Review Article

Factors affecting the cognitive skills of Ghanaian Children

ABSTRACT

Abstract
This study focuses on the effect of parental education, risk preference, soft skills, and household structure on the cognitive skills development of Ghanaian children. Cognitive skills fundamentally refer to as the abilities and processes involved in learning, problem-solving, and decision-making. Various factors have been coined in explaining children's cognitive skills but predictors such as parental education, risk preferences, soft skills, household structure, child's previous cognitive skills, and teacher effectiveness, in both theoretical and empirical settings. Cognitive skills development has received much attention from scholars and policymakers due to its contribution to human capital formation, economic growth and development, distribution of income, and individual earning. This study confirms the significance of assessing cognitive skills with digit span. Per the GSPS questionnaire, there were 15 hurdles of the digit span test.
Keywords: cognitive skills, teaching-learning concepts, human capital development, academic achievement

Introduction

Human capital plays a key role in nation-building and economic development. It is considered a treasured asset that contributes to the competitiveness and growth of a nation. The development of science, education, and knowledge is seen as a profitable investment that creates knowledge as a commodity with value (Baek & Cho, 2018; Kuzmin et al., 2020). Poor human capital is a global issue that particularly affects developing countries like Ghana. One out of every three children under the age of 5 in developing countries faces conditions that hinder their human capital development. These conditions include poverty, malnutrition, limited access to quality education, and inadequate healthcare. Without proper intervention, these children will experience significant challenges in developing their cognitive skills, which are relevant to their educational attainment and future success.

Cognitive skills fundamentally refer to as the abilities and processes involved in learning, problem-solving, and decision-making (Hsin & Xie, 2012; Reed, 2020; Sethy, 2012). These skills play a significant role in comprehending and applying knowledge in various contexts. They encompass a range of abilities, including reading, writing, technological proficiency, emotional intelligence, and language skills. Cognitive skills help learners in personalized learning, based on their progress and responses, and enable them to increase their knowledge, apply, interpret, and synthesize teaching-learning concepts, and understand concepts, ideas, and events (Sethy, 2012).

Shaping or developing these cognitive skills of the child to take over the nation-building process when the old anchors fade comes for three main reasons (Amelia et al., 2019; Gomes & Pereira, 2014; Handayani et al., 2021; Moe, 2019; Rocmah, 2018; Weng et al., 2020). Firstly, cognitive skills are closely linked to academic achievement. Students with strong cognitive skills are more likely to perform well in school and have better educational outcomes. These skills also contribute to critical thinking, creativity, and innovation, which are essential for driving economic growth and societal progress. Secondly, a strong foundation in cognitive skills is necessary for lifelong learning and adaptability in a rapidly changing world. Without proper cognitive skills, individuals may struggle to acquire and apply new knowledge, hindering their ability to adapt to new technologies and advancements. Thirdly, cognitive skills are needful for problem-solving and decision-making, both in personal and professional settings. Having strong cognitive skills allows individuals to analyze complex situations, think critically, and make informed decisions. For society to reap the gains associated with a detailed understanding of the factors influencing the cognitive skills of children, it is important to investigate their cognitive development over time. Various factors have been coined in explaining children's cognitive skills but predictors such as parental education, risk preferences, soft skills, household structure, child's previous cognitive skills, and teacher effectiveness, in both theoretical and empirical settings.

Theoretically, the present study sought to evaluate the cognitive skills of Ghanaian children relying on the human capital view. The human capital theory posits that investments in education and skills lead to higher economic productivity and growth (Becker, 1962; Caire & Becker, 1967; Richardson, 1973; Sahota, 1975). Therefore, it is important to understand the factors that influence the cognitive skills of children in order to make effective investments in their education and development. Specifically, the study sought to leverage social learning

theory, expected utility theory, social and emotional learning theory, family system theory, information processing theory, social cognitive theory, and social cognitive theory, to respectively, explain how factors such as parental education, risk preferences, soft skills, household structures, children's previous cognitive skills, and teacher effectiveness, affect children's cognitive skills. Although the literature on the predictors of children's cognitive skills is important to human capital creation, the understanding of researchers and policymakers on the subject is insufficient and inconclusive. There is a particular need for research on Ghanaian children in order to address the unique contextual factors that may influence their cognitive development.

Cognitive skills development has received much attention from scholars and policymakers due to its contribution to human capital formation, economic growth and development, distribution of income, and individual earning (Barro, 2001; Hanushek & Woesman, 2008; Murnane et al., 1995; Pekkala et al, 2013). It is also the bedrock for school readiness and higher academic attainment (Fin et al., 2014; Kaila et al., 2018; Keen, 2010; Welsh et al., 2010).

These enormous contributions by cognitive skills to individuals and global economies have prompted researchers to assess the factors affecting cognitive skills development in developed and developing countries. A recent study conducted in 21 European countries found that an additional year of schooling has a positive effect on numeracy and literacy scores, and it was revealed that cognitive skills development is influenced by early and late schooling years (Cappellari et al, 2023). Similar findings were reported by Glick and Sahn (2009) who noticed that years of schooling strongly affect the cognitive skills of children in Senegal, but it is conditional on household wealth, quality of public education, and parental education (Kaila et al., 2018). Moreover, other factors such as the child's health (Dezfouli et al., 2021), home and school factors (Glick & Sahn, 2009; Votruba et al, 2013), and complex motor skills (Van der Fels, 2015) have a significant effect on the cognitive skills development. These studies provide the framework for educators, parents, and policymakers to ascertain what is needed to enhance the cognitive skills development of children.

The 2018 World Bank Learning to realize education's promise report, revealed that there is a global learning crisis; that is, most children are schooling but not learning. The phenomenon leads to what the literature term 'learning poverty'- which means the "inability to read and understand a simple text before age 10." In other words, the years spent in school do not matter if learning is not achieved (Saveedra, 2019); and this poses a threat to global human capital development, global wealth, and countries' inability to achieve Sustainable Development Goal 4, especially SDG 4.1 and 4.2 (World Bank, 2019; 2018). The United Nations Children's Emergency Fund (UNICEF) has acknowledged the issue of the learning crisis as the greatest global challenge and suggested urgent attention. Per their report, children at the preschool, primary, and secondary levels have access to education than a decade ago, but the majority of these children have challenges learning due to multiple factors which include inadequate teaching and learning materials, inadequately trained teachers, a shift system, and poor sanitation (UNICEF, 2021).

Similarly, the United Nations Development Programme (UNDP) reported that more than 103 million youth across the globe lack basic skills, and 6 out of 10 adolescents are struggling to achieve proficiency in mathematics and reading (UNDP, n.d.). Again, the United Nations (n.d.), indicated that more than 250 million children across the globe cannot read and write even after 4 years of primary education. This is a clear sign of a learning crisis that has even

worsened due to the COVID-19 pandemic. Per the World Bank (2020) estimates, the pandemic is likely to push additional 72 million primary school young age children into learning poverty.

For education to achieve its major goal of economic development and economic growth, it should be of higher quality and based on 21st-century skills (Almendarez, 2013). Reading serves as a foundational skill for every child before age 10. After this age, any child who struggles to read or is unable to read at all is a sign of a learning crisis. It indicates that the school system did not prepare such a child to progress easily in further learning in other areas such as humanities, mathematics, and science (World Bank, 2021).

Also, such children lack the foundational skills to thrive later in the workplace. Before the COVID-19 pandemic, the global Human Capital Index (HCI) was 0.56 – which implies that children born today before the age of 18 stand a 56 percent chance of reaching their full potential. Before the pandemic, 53 percent of children in low- and middle-income countries could not read and even understand a simple story at the end of their schooling at the primary level. The figure is as high as 80 percent in poor countries. The huge impact of the COVID-19 pandemic clearly shows that the learning crisis will worsen especially in developing countries. The current projection by the World Bank is that learning poverty will increase to 63 percent in developing countries.

Ghana's 2020 HDI was 0.45 – this means that Ghanaian children stand a 45 percent chance of reaching their full potential, but this figure is below the world average of 0.56 (World Bank, 2020). From the 2018 World Bank report, more than four-fifth of grade 2 children in Ghana and Malawi could not pronounce simple words such as "the" and "cat" (World Bank, 2018). Similarly, the 2016 Ghana National Education Assessment (NEA) which was conducted to assess the competency of Primary 4 and 6 pupils in English and Mathematics revealed that 22.0 percent of Primary 4 and 24.9 percent of Primary 6 pupils achieved proficiency in Mathematics. English proficiency in primary 4 was 37.2 percent and 37.9 percent for primary 6 pupils. It should emphasize that the test score cut-points for minimum competency were set at 35 percent and proficiency was set at 55 percent, which is below the average international cut-point proficiency of 70 percent. These findings clearly show that the performance of the pupils is generally low level (Ministry of Education, 2016). Additionally, the Ghana Education Fact 2020 fact sheet shows that only 7 percent and 8 percent of grade 3 children have foundation learning in reading and numeracy skills respectively (UNICEF, 2020). This shows a deficit in Ghana's HDI and a clear indicator of learning poverty which is a threat to the cognitive skill development of Ghanaian children and indirect effect on Ghana's poverty reduction and socio-economic development.

Literature Review

Available evidence shows that cognitive skills development is a strong predictor of economic growth and development and individual earning (Barro, 2001; Hanushek, 2008; Murnane et al., 1995). Also, there is no doubt that global issues such as extreme poverty and climate change could be tackled to optimum if quality education is delivered. It is therefore imperative that scholars and policymakers continue to study issues surrounding cognitive skills development.

Various factors play key roles in the most formative years for children when they start developing their cognitive skills (Rao et al. 2019, Schaub et al., 2019). Hence, evaluating the impact of ideal factors on children's cognitive skills is important for policy and resource

allocation, as well as for tracking progress toward meeting Sustainable Development Goals (SDG) in most of developing countries (Kopnina, 2020; Uddin et al., 2020). A considerable body of evidence shed light on the predictors of children's cognitive skills. This literature emphasizes the importance of several domains of child cognitive skills such as parental education (Bago et al., 2020; Cabrera et al., 2020; Cheung, 2010; Ghekiere et al., 2014; Grazuleviciene et al., 2017; Khoiroh et al., 2021), risk preference (Andreoni et al., 2020; Cheung, 2010; Ford & Stein, 2016a; Mechera-Ostrovsky et al., 2022), soft skills (Bago et al., 2020; Dimitrova, 2018; Hsin & Xie, 2017), household structure (Harkness et al., 2020; Lee et al., 2021; Lin et al., 2019; Marsh et al., 2020; Yusuf et al., 2020), child's previous cognitive skills (Bago et al., 2020; Carlsson et al., 2015; Carneiro et al., 2011; Elshani et al., 2020; Lazzari & Vandenbroeck, 2013; Sánchez, 2017; Smithers et al., 2018), and teacher effectiveness (Aina et al., 2015; Hennrick, 2017; Pakarinen et al., 2021; Wolf et al., 2019; Yan et al., 2023). Despite the extensive assessment of these fundamental predictors of children's cognitive skills, child development remains a major challenge in developing countries such as Ghana, pointing the possibility of gaps left unaddressed in the literature.

While there have been numerous studies exploring the determinants of children's cognitive skills in various countries, very few have focused specifically on Ghana and its unique socio-cultural dynamics. This scarcity of research in the Ghanaian context is concerning because it limits the understanding of the factors that influence cognitive development among Ghanaian children. Ghana has its own distinct cultural practices, educational system, and socioeconomic challenges that may differ from those found in other countries. Therefore, it is decisive to conduct research within this specific context to identify the factors that are most relevant to promoting optimal cognitive skills among Ghanaian children. Moreover, studying the determinants of children's cognitive skills in Ghana is essential due to the human capital development challenge facing the country. Investing in early childhood education and fostering strong cognitive skills among children can have long-term benefits for individual success and general national well-being. Through this study, policymakers and educators can design targeted interventions and programs to support their growth and maximize their potential.

Another notable gap is the over-reliance on descriptive analytical approaches, which often provide a surface-level understanding of the subject without delving into the underlying complexities. Additionally, some studies have utilized fixed effect and random effect inferential statistical techniques, but these methods may not fully address potential biases or limitations arising from the use of self-selection measures. To overcome these methodological gaps, it is essential to employ a more robust analytical technique such as the Endogenous Switching Model (ESM). This model allows for a more comprehensive analysis by considering both observed and unobserved factors that may influence cognitive skills in Ghanaian children without given room for bias estimation. This approach provides a more accurate assessment of the relationships between various factors and cognitive skills by accounting for endogeneity issues and potential biases.

