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The Impact of Age and Gender on Cognitive Outcomes among Typically Developing Preschool Children in China

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Abstract
Cognitive outcomes have the irreplaceable function of ensuring survival and promoting growth for children's development, especially in early childhood. This study examines the impact of age and gender on cognitive outcomes in typically developing preschool children in China. Assessing four key cognitive outcome constructs (verbal concept, visual discrimination, logical relations, and basic school skills), provides insights into the developmental trajectories of these cognitive abilities during the preschool period. Results show no significant gender differences, but age plays a crucial role, with older children demonstrating higher cognitive outcomes. The preschool period is a critical time for cognitive development, influencing future academic and social competencies. Understanding early cognitive growth is essential for designing effective interventions and supporting children's overall development. Further research is needed in diverse contexts to enhance generalizability.
Keywords: Cognitive Outcomes, Age, Gender, Preschool Children, China

Introduction

Cognitive development during early childhood is a crucial period that sets the foundation for children's academic and social competencies in later years (Nesbitt et al., 2019; Oberer et al., 2018). Understanding the factors that influence cognitive outcomes in preschool children is

essential for promoting effective early education and intervention programs. Among the potential factors, age and gender have been subjects of interest in numerous studies exploring cognitive development differences (Kim et al., 2018; Fischer et al., 2017; Osorio-valencia et al., 2018; Pitchford et al., 2016). In the context of China, where cultural norms and educational systems may shape children's learning experiences, investigating the impact of age and gender on cognitive outcomes becomes particularly relevant.

The present study aims to examine the influence of age and gender on cognitive outcomes among typically developing preschool children in China. Specifically, we explore four key cognitive constructs: verbal concept, visual discrimination, logical relations, and basic school skills. By focusing on these cognitive abilities, we aim to gain insights into the developmental trajectories of preschoolers and identify any potential gender-based differences that might be present in this population.

Prior research on gender differences in cognitive development has yielded mixed results, with some studies suggesting possible disparities in specific cognitive domains, while others finding no significant differences (Osorio-valencia et al., 2018; Pitchford et al., 2016). Moreover, studies exploring the impact of age on cognitive outcomes have emphasized the dynamic nature of cognitive development during early childhood (Kim et al., 2017; Fischer et al., 2017). However, it remains essential to investigate these factors in the unique cultural context of China, as cultural norms and societal expectations may influence cognitive development differently in this setting.

The significance of this research lies in its potential implications for educators, parents, and policymakers. This study has broader implications for the field of early childhood development and educational research. By comprehensively evaluating cognitive outcomes within this study, researchers can achieve a deeper understanding of preschool children's cognitive development. To be specific, by understanding how age and gender might shape cognitive outcomes in Chinese preschool children, we can tailor educational strategies and interventions to meet the specific needs of different groups. Additionally, the findings can contribute to the broader field of cognitive development research, enhancing our understanding of early childhood cognitive trajectories across diverse cultural contexts.

In the subsequent sections, we will discuss the methodology employed in this study, present our findings, and analyze the results in the context of existing literature. By shedding light on the impact of age and gender on cognitive outcomes in typically developing preschool children in China, this research aims to contribute to the growing body of knowledge in developmental psychology and inform evidence-based practices for early childhood education.

Literature Review

Cognition, cognitive skills, cognitive development, and cognitive outcomes are related terms that are often used in the context of understanding human mental processes and abilities. However, they have distinct meanings and implications. Cognition refers to the general process of acquiring, processing, and using knowledge and information through mental activities such as perception, attention, memory, reasoning, problem-solving, and decision-making. It encompasses all mental processes involved in understanding, thinking, and learning (Callaghan et al., 2011). Cognitive skills are specific abilities or capacities that are part of the broader cognitive process. These skills are the building blocks of cognition and are essential for various intellectual tasks. Examples of cognitive skills include attention, memory, language comprehension, mathematical reasoning, and spatial awareness (Tandon et al.,

2016). Cognitive development refers to the progressive and systematic growth and improvement of cognitive abilities and skills over time. It encompasses the changes in thinking, reasoning, and problem-solving that occur from infancy through adulthood. Cognitive development is shaped by both genetic factors and environmental experiences (Miller & Krajcik, 2019).

Cognitive outcomes refer to the measurable results or achievements related to an individual's cognitive abilities, processes, and skills. These outcomes reflect the level of cognitive development, knowledge acquisition, and problem-solving capabilities attained by an individual within a specific context or timeframe. Cognitive outcomes are a critical aspect of understanding and assessing human cognitive functioning and intellectual growth (Tandon et al., 2016). The definition of cognitive outcomes can encompass a wide range of cognitive abilities and domains. It depends on the specific context and age group being studied. For preschool children, cognitive outcomes may be assessed through play-based activities, observations, and age-appropriate tasks. Therefore, in the resent study, the specific aspects of cognitive outcomes that were evaluated in the study include: reasoning skills, visual organization and discrimination, receptive and expressive vocabulary, and basic school skills.

In summary, cognition is the overarching concept that encompasses all mental processes, while cognitive skills are specific abilities that contribute to cognition. Cognitive development refers to the overall growth and improvement of cognitive abilities over time, and cognitive outcomes are the observable results of cognitive development and skills in practice. Understanding these terms is important in studying and assessing cognitive functioning and its impact on various aspects of human behavior and learning.

The debate on the elements of cognitive outcomes for preschool children revolves around the complexity and interrelatedness of these outcomes, as well as the challenge of assessing and measuring them accurately in young children (Osorio-valencia et al., 2018; Pitchford et al., 2016; Kim et al., 2018; Fischer et al., 2017). Preschool children are at different stages of cognitive development, and their abilities can vary widely. There is a debate about how to define age-appropriate cognitive outcomes, considering the diverse cognitive trajectories in early childhood. In addition, the debate also addresses the influence of cultural and environmental factors on cognitive outcomes(Kim et al., 2018; Fischer et al., 2017). Some argue that cognitive development is highly influenced by the child's age, gender, cultural background and the quality of their home environment, while others emphasize universal cognitive milestones (Osorio-valencia et al., 2018; Pitchford et al., 2016).

Cognitive outcomes encompass various domains such as language, memory, attention, problem-solving, and social cognition. The challenge lies in understanding the interplay between these domains and how they collectively contribute to a child's overall cognitive abilities.Optimal cognitive development in early childhood involves the emergence and development of cognitive skills in multiple domains. Indicators of cognitive skills are varied such as intelligence (Suggate et al., 2019; Galdi et al., 2015) and academic skills involving reading (Pitchford et al., 2016; Suggate et al, 2019; Michel et al., 2019; Oberer et al., 2018; Chang & Gu, 2018) and math (Kim et al., 2017; Fischer et al., 2017; Osorio-valencia et al., 2018; Pitchford et al., 2016; Nesbitt et al., 2019; de Waal, 2019; Oberer et al., 2018).

For example, in the area of language, children must acquire the ability to understand and generate increasingly complex language in order to communicate with others (Michel et al., 2019). Regarding memory, children must acquire the ability to encode information in memory and access long-term memory through recognition and recall mechanisms even with increasing delay (Suggate et al., 2019). In the spatial domain, children must acquire the ability

to encode and use information about the spatial organization of objects and arrangements and use it to control grasping and motor behavior (Osorio-valencia et al., 2018). Healthy brain development during early childhood promotes optimal cognitive development and lays the foundation for future cognitive and academic success (Carson et al., 2016).

Therefore, cognitive outcomes refer to the degree of cognitive development that is related to many domains. In the present study cognitive outcomes are regarded as the performance of children in the context that cognitive skills are required. In other words, cognitive outcomes refer to the results of cognitive activities including not only basic cognitive skills but also academic achievement in the kindergarten. To be specific, visual organization and discrimination, reasoning skills, basic school skills and receptive and expressive vocabulary are investigated as the components of cognitive outcomes in the present study.
Cognitive outcomes are critical aspects of preschool children's functioning (Scionti et al., 2020). It enables them to understand and adapt to the world, interact with others, take care of themselves, and meet various demands. Research in this area has been increasing, with studies covering various perspectives and aspects of cognitive development (Donnelly et al., 2016).

Some studies have investigated the influence of family, upbringing environment, and social factors on children's cognitive outcomes (Smith et al., 2006). Others have focused on social cognitive development and its connection to behaviors like aggressive behavior in young children (Lochman & Wells, 2002). The cognitive outcomes of rural children has also been studied, revealing the impact of factors such as the type of kindergarten and the level of teachers (Celik, 2020). Comparative studies have also been conducted to understand differences in cognitive outcomes between urban and rural areas (Roberts et al., 2022). Family factors like parents' occupation, education, economic status, and whether they are the only child were found to affect children's cognitive outcomes (Tomasi & Volkow, 2021).

Furthermore, research on children's cognitive development has emphasized its relationship with reading, language, and academic achievement. Reading was found to have a positive impact on cognitive development in teenagers and college students (Del Boca, Monfardini & Nicoletti, 2017). Better cognitive development was associated with higher levels of literacy learning (Purpura et al., 2017), and cognitive development was shown to have a restricting effect on learning (Tomporowski et al, 2015). Good peer relationships were also found to play a significant role in children's cognitive development (Aftab et al., 2021).

Moreover, studies have explored the association between cognitive skills and motor skills in children, with evidence indicating that motor skills are related to cognitive development, language, and social interactions (Leonard & Hill, 2014). Better academic performance has been linked to higher fitness levels in both elementary and secondary school children (Wittberg et al., 2020; van der Niet et al., 2014; Xu, 2021). Cognitive flexibility, essential for task switching, has been shown to affect reading and math performance (Magalhães et al., 2020). Additionally, inhibitory control has been identified as important in task shifting, especially in environments with changing attention targets (Liu et al., 2015). Attention has been recognized as a key variable in predicting children's academic achievement (Burgoyne & Engle, 2020). Coping plans and cognitive flexibility have been found to be related to academic performance, particularly in mathematics and reading (Best, Miller & Naglieri, 2011; van der Niet et al., 2014).

To conclude, several previous studies have investigated cognitive outcomes for preschool children, examining various aspects of cognitive development and its impact on academic achievement and other domains. Previous studies on cognitive development for

preschool children have consistently highlighted the crucial role of age and gender in shaping various aspects of cognitive development and academic performance. These studies emphasize the significance of early cognitive abilities in predicting school readiness and academic achievement later in life.

Methodology

The research sample consists of 222 Chinese preschool children, which is determined based on the well-established sampling technique. The location of the study is in Shaanxi Province, China. From the pool of children who returned a parental approval, and with the help of the preschool teacher, one-on-one direct child assessments on cognitive outcomes were conducted. All the data of the present study were kept confidential and anonymous.

Early Screening Profiles published by American Guidance Service, which is a compilation of items from some well-known measurements, Vineland Adaptive Behavior Scales, Bruininks-Oseretsky Test of Motor Proficiency, the Kaufman Assessment Battery for Children, and others (Harrison, 1990). It is a standardized instrument for preschool-aged children from 3-5 years that is easy to conduct requiring only around 30 minutes to complete. There are domains measured by three basic profiles (cognitive and language profile; motor profile; self-help and social profile). The specific aspects of cognitive outcomes that will be evaluated in the study include:

Reasoning Skills: this aspect examines a child's ability to think logically, problem-solve, and make connections between different pieces of information. Reasoning skills play a vital role in a child's cognitive development and are essential for academic success.

Visual Organization and Discrimination: this assessment evaluates a child's ability to perceive, organize, and differentiate visual information. Visual organization and discrimination skills are crucial for understanding visual stimuli and learning from visual cues in the environment.

Receptive and Expressive Vocabulary: this aspect measures a child's ability to understand and use words in both receptive (listening and comprehension) and expressive (speaking and communication) language tasks. Vocabulary development is fundamental for communication and language comprehension.

Basic School Skills: this assessment likely encompasses a range of academic skills relevant to the kindergarten setting, such as letter recognition, number concepts, and early literacy and numeracy abilities.

Existing statistics have suggested that this instrument has good internal consistency among different subscales (0.89-0.95). Test-retest reliability of each profile or subscale is all above 0.80 except motor profile which is 0.70. Interrater reliability for diverse subscales differs from 0.80 to 0.99. In terms of concurrent validity of the Early Screening Profiles (ESP), the cognitive language profile correlates significantly with the Kaufman Assessment Battery for Children standard score for achievement (0.83) and Battelle Developmental Inventory Screening Test total score (0.62). In general, this instrument has both excellent reliability and validity (Harrison, 1990)

Data collected from these instruments was coded, computed and analyzed using the Statistical Packages for the Social Science (SPSS) version 22.0. To be specific, independent sample T test was used for testing the difference on valuables between boys and girls in SPSS

firstly. Secondly, one-way ANOVA was used for testing the difference on valuables among different age groups in SPSS. Thirdly, multiple comparison in terms of manifest valuables among age 3; age 4; and more than age 5 is conducted using Scheffe test, one-way ANOVA in SPSS. These results provide developmental features and norm scores on cognitive outcomes for Chinese preschool children from 3 to 5 years old.

Finding

An independent sample t-test was performed in SPSS to examine the differences in physical well-being between boys and girls. The total sample consisted of 114 boys and 108 girls, with similar sample sizes for both groups. The results of the t-test are as follows: boys' mean score of visual discrimination was 8.91, slightly higher than girls' mean score of 8.75; boys' mean score of logical relations was 8.82, slightly higher than girls' mean score of 8.59; and boys' mean score of basic school skills was 4.64, slightly higher than girls' mean score of 4.17. On the other hand, girls' mean score of verbal concept was slightly higher than boys' with a mean score of 19.37 compared to boys' mean score of 19.18.

However, the t-test results indicated that there were no significant differences between boys and girls in terms of all the constructs of cognitive outcomes, including verbal concept, visual discrimination, logical relations, and basic school skills ($p > 0.05$). This suggests that the degree of cognitive outcomes development is quite similar between boys and girls during the preschool period.

In summary, the results indicate that while there may be slight differences in specific components of physical well-being between boys and girls, there are no significant differences in cognitive outcomes development between the two genders during the preschool period. These findings highlight the importance of providing equal opportunities and support for both boys and girls to foster their cognitive development during this crucial stage of early childhood.

Table 1
Gender Difference on Cognitive Outcomes

	t-test for Equality of Means				Sex	N	Mean	SD
	t	df	Sig	MD				
Verbal Concepts	-0.506	220	0.613	-0.195	Male	114	19.18	3.02
					Female	108	19.37	2.702
Visual Discrimination	0.46	220	0.646	0.162	Male	114	8.91	2.544
					Female	108	8.75	2.714
Logical Relations	0.64	220	0.523	0.232	Male	114	8.82	2.894
					Female	108	8.59	2.476
Basic School Skills	0.313	220	0.755	0.186	Male	114	12.32	4.64
					Female	108	12.14	4.17

Table 2 displays the mean scores, sample size, and standard deviations of cognitive outcomes for each age group: age 3, age 4, and more than age 5. Due to the limited sample size of age group 6 (only 15 participants), statistical results may be inaccurate due to the large difference in group sample size compared to age group 4 (106). To address this issue, age group 5 and age group 6 were combined into a single category labeled "more than 5 years." The mean scores and standard deviations of verbal concepts for each age group were as follows: 17.33 ± 2.919 for age 3, 19.09 ± 2.635 for age 4, and 21.33 ± 1.61 for more than 5 years. On the other hand, for visual discrimination, the mean scores were 7.27 ± 2.329 for age

3, 8.68 ± 2.646 for age 4, and 10.51 ± 1.757 for more than 5 years. For logical relations, the mean scores were 7.42 ± 2.891 for age 3, 8.71 ± 2.715 for age 4, and 9.89 ± 1.845 for more than 5 years. Finally, for basic school skills, the mean scores were 9.07 ± 3.447 for age 3, 11.75 ± 3.617 for age 4, and 15.92 ± 3.827 for more than 5 years.

It is evident from the data that the mean scores of every aspect of cognitive outcomes increase gradually with age. Verbal concepts, visual discrimination, logical relations, and basic school skills all show developmental improvements as children grow older during the preschool period. By combining age group 5 and age group 6 into a single category, more accurate statistical analyses can be conducted to represent the developmental changes in cognitive outcomes across the preschool age groups. These findings offer valuable insights into the developmental trajectories of different aspects of cognitive abilities in young children.

Table 2
Mean Score of Cognitive Outcomes among Age Groups

Age		Verbal Concepts	Visual Discrimination	Logical Relations	Basic School Skills
3	Mean	17.33	7.27	7.42	9.07
	N	55	55	55	55
	Std. Deviation	2.919	2.329	2.891	3.447
4	Mean	19.09	8.68	8.71	11.75
	N	106	106	106	106
	Std. Deviation	2.635	2.646	2.715	3.617
5	Mean	21.33	10.51	9.89	15.92
	N	61	61	61	61
	Std. Deviation	1.61	1.757	1.845	3.827
Total	Mean	19.27	8.83	8.71	12.23
	N	222	222	222	222
	Std. Deviation	2.865	2.623	2.695	4.409

A one-way ANOVA analysis was conducted in SPSS to examine the differences in cognitive outcomes among the different age groups: age 3, age 4, and more than age 5. The results are presented in Table 3, which shows the significance levels for verbal concept, visual discrimination, logical relations, and basic school skills. The analysis revealed that the differences in verbal concept, visual discrimination, logical relations, and basic school skills among the three age groups were all statistically significant ($p < .05$). This finding indicates that all aspects of cognitive outcomes, including verbal concept, which involves language and communication abilities, visual discrimination, which pertains to the ability to distinguish visual stimuli, logical relations, which relates to reasoning and problem-solving skills, and basic school skills, which include early academic abilities, show noticeable development during the preschool period. Specifically, the scores for verbal concept, visual discrimination, logical relations, and basic school skills in the age group more than 5 were significantly higher than those in the age 4 and age 3 groups. This suggests that as children grow older, there are substantial improvements in their cognitive abilities, making them more proficient in these cognitive processes and early academic skills.

As a result, it suggested that age-related differences in verbal concept, visual discrimination, logical relations, and basic school skills, respectively, are all supported by the data. The results of the one-way ANOVA analysis provide valuable insights into the developmental trajectories of different aspects of cognitive outcomes during early childhood.

Table 3
The Difference of Physical Cognitive Outcomes among Different Age

		Sum of Squares	df	Mean Square	F	Sig.
Verbal Concepts	Between Groups	469.175	2	234.588	38.208	0
	Within Groups	1344.608	219	6.14		
	Total	1813.784	221			
Visual Discrimination	Between Groups	307.584	2	153.792	27.761	0
	Within Groups	1213.249	219	5.54		
	Total	1520.833	221			
Logical Relations	Between Groups	176.037	2	88.019	13.484	0
	Within Groups	1429.513	219	6.527		
	Total	1605.55	221			
Basic School Skills	Between Groups	1401.898	2	700.949	53.045	0
	Within Groups	2893.922	219	13.214		
	Total	4295.82	221			

To further investigate the differences in verbal concept, visual discrimination, logical relations, and basic school skills among the age groups (age 3, age 4, and more than age 5), a multiple comparison analysis was conducted using the Scheffe test and one-way ANOVA in SPSS. The results are presented in Table 4.22, with a confidence level of 95%. The analysis revealed that verbal concept, visual discrimination, logical relations, and basic school skills all showed significant differences between each pair of age groups at the $p < 0.05$ level. For verbal concept, the scores in age group 3 were significantly different from those in age group 4, and the scores in age group 4 were also significantly different from those in the age group more than 5. Similarly, for visual discrimination, there were significant differences in scores between age group 3 and age group 4, as well as between age group 4 and the age group more than 5. For logical relations and basic school skills, significant differences in scores were also observed between each age group pair.

These findings indicate distinct developmental changes in verbal concept, visual discrimination, logical relations, and basic school skills between each age group, with scores increasing as children grow older. The data suggest that cognitive outcomes related to language, visual perception, reasoning, and early academic skills show notable improvements during the preschool period. In summary, the multiple comparison analysis provides valuable insights into the developmental trajectories of different cognitive abilities among preschool children.

Table 4
Multiple Comparison on Cognitive Outcomes Using Scheffe

Dependent Variable	Age (I)	Age (J)	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Verbal Concepts	3	4	-1.767*	0.412	0	-2.78	-0.75
		5+	-4.001*	0.461	0	-5.14	-2.87
	4	3	1.767*	0.412	0	0.75	2.78
		5+	-2.234*	0.398	0	-3.21	-1.25
	5+	3	4.001*	0.461	0	2.87	5.14
		4	2.234*	0.398	0	1.25	3.21
Visual Discrimination	3	4	-1.407*	0.391	0.002	-2.37	-0.44
		5+	-3.235*	0.438	0	-4.31	-2.16
	4	3	1.407*	0.391	0.002	0.44	2.37
		5+	-1.829*	0.378	0	-2.76	-0.9
	5+	3	3.235*	0.438	0	2.16	4.31
		4	1.829*	0.378	0	0.9	2.76
Logical Relations	3	4	-1.289*	0.425	0.011	-2.34	-0.24
		5+	-2.467*	0.475	0	-3.64	-1.3
	4	3	1.289*	0.425	0.011	0.24	2.34
		5+	-1.178*	0.411	0.018	-2.19	-0.17
	5+	3	2.467*	0.475	0	1.3	3.64
		4	1.178*	0.411	0.018	0.17	2.19
Basic School Skills	3	4	-2.682*	0.604	0	-4.17	-1.19
		5	-6.845*	0.676	0	-8.51	-5.18
	4	3	2.682*	0.604	0	1.19	4.17
		5	-4.163*	0.584	0	-5.6	-2.72
	5	3	6.845*	0.676	0	5.18	8.51
		4	4.163*	0.584	0	2.72	5.6

Note, * The mean difference is significant at the 0.05 level.

Discussion

The findings suggests that there is no significant difference between boys and girls in terms of all the constructs of cognitive outcomes which are verbal concept; visual discrimination; logical relations; and basic school skills. In general, the results suggest that the degree of development of cognitive outcomes for boys and girls is much similar during preschool period. However, the finding is not in line with previous study. For instance, according to Du Toit et al (2011), it is confirmed that girls performed better in cognitive outcomes than boys, however, the difference between boys and girls was not significant statistically. Farooq et al (2011) also provide an evidence that girls perform better in academic achievement, which is a part of cognitive outcomes, than boys. They suggested that boys

suffer an educational disadvantage to girls, especially in the aspect of literacy performance. This difference between boys and girls could be attribute to biological differences and gender bias (Considine & Zappalá, 2002). Pajares (2002) proposed that girls have better study skills than boys probably because girls usually work harder and attend class more often. But this did not exist to be the case in the present research.

The difference in findings between the present study and previous studies may be attributed to several factors, including methodological differences, sample characteristics, and cultural contexts. One major factor contributing to the disparity in findings could be the different methodologies used in the present study and previous research. For example, the present study employed experimental tests to assess cognitive outcomes, while some previous studies might have relied on parent-report assessment tools. The choice of assessment method can impact the results obtained and may lead to variations in the observed outcomes. Differences in the characteristics of the study participants, such as age range, cultural background, and socioeconomic status, can also play a role in the discrepant findings. The present study focused on a specific sample of Chinese preschool children aged 3 to 5, and the results might be influenced by the unique developmental and cultural factors of this group. Previous studies, on the other hand, might have included participants from diverse backgrounds, leading to varying outcomes.

The cultural context in which the studies were conducted can significantly influence cognitive development. Cultural norms and expectations related to education and gender roles may impact cognitive outcomes differently in different societies. Therefore, the cultural context of the present study in China may have contributed to the observed similarities between boys and girls in cognitive outcomes. Additionally, differences in the timing and historical context of the studies could also contribute to varying findings. Social and educational changes over time may influence cognitive development and academic achievement differently for boys and girls.

It is important to consider these factors when interpreting and comparing the results of different studies. While the present study's findings suggest no significant gender differences in cognitive outcomes during the preschool period, it is essential to acknowledge that the research landscape is complex, and results may vary across different populations and study designs. More research and replication studies are necessary to gain a comprehensive understanding of the factors contributing to cognitive development and potential gender differences in different cultural and societal contexts.

The study revealed significant differences in verbal concept, visual discrimination, logical relations, and basic school skills among three distinct age groups. These findings suggest that these cognitive abilities undergo evident development during the preschool period, with scores for children aged over 5 showing considerable advancement compared to those aged 4 and 3. Consistent with prior research, this study aligns with the notion that cognitive growth during early childhood is a vital and dynamic process (Michel et al., 2019). The preschool years play a critical role in the development of essential cognitive skills, which form the foundation for children's academic and social competencies.

As for verbal concept, it is found that verbal concept development is closely linked to phonological memory in children. As children's phonological memory capacity improves with age, their ability to understand and express verbal concepts also shows significant progress (Gathercole & Baddeley, 1990). In addition, chronological age was an significant predictor of reading and spelling skills as well as fluid intelligence for preschool children according to (Michel et al., 2019). In terms of visual discrimination, it is revealed that visual discrimination

abilities in children develop over time. As they get older, children become more proficient at inhibiting irrelevant information and focusing on relevant visual cues, leading to improved visual discrimination skills (Gerstadt et al., 1994). As for logical relations, the researchers demonstrated that logical reasoning abilities in children are influenced by their cognitive processing capacity, which tends to increase with age. As children's cognitive resources expand, they become more capable of handling complex logical relations (Michel et al., 2019). In terms of, basic school skills, a longitudinal study highlighted the importance of early basic school skills for later academic achievement. The researchers found that age-related improvements in early literacy and numeracy skills significantly predicted better academic performance in later school years (Duncan et al., 2007).

To conclude, the study found no significant gender differences in cognitive outcomes, including verbal concept, visual discrimination, logical relations, and basic school skills, among Chinese preschool children aged three to five. Both boys and girls exhibited similar levels of cognitive development during this period. However, the influence of age on cognitive outcomes was significant. As children aged, their performance in all cognitive areas improved noticeably. Age more than five showed significantly higher cognitive proficiency compared to age four and age three, indicating significant cognitive development during the preschool years. The study underscores the importance of considering age differences when studying cognitive outcomes in preschool children and highlights the dynamic nature of cognitive development during this stage.

Conclusion

The study's results underscore the significance of the preschool period as a critical time for cognitive development. Verbal concept, visual discrimination, logical relations, and basic school skills all demonstrated evident growth as children aged from three to five years. These cognitive abilities serve as fundamental building blocks for later academic and social competencies. Understanding the development of these cognitive skills during early childhood can aid educators, parents, and policymakers in designing appropriate interventions and educational programs to support children's overall growth and learning.

Despite the valuable insights provided by this study, further research is necessary to explore cognitive development in diverse cultural contexts and populations. Replication studies with larger and more diverse samples can strengthen the generalizability of the findings. Additionally, longitudinal studies tracking cognitive development over an extended period would deepen our understanding of how these skills evolve beyond the preschool years and into later stages of development.

Overall, this study contributes to the growing body of knowledge on cognitive development in preschool children and highlights the importance of considering age as a crucial factor in understanding cognitive outcomes. By fostering a comprehensive understanding of early cognitive development, researchers and educators can better support children's learning and growth during this crucial stage of life.

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