teachers are encouraged to use flexible and formative assessments to monitor children's readiness and adapt instructional practices accordingly. It is particularly important to avoid prematurely introducing formal primary-level content, as doing so may create unnecessary stress and diminish children's natural curiosity.

Fourth, collaboration between preschool and primary education should be strengthened. Preschools and primary schools should organize professional exchanges, classroom observations, and joint discussions between teachers from both levels. This collaboration enables preschool teachers to better understand Grade 1 expectations, while primary school teachers gain insights into preschool methodologies. Such alignment supports the design of learning experiences consistent with Vygotsky's concept of the zone of proximal development (ZPD), ensuring that instruction is developmentally appropriate and promotes continuity in learning.

Fifth, educators should prioritize the development of observation, perception, and classification skills. Children should be encouraged to explore objects using multiple tools and sensory modalities, analyse their features, and classify them according to different criteria. Systematic observation—moving from general to detailed perspectives—helps build analytical thinking, which serves as a foundation for mathematical reasoning.

Sixth, mathematics-related games should be widely employed as an effective pedagogical tool. Games designed in accordance with children's cognitive levels not only reinforce knowledge and enhance retention but also stimulate motivation, persistence, and cooperation. The regular use of such games provides teachers with opportunities to assess children's progress informally and naturally.

Finally, technology should be incorporated as a complementary tool in mathematics instruction. Age-appropriate software, interactive applications, smart boards, and digital games can create dynamic and engaging learning experiences. However, technology must be balanced with hands-on, experiential learning to ensure the simultaneous development of logical thinking and problem-solving skills. In conclusion, preparing children for mathematics readiness requires an integrated strategy that encompasses stimulating environments, practical activities, curriculum alignment, cross-level collaboration, cognitive skill development, mathematics games, and technology. When implemented systematically and coherently, these elements equip children with the confidence, enthusiasm, and competencies necessary to embark successfully on their mathematics learning journey in primary school.

5. Discussions

The transition from preschool to primary school is a critical phase in a child's educational journey, particularly in preparing for mathematics readiness in Grade 1. This stage involves not only adapting to a new learning environment but also meeting new demands in mathematical knowledge, logical thinking skills, concentration, and adaptability to different learning methods. Through the analysis of theoretical and practical issues and proposed recommendations it is evident that children need to build confidence in approaching basic mathematical concepts such as counting, comparing, recognizing shapes, and understanding numerical relationships. Supporting children in math readiness requires

a continuous and comprehensive preparation process, involving close collaboration between the child, family, and school. Parents play a foundational role in encouraging children to actively engage in learning activities and providing opportunities to practice mathematics in real-life situations, such as measuring, simple calculations, and problem-solving. They should also maintain a friendly and safe learning environment, fostering children's interest in mathematics. Schools need to design appropriate and engaging math activities that connect with skills already developed at the preschool level. Teachers should focus on fostering a positive learning mindset, helping children view mathematics not as a significant challenge but as a practical tool in life. Additionally, families and schools should regularly communicate to ensure a consistent approach, from the use of mathematical language to supporting children in overcoming challenges in learning math. This collaboration not only promotes success during the transition period but also lays a solid foundation for the development of mathematical thinking in later stages of education. The research findings and recommendations from this discussion aim to contribute to enhancing the quality of preschool education and establishing a strong foundation for children's future learning in mathematics.

6. Conclusions

Preparing kindergarten children for mathematics learning before they enter Grade 1 is a vital mission of early childhood education and is critical for a successful transition to primary school. The analysis demonstrates that mathematics readiness extends beyond basic numerical skills such as counting, comparing, or shape recognition, encompassing cognitive development, socio-emotional growth, and the supportive involvement of families and schools. However, most existing studies have focused primarily on general aspects of school readiness, while the specific role of mathematics remains underexplored. This paper contributes to the field by systematizing theoretical foundations and offering recommendations to support teachers, parents, and educational administrators in preparing children for mathematics learning. Future research should develop comprehensive assessment frameworks and practical solutions to ensure that all children enter primary school with the confidence and competencies necessary to embark confidently on their mathematics learning journey.

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