The study on factors affecting the cognitive skills of Ghanaian children is justified for several reasons. Firstly, as noted before, Ghana faces a significant human capital development challenge. Improving the cognitive skills of children is important for the country's future human capital towards sustainable development. Here, policymakers and educators can implement targeted interventions to enhance educational outcomes and improve general human capital in Ghana by understanding the factors that influence cognitive skills. Secondly, there is a shortage of studies specifically focused on Ghana in relation to cognitive skill development. While there are existing studies from other countries, it is important to consider Ghana's unique socio-

cultural dynamics when examining these factors. Factors such as parental education, risk preferences, soft skills, household structures, children's previous cognitive skills, and teacher effectiveness, may have different impacts on cognitive skill development in the Ghanaian context. Therefore, conducting research within the local context will provide important revelations into the specific challenges faced by Ghanaian children and inform evidence-based interventions. Furthermore, existing studies often rely on descriptive analytical approaches or fixed effect and random effect techniques that have limitations in addressing potential biases or limitations from self-reporting measures. To overcome these methodological gaps, this study proposes using an ESM as the most appropriate analytical technique. This model allows for a more robust analysis of causal relationships between various factors and cognitive skill development among Ghanaian children.

Cognitive Skills Development

Globally, several factors have been associated with cognitive skills development. In developed countries like the US, growth in the domain-general cognitive process (attention control and working memory) has been found as a strong predictor of improvement in kindergarten reading and math skills (Welsh et al., 2010). Center-based early education setting has also been linked to improvement in cognitive skills development but adding home-based support appears to be more beneficial to children (2-year-olds and 4-year-olds) from low-income families thereby addressing the cognitive skill development gap among children (Votruba-Drzal et al., 2013). Additionally, Van der Fels et al., (2014) asserted that complex motor skills development is a strong predictor of cognitive skills development in pre-pubertal children. However, children who have experienced meningitis are prone to low cognitive skills development. In Australia, it was noticed that children who leave with parents who smoke exhibit lower cognitive development within a standard deviation of 0.09 and 0.17 (Srivastava & Trinh, 2021). Using 21 European countries, Cappellari et al., (2023) observed that an additional year of schooling has a positive effect on numeracy and literacy skills. This is not different from Glick and Sahn's (2009) results in Senegal where they noticed that years of schooling of children (14- and 17-year-olds) affect cognitive skills development directly but is indirectly influenced by family background. They emphasized that these findings are conditional on the quality of public education, parental education, and household wealth. Fin et al., (2014) on the other hand argued that the type of school has no effect on cognitive skills.

Other studies in developing countries have reported similar results. Rao et al., (2014) in an extensive review of 111 studies from 40 developing countries concluded that early childhood intervention has a positive effect on cognitive development. In Africa, Kaila et al., (2018), used the production function approach and a unique comparable long-term panel data set to assess the determinants of education and cognitive outcomes of young adults in Madagascar and Senegal. They found that cognitive skills measured by second-grader test scores are a grade predictor of cognitive ability and school attainment of young adults in their early twenties. It was also revealed that household characteristics such as parental education and household wealth do not diminish the impact of early cognitive ability on the cognitive skills and educational outcomes of young adults. Glick et al., (2011) corroborate that household factors affect the cognitive skills development of Madagascan children (8-10 years and 14-16 years), but mothers' schooling has a higher significant impact than fathers. Also, early primary schooling and infrastructure and teacher experience influence cognitive skills development. Rolle et al., (2019) emphasized the role of parental involvement through their systematic

review study and found that father-school involvement has a positive significant impact on children’s cognitive skills in maths and reading.

It is widely believed that the cognitive skills children develop earlier in life have a profound and lasting impact on their current cognitive abilities. These foundational skills, such as language acquisition, problem-solving, and critical thinking, serve as building blocks for further cognitive development and learning. Therefore, the quality and extent of a child's previous cognitive experiences can greatly influence their current cognitive capabilities and potential for future growth and success. While early cognitive skills are seen as important to the development of later cognitive abilities of children there seems to be no literature directly relating to that effect. Smithers et al. (2018) conducted a systematic review of 9553 publications and analyzed 222 better quality publications to investigate the associations between early life non-cognitive skills and later outcomes in academic, psychosocial, cognitive, and health domains. The review found that there is some evidence that non-cognitive skills are associated with improved outcomes, but the effects varied and were heterogeneous. The study was unable to examine the effect of a child's previous cognitive skills on their current cognitive skills. The focus of the study was on the associations between early life non-cognitive skills and later outcomes in academic, psychosocial, cognitive, and health domains. The focus of the study was on the associations between early life non-cognitive skills and later outcomes in academic, psychosocial, cognitive, and health domains. Understanding the relationship between previous cognitive skills and current cognitive skills will guide policymakers, researchers, and parents on the development and trajectory of the cognitive abilities of children over time.

Sánchez (2017) examined the acquisition of cognitive and non-cognitive skills in four developing countries (Ethiopia, India, Peru, and Vietnam) during childhood, with a focus on the role of early nutrition. The findings suggest that early nutrition has a positive effect on cognitive skills, with an increase in height-for-age at age 1 leading to higher cognitive skills at age 8. The effect on non-cognitive skills is indirect and relatively small in magnitude. The effect of early nutrition on non-cognitive skills is found to be relatively small in magnitude, suggesting that other factors such as the child’s previous cognitive skills may also play a significant role in the development of non-cognitive skills and by extension cognitive skills.

The effectiveness of teachers is viewed as a major architect in shaping the cognitive skills of children. The impact that teachers have on their students' intellectual development cannot be overstated, as they possess the power to inspire, motivate, and guide young minds toward academic success. Through their expertise, dedication, and ability to create engaging learning environments, effective teachers cultivate a love for learning, foster critical thinking skills, and promote a growth mindset, ultimately shaping the cognitive abilities of children in profound ways. Hennrick (2017) examined the role of teacher warmth in teacher accuracy in evaluating a child's cognitive and executive functioning. The study emphasizes that teacher warmth plays a role in teacher accuracy when evaluating a child's cognitive and executive functioning, particularly in predicting working memory and executive function abilities. While the study found that teacher warmth contributed to teacher accuracy in evaluating children's cognitive and executive functioning, it did not directly investigate the broader concept of teacher effectiveness and its impact on cognitive skills. Therefore, the study does not provide specific knowledge into the influence of teacher effectiveness on the cognitive skills of children, an issue of great need to society.

Yan et al. (2023) sought to understand the working mechanism and relationships among the quality of teacher-child interaction (TCI), children's comprehensible vocabulary (CCV), and executive function (EF) in China. The study found that there are associations among TCI, EF,

and CCV. The study relies on self-reported measures and tests conducted in a controlled setting, which may not fully capture the naturalistic interactions and real-world contexts of teacher-child interactions. This could undermine teacher effectiveness in predicting cognitive skills as expected in the current study. This current study, therefore, sought to partly address this gap through the evaluation of the influence of teacher effectiveness on the cognitive skills of children in Ghana factoring in other contextual factors such as parental education, risk preferences, soft skills, and the child's previous cognitive skills. The cognitive development of children is a critical aspect of their growth and well-being. It plays a major role in shaping their future academic success, social interactions, and general quality of life. Understanding the factors that influence cognitive skills is essential for designing effective interventions and educational programs (Bustos et al., 2016; Dark et al., 2018).

The general review of cognitive skills development in developed and developing countries show that several factors contribute to cognitive skills development. This study focuses on the effect of parental education, risk preference, soft skills, and household structure on the cognitive skills development of Ghanaian children.

Parent Education and Cognitive Skills development

An extensive review of studies reveals that parent's education influences the academic outcomes of their children (Duflo et al.,2018; Heckman, 2014; Rindermann & Ceci, 2018), but the magnitude and mediating factors are less explored (Green & Riddell, 2009; Phillipson & Phillipson, 2012). For instance, using the Early Childhood Longitudinal Study-Birth Cohort (N = 1,258) in the United States, Cabrera et al. (2020) examined the influence of high levels of cognitive stimulation from mothers, fathers, and childcare providers at 24 months and children's pre-academic skills at 48 and 60 months in two-parent families. Results from path analysis showed direct positive effects of fathers' early cognitive stimulation on early reading and math skills at 48 and 60 months. There were also two moderated effects: The effects of high levels of maternal stimulation at 24 months on early math and reading skills at 48 months were largest for children also receiving high levels of cognitive stimulation from their childcare providers. Similarly, Bago et al. (2020) in a study on children's development in Ghana, using robust econometric estimations, examined the impact of parental education on children's cognitive skills. The authors found that mother's education, father's involvement and living in urban areas increase child development.

Moreover, Rindermann and Ceci (2018) compared the effect of wealth and parents' education on the cognitive ability of children (aged 4-22 years) in seven countries (Brazil, the United States, Vietnam, Austria, Costa Rica, and Ecuador). The cognitive abilities of children were measured with Cognitive Ability Test (CogAT), Culture Fair Intelligence Test (CFT), Piagetian Tasks, Raven Wiener Entwicklungstest (WET), Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), and Progress in International Reading Literacy Study (PIRLS). They found that parental education has a stronger impact on a child's intelligence than wealth. Heckman (2014) confirms this when he concludes that low parental education is associated with worse working memory, as well as Duflo et al., (2018) who reported that parental education is positively correlated with the child's cognitive ability. In the same way, Schady (2011), noticed the vocabulary level and schooling of mothers in Ecuador were strong predictors of cognitive skills development. Hence the need to work on the vocabulary of mothers.

Using the British Cohort Study (BCS) data set, De Coulon, et al., (2008) noticed that parents aged 34 years' basic skills in numeracy and literacy have a positive significant impact on their child's cognitive skills. Relatedly, Wilderhold et al., (2022), confirm that the cognitive skills of parents are highly correlated with their children's cognitive abilities. Specifically, an increase in a parent's basic skills by one standard deviation is associated with an increase in the child's skills in math and language by 0.28 and 0.30 standard deviations respectively. Glick and Shan (2000) corroborate with their studies on the schooling of girls and boys in West African countries where they noticed that father education raises the schooling of both boys and girls, but mothers' education has an impact only on girls' schooling.

In Ghana, several studies have been conducted to assess the effect of parent's education on their child's academic achievements but only a few explicitly look at its impact on cognitive skills development and also specify the exact age range (Chowa et al., 2013) hence the need to assess the effect of parental education on cognitive skills development of Ghanaian children. While findings from these existing studies point to the importance of parental education in influencing children's cognitive skills, they failed to incorporate other contextual factors that may be unique at every stage of a child's cognitive skills. This observation suggests the need to establish other contextual factors that can explain children's cognitive skills at various stages of their development.

Risk Preference and Cognitive Skills Development

Risk preference is one major contextual predictor of a child's cognitive skills and has received relatively little attention from researchers creating a huge knowledge gap. Lack of adequate knowledge of risk preferences has over the years denied policymakers the right prescriptions for child development. This is because the risk preferences of children and families at large can impact their decision-making abilities and learning outcomes. Most studies focus on cognitive skills and risk preference but not the effect of risk preference on cognitive skills development (Both & Katic, 2013; Taylor, 2013 as cited in Dohmen et al., 2018) because there is an issue of finding the appropriate measure for risk preference (Brown et al., 2006). The limited studies have conflicting findings and also tend to measure the risk preference and cognitive skills of university students and adults. For instance, Honn and Kiss (2018) explored the type of preferences associated with the school performance of university students. They found that risk-averse students perform better than risk-tolerant students. Burks et al., (2015) also reported a weak negative relationship between risk aversion and GPA of university students. However, Branas-Garza et al., (2011) found no relationship between risk preference and math skills.

To the best of our knowledge, Andreoni, et al. (2019) were the first group to assess the effect of risk preference and cognitive skills of children (3-15 years old). Through an experimental technique with over 1,400 children, they found that adolescent girls are more risk-averse than boys but not this relationship wasn't the same for children. First, the study finds that adolescent girls display significantly greater risk aversion than adolescent boys. This pattern was not observed among young children, suggesting that the gender gap in risk preferences emerges in early adolescence. Second, it was found that at all ages in our study, cognitive skills (specifically math ability) are positively associated with risk-taking. Executive functions among children, and soft skills among adolescents, are negatively associated with risk-taking. Third, it finds that greater risk tolerance is associated with a higher likelihood of disciplinary referrals, which provides evidence that the study was equipped to measure a relevant behavioral outcome. For academics, the research provides enormous understanding of the developmental

origins of risk preferences and highlights the important role of cognitive and executive function skills to better understand the association between risk preferences and cognitive skills over the studied age range, an area expected to be contributed in the current study. The limited literature on risk preference and cognitive skills development shows the need to tackle this issue from the Ghanaian perspective.

Soft Skills and Cognitive Skills Development

Success in the modern era is determined by how children strive to have certain skills. This can be achieved by kids through the development of soft skills because it is considered the ability to master subject matter with regard to thinking ability in addition to learning. In an increasingly fast-changing, complex and diverse world, soft skills are becoming ever more important. It is believed that soft skills are prominent prerequisites for children's cognitive skills. Soft skills, such as motivation, self-control, social skills, work habits, patience, and perseverance (Hsin & Xie, 2017), play an important role in the development of cognitive skills. Referencing pedagogical theory, practice, and the role of family and educational institutions in shaping soft skills and a particular authority from suggestions made by United Nations International Children's Emergency Fund (UNICEF) to introduce a module of important skills in schools, Dimitrova (2018) emphasizes that academic knowledge alone is not sufficient and that soft skills, such as communication, teamwork, empathy, and decision-making, are essential for the development children. The study found that the formation of these skills starts from an early age and is influenced by the family and educational institutions. It highlights the need for a balance between academic and social education, as schools often prioritize academic knowledge over soft skills. According to UNICEF, there is the need to introduce a module of ten important skills in schools, including life skills and soft skills, to address this imbalance and better prepare children for the challenges of life. The study does not provide empirical evidence on the direct effect of soft skills on children's cognitive skills. One possible approach could be conducting longitudinal studies that measure both soft skills (such as communication, teamwork, empathy, and decision-making) and cognitive skills (such as problem-solving, critical thinking, and creativity) in children over time. This would allow for the examination of any correlations or causal relationships between the development of soft skills and cognitive skills.

Hsin and Xie (2017) evaluated the relative roles of cognitive and soft skills (socio-behavioral skills) in mediating the effects of family socioeconomic status (SES) on children's academic achievement. The study finds that both cognitive and socio-behavioral skills play a significant role in mediating the relationship between family SES and academic achievement. The study acknowledges that the term "socio-behavioral skills" used in the social science literature does not conform to the conventional notion of "soft skills" as abilities acquired through learning or training. The study finds that the effect of socio-behavioral skills on academic achievement is weaker relative to the effect of cognitive skills. The paper acknowledges that the academic literature is mixed regarding the importance of socio-behavioral skills compared to cognitive abilities in explaining variation in children's academic performance.

Soft skills should be introduced at the early stage of development because of its significant role in shaping an individual's personality and productivity and their contribution to lifelong learning (Gibb, 2014). It is noted to be productive as hard skills and in fact, hard skills productivity is influenced by soft skills (Balcar, 2016). Additionally, soft skills contribute to the wage gap because it leads to significant wage returns (Belcar, 2014). As a result, there has

been an upsurge in demand for soft skills since 1970 (Borghans et al., 2008 as cited in Belcar, 2014).

The significance of soft skills in positive child and youth growth development has received much attention (Galloway et al., 2017). For instance, Chamorro-Premuzic et al., (2009), conducted three UK studies to assess soft skills and higher education. They observed that soft skills were found as a predictor of outstanding academic performance. Relatedly, Obilor (2019) and Naibaho et al., (2022) found that student's soft skills such as time management, problem-solving, willingness to learn, communication skills, and consciousness influence the academic outcomes of students to a large extent.

Similar to risk preference, literature on the effect of soft skills on the cognitive skills development of children is lacking hence the need for the inclusion of this variable. The study does not provide information on the specific measures used to assess soft skills, which may limit the ability to compare findings with other studies.

Household Structure and Cognitive Skills Development

Another important contextual factor often mentioned in the literature is household structure referred to as the composition and arrangement of individuals within a household. It can include factors such as the presence of parents, grandparents, siblings, and non-related adults in the household. Research suggests that household structure can affect the cognitive skills of children. For example, using household data from two districts in northern Ghana, Garcia-Hombrados (2017) examined how cognitive skills affect the allocation of schooling across the children of a household and found that the allocation of schooling across siblings is influenced by the cognitive skills of the children. The study only examines household data from two districts in northern Ghana, which may limit the generalizability of the findings. The analysis suggests that polygyny, household size, and household wealth do not significantly affect the magnitude of the effect of cognitive skills on schooling allocation. Additionally, a study on household structure and child growth in the United States by Cunningham et al. (2019) found that the presence of social fathers in the household was found to harm children's cognitive ability. While the finding figured out household structure is a detrimental predictor of children's cognitive ability, the study relies on self-reported measures of household structure and child anthropometrics, which may introduce measurement error and bias into the results. The discovery of the negative effect of household structure on children's cognitive skills depends on the kind of household structure reported in the database. This assertion is evident in a study executed by Harkness et al. (2020) on the effect of single-mother families on cognitive development.

Household structure has an effect on the educational outcomes of children and their skill formation (Anger & Schnizlein, 2017). In rural South Africa, Madhavan et al., (2017) found that children who live with a single parent were worse academically than their counterparts who lived with both parents. They also reported that a lack of role models in a family and economic pressure has a negative effect on education outcomes. Similarly, Radl et al., (2017) observed that in developed countries, the absence of a father in the household has an adverse effect on the children's learning outcomes. For children whose parent(s) were incinerated before age 9, the absence of their parent(s) has a negative effect on cognitive skills development (Haskins, 2016). In Japan, Tobishima (2018) also realized the academic achievement of children who live with either their mother or father alone is negatively affected at the lower and median quintile levels respectively. In conclusion, both parent time input is required for the cognitive skill development of their children especially in the early stages (Del Boca &

Wiswall, 2014). However, Azumah et al., (2018) using 12–18-year-olds in Ghana, reported different findings. Their study revealed that the academic performance of children with single parents and those with both parents were not statistically different. Several studies (Chowa et al., 2013; Mante et al., 2021) in Ghana disagree with their findings. The study concludes that while the direct effects of single motherhood on children's cognitive development were small and insignificant, the indirect effects through reduced economic and parental resources were significant and often large.

Data and Methods

Source of Data

The data used in this study was extracted from the Ghana Socioeconomic Panel Survey (GSPS). GSPS is a collaboration between the Institute of Statistical, Social, and Economic Research (ISSER) at the University of Ghana, Economic Growth Center (EGC) at Yale University, and the Global Poverty Research Lab (GPRL) at Northwestern University. However, the survey was funded by the Economic Growth Center. The overarching aim of the survey is to provide a comprehensive data set for understanding economic development over time in low-income countries within a period of 15-21 years with 5 surveys (waves). The first wave was collected in 2009-2010 using the manual method (paper and pencil) while waves 2 and 3 were collected in 2013-2014 and 2017-2018 respectively through computer-aided Personal Interviewing (CAPI). A two-stage stratified sampling technique was used to provide a regional representative of the regions in Ghana. For wave 1, 5010 households from 334 Enumeration Areas (EAs) were sampled but 5009 households from the 334 EAs were successfully interviewed. The second wave tracked the movement of households and individuals within households. The total sample of households selected for Wave 2 was 5484 and it included the 5009 households from the Wave 1 survey. The number of households successfully interviewed was 4774. A total of 5669 households were interviewed in wave 3 (Osei et al., 2022). This data was important for this study because it has rich information on the cognitive skills of children (age 5-15 for Waves 1 and 2 and >5 years for Wave 3) and possible factors affecting cognitive skills development.

Theoretical Framework

The theoretical framework for the study is influenced by the Human Capital Theory (HCT). Generally, human capital is the sum of an individual’s skills and knowledge. It is also referred to as the stock of knowledge (training skills and education attainment) within a specific geographical region (Wagner et al., 2003). HTC is attributed to five Nobel laureates from economics - Robert Solow, Theodore Schultz, Simon Kuznets, Milton Friedman, and Gary Becker. However, this study focused on Becker’s HCT (Becker 1962; 1992). The theory stipulates that formal education is required to improve the productive capacity of people within an economy. Hence recognizing formal education as a significant component human capital investment which has an influence on the individual and the economy (Becker, 1992; Gillies, 2015; Tan, 2014). By implication it shows how an educated population contributes to productivity and efficiency through increase in their cognitive skills (Almendarez, 2013) on their personal earning and the economy (Becker, 1962; Gillies, 2015; Tan, 2014).

Becker (1992) stated that “Human capital analysis assume that schooling raises earnings and productivity mainly by providing knowledge, skills and a way of analysing problem” (p.88).

This implies that for HCT to realize its objectives, the quality of cognitive skills development shouldn't be compromised. As result the factors that influence one's cognitive skill development need to be assessed since it has been found to influence education outcomes and attainment (Glick, 2011; Welsh et al., 2010). Empirical studies have observed several factors that affect cognitive skills development of children that includes parental education, risk preference, soft skills, and household structure. Whiles there seems to be a consensus on the impact of parental education, soft skills and household structure on cognitive skills development, the effect of risk preference is inconclusive. Making the risk preference variable an important contributing factor of this paper to existing studies for policy making and most importantly within the Ghanaian setting. We argue that quality parental education (especially higher level of education at least high school) will mean parents comprehend basic curriculum of their child hence would be able to support them with their homework and also encourage them to learn to improve on their literacy and numeracy skills which is an important ingredient for the cognitive skills development. We further argue that soft skills (communication and leadership skills – status) is influenced productivity and efficiency. Therefore, being an being an important contributing skill to cognitive skills development. Additionally, we argue that risk averse students wouldn't take risk of failing and would therefore prepare for any assessment hence the considers risk averse important in cognitive skills development. Finally, we argue that children leaving with both parents and also having siblings around (especially with some form of formal education) has the opportunity of developing some inherent skills and support which influences their cognitive skills development.

We perform a Structural equation model (SEM) to assess the effect of parental education, risk preference, soft skills, and household structure on cognitive skills development. The path diagram for the SEM is depicted in figure 1.

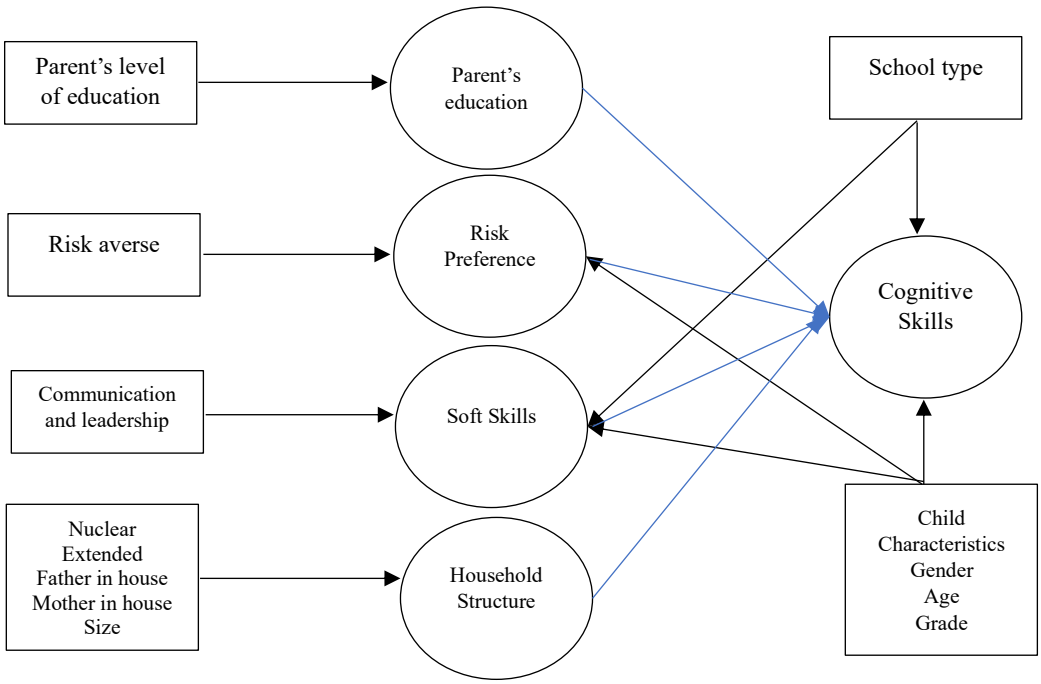

Figure 1: Path analysis for cognitive skills development

We hypothesize a positive effect of higher parental education on cognitive skills (Duflo et al., 2018; Rindermann & Ceci, 2018; Wilderhold et al., 2022) as well lower risk preference on cognitive skills (Chamorro-Premuzic et al., 2009; Naibaho et al., 2022; Obilor, 2019). Stronger soft skills (Andreoni, et al., 2019; Honn and Kiss, 2018) and household structure with both parents are also hypothesized to positively affect cognitive skills (Del Boca & Wiswall, 2014; Madhavan et al., 2017; Radl et al., 2017; Tobishima, 2018). Certain soft skills (leadership and communication skills) are inherent and accumulated over time hence we anticipate that child characteristics can have an indirect influence on cognitive skills through soft skills. Similarly, as a child grows the more, the child appreciates the need for schooling and its significance to his life. As a result, the child becomes risk-averse towards the quality of input towards education. We, therefore, see child characteristics influencing cognitive skills indirectly through risk preference. School type (private or public) and the location of the child (urban or rural) also influence cognitive skills indirectly through soft skills.

Empirical model

Todd and Wolpin (2003, 2007) asserted that knowledge acquisition is a cumulative process that is influenced by observed and unobserved factors. Glick et al., (2011) added that cognitive skills development may be influenced by many unobserved factors even before and during a child's schooling age. This study agrees with Todd and Wolpin (2003, 2007) and Glick et al., (2011) and therefore models the cognitive skill development of a child to depend on parents' education, risk preference, soft skills, household structure, and other unobserved and confounding variables.

Due to the hot debate on the type of panel model estimation, it is always a daunting task for researchers to choose the type of model (Baltagi, 2021). However, Hausman (1978 as cited in Beltagi, 2021) and Breush and Pegan (1980 as cited in Beltagi, 2021) provide a robustness check in determining the type of model to be used. Based on the robustness check (The Breusch-Pagan Test and Hausman's Specification Test), the fixed effect and random effect model are estimated based on the equation below.

$$CS_{it} = \beta_0 + \beta_1 Par\_edu_{it} + \beta_2 Ri\_pref_{it} + \beta_3 So\_skills_{it} + \beta_4 Ho\_stuc_{it} + \beta_5 Z_{it} + \mu_{it}$$

Where CS_{it} is cognitive skill outcome for the ith child, Par_edu_{it} is parent education measured by the parent level of education, Ri_pref_{it} is risk preference which measures the risk level of the child, So_skills_{it} is soft skills measured by the child's communication and leadership and problem-solving skills, Ho_stuc_{it} the household structure of the child measure by parent presence in a household as well as siblings, and the Z comprises child-specific characteristics (age, gender, grade level), type of school (private or public), location of the child (urban or rural) and μ_{it} is the error term. The Raven's Pattern Cognitive tests and Digit Span test scores were used to measure cognitive skills. Raven's test was developed to assess the two major components of general intelligence by Spearman in 1923 (see Spearman, 1927). These two components are, reproductive ability, the "ability to recall required information" and eductive ability which is the ability to "educe correlates, the ability to generate high level schemata, which makes it easy to handle complex events" (Raven, 1989, p. 1). Since its development, Raven's text has received much attention due to its validity, reliability, and ability to measure the two major abilities (Bolton, 1955; Raven, 1989). The Raven tests are made up of a series of design or diagrams with missing parts (Raven, 2000), and it comes in three forms, coloured

version for children, the standard version for all age range, and the advanced version, which is also designed specifically for top 10% on the standard deviation (Raven, 1989). Per the GSPS questionnaire, 12 designs (shapes) were used to assess the respondents. The Digits span on the other hand is used to measure cognition. It is a standardized test used to assess verbal Short-Term-Memory (STM) skills or performance (Jones & Macken, 2015; Wambach et al., 2011). The test is made up of a progressive longer sequence of numbers with the ability to recall in the correct sequence presented. As a result of this unique feature, evidence from previous studies show that digit span is an effective technique for assessing STM (Hale et al., 2002; Jones & Macken, 2015), and people who perform well on the intelligence scale have high digit span score (Bachelder & Denny, 1977 as cited in Jones & Macken, 2015). Leung et al., (2011) concluded that digit span is an effective tool doe identifying patience with cognitive impairment. These studies confirm the significance of assessing cognitive skills with digit span. Per the GSPS questionnaire, there were 15 hurdles of the digit span test.

REFERENCES

Aina, J. K., Olanipekun, S. S., & Garuba, I. A. (2015). Teachers' Effectiveness and its Influence on Students' Learning. *Advances in Social Sciences Research Journal*, *2*(4). https://doi.org/10.14738/assrj.24.1082

Al-Onizat, S. H. H. (2019). The effectiveness of an educational program in enhancing parents level of knowledge about normal growth indicators in the development of children and determining the indicators which delay development in children from birth to three years old. *Educational Research and Reviews*, *14*(9), 300–308. https://doi.org/10.5897/ERR2019.3719

Amelia, H., Hendratno, H., & Jannah, M. (2019). The Effect of Playing Bridge Beams on the Coordination and Balance of the Body of Early Childhood. *International Journal for Educational and Vocational Studies*, *1*(1), 72. https://doi.org/10.29103/ijevs.v1i1.1499

Andreoni, J., Di Girolamo, A., List, J. A., Mackevicius, C., & Samek, A. (2020). Risk preferences of children and adolescents in relation to gender, cognitive skills, soft skills, and executive functions. *Journal of Economic Behavior & Organization*, *179*, 729–742. https://doi.org/10.1016/j.jebo.2019.05.002

Baek, W., & Cho, J. (2018). Identifying the Virtuous Circle of Humanity Education and Post-Graduate Employment: Evidence from a Confucian Country. *Sustainability*, *10*(1), 202. https://doi.org/10.3390/su10010202

Bago, J. L., Ouédraogo, M., Akakpo, K., Lompo, M. L., Souratié, W. dite M., & Ouédraogo, E. (2020). Early Childhood Education and Child Development: New Evidence from Ghana. *Children and Youth Services Review*, *108*. https://doi.org/10.1016/j.childyouth.2019.104620

Becker, G. S. (1962). Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, *70*(5, Part 2). https://doi.org/10.1086/258724

Bustos, N., Olivares, S., Leyton, B., Cano, M., & Albala, C. (2016). Impact of a school-based intervention on nutritional education and physical activity in primary public schools in Chile (KIND) programme study protocol: cluster randomised controlled trial. *BMC Public Health*, *16*(1), 1217. https://doi.org/10.1186/s12889-016-3878-z

Cabrera, N. J., Jeong Moon, U., Fagan, J., West, J., & Aldoney, D. (2020). Cognitive Stimulation at Home and in Child Care and Children's Preacademic Skills in Two-Parent Families. *Child Development*, *91*(5). https://doi.org/10.1111/cdev.13380

Caire, G., & Becker, G. S. (1967). Human Capital, A Theoretical and Empirical Analysis with Special Reference to Education. *Revue Économique*, *18*(1), 132. https://doi.org/10.2307/3499575

Carlsson, M., Dahl, G. B., Öckert, B., & Rooth, D. O. (2015). The effect of schooling on cognitive skills. *Review of Economics and Statistics*, *97*(3). https://doi.org/10.1162/REST_a_00501

Carneiro, P., Crawford, C., & Goodman, A. (2011). The impact of early cognitive and non-cognitive skills on later outcomes. *Centre for the Microeconomic Analysis of Public Policy, IFS*.

Cheung, C. (2010). Environmental and Cognitive Factors Influencing Children's Theory-of-Mind Development. *University of Toronto*.

Cunningham, S. A., Chandrasekar, E. K., Cartwright, K., & Yount, K. M. (2019). Protecting children's health in a calorie-surplus context: Household structure and child growth in the United States. *PLoS ONE*, *14*(8). https://doi.org/10.1371/journal.pone.0220802

Dark, F., Harris, M., Gore-Jones, V., Newman, E., & Whiteford, H. (2018). Implementing cognitive remediation and social cognitive interaction training into standard psychosis care. *BMC Health Services Research*, *18*(1), 458. https://doi.org/10.1186/s12913-018-3240-5

Dimitrova, K. (2018). Formation of soft skills in preschool and primary school age - an important factor for success in a globalizing world. *Knowledge International Journal*, *28*(3). https://doi.org/10.35120/kij2803909k

Drago, F., Scharf, R. J., Maphula, A., Nyathi, E., Mahopo, T. C., Svensen, E., Mduma, E., Bessong, P., & Rogawski McQuade, E. T. (2020). Psychosocial and environmental determinants of child cognitive development in rural south africa and tanzania: Findings from the mal-ed cohort. *BMC Public Health*, *20*(1). https://doi.org/10.1186/s12889-020-08598-5

Elshani, H., Dervishi, E., Ibrahimi, S., Nika, A., & Maloku Kuqi, M. (2020). The Impact of Cognitive Impairment in Children with Intellectual Disabilities. *Journal of International Cooperation and Development*, *3*(2). https://doi.org/10.36941/jicd-2020-0013

Ford, N. D., & Stein, A. D. (2016a). Risk factors affecting child cognitive development: a summary of nutrition, environment, and maternal–child interaction indicators for sub-Saharan Africa. *Journal of Developmental Origins of Health and Disease*, *7*(2), 197–217. https://doi.org/10.1017/S2040174415001427

Ford, N. D., & Stein, A. D. (2016b). Risk factors affecting child cognitive development: a summary of nutrition, environment, and maternal–child interaction indicators for sub-Saharan Africa. *Journal of Developmental Origins of Health and Disease*, *7*(2), 197–217. https://doi.org/10.1017/S2040174415001427

French, B., Outhwaite, L. A., Langley-Evans, S. C., & Pitchford, N. J. (2020). Nutrition, growth, and other factors associated with early cognitive and motor development in Sub-Saharan Africa: a scoping review. In *Journal of Human Nutrition and Dietetics* (Vol. 33, Issue 5). https://doi.org/10.1111/jhn.12795

Garcia-Hombrados, J. (2017). Cognitive Skills and Intra-Household Allocation of Schooling. *University of Sussex Business School*.

Ghekiere, A., Van Cauwenberg, J., de Geus, B., Clarys, P., Cardon, G., Salmon, J., De Bourdeaudhuij, I., & Deforche, B. (2014). Critical Environmental Factors for Transportation Cycling in Children: A Qualitative Study Using Bike-Along Interviews. *PLoS ONE*, *9*(9), e106696. https://doi.org/10.1371/journal.pone.0106696

Gomes, R. M. S., & Pereira, A. S. (2014). Influence of Age and Gender in Acquiring Social Skills in Portuguese Preschool Education. *Psychology*, *05*(02), 99–103. https://doi.org/10.4236/psych.2014.52015

Grazuleviciene, R., Andrusaityte, S., Petraviciene, I., & Balseviciene, B. (2017). Impact of Psychosocial Environment on Young Children's Emotional and Behavioral Difficulties. *International Journal of Environmental Research and Public Health*, *14*(10), 1278. https://doi.org/10.3390/ijerph14101278

Handayani, M. D., Rahmawati, L. E., Prastiwi, Y., Supriyanto, E., & Widyasari, C. (2021). Analyzing The Use of The Year Four, Theme Three Student Book of the 2013 Curriculum to Build Environmental Awareness. *Profesi Pendidikan Dasar*, *8*(1), 48–62. https://doi.org/10.23917/ppd.v8i1.11658

Harkness, S., Gregg, P., & Fernández-Salgado, M. (2020). The Rise in Single-Mother Families and Children's Cognitive Development: Evidence From Three British Birth Cohorts. *Child Development*, *91*(5), 1762–1785. https://doi.org/10.1111/cdev.13342

Hennrick, H. (2017). The role of teacher warmth in teacher accuracy evaluating child cognitive and executive functioning. *Eastern Michigan University*.

Hsin, A., & Xie, Y. (2012). Hard Skills, Soft Skills : The Relative Roles of Cognitive and Non-cognitive Skills in Intergenerational Social Mobility. *Population Studies Center Research Reports*.

Hsin, A., & Xie, Y. (2017). Life-course changes in the mediation of cognitive and non-cognitive skills for parental effects on children's academic achievement. *Social Science Research*, *63*, 150–165. https://doi.org/10.1016/j.ssresearch.2016.09.012

Khoiroh, A., Rachmawati, Y., & Adriany, V. (2021). *Analysis of Parental Views on the Value of Children*. https://doi.org/10.2991/assehr.k.210322.052

Kopnina, H. (2020). Education for the future? Critical evaluation of education for sustainable development goals. *Journal of Environmental Education*, *51*(4). https://doi.org/10.1080/00958964.2019.1710444

Kuzmin, O., Bublyk, M., Shakhno, A., Korolenko, O., & Lashkun, H. (2020). Innovative development of human capital in the conditions of globalization. *E3S Web of Conferences*, *166*, 13011. https://doi.org/10.1051/e3sconf/202016613011

Lazzari, A., & Vandenbroeck, M. (2013). The impact of Early Childhood Education and Care on cognitive and non-cognitive development. A review of European studies. *Transatlantic Forum on Inclusive Early Years*.

Lee, H., Ryan, L. H., Ofstedal, M. B., & Smith, J. (2021). Multigenerational Households During Childhood and Trajectories of Cognitive Functioning Among U.S. Older Adults. *The Journals of Gerontology: Series B*, *76*(6), 1161–1172. https://doi.org/10.1093/geronb/gbaa165

Lin, Y. C., Washington-Nortey, P. M., Hill, O. W., & Serpell, Z. N. (2019). Family Functioning and Not Family Structure Predicts Adolescents' Reasoning and Math Skills. *Journal of Child and Family Studies*, *28*(10). https://doi.org/10.1007/s10826-019-01450-4

Marsh, S., Dobson, R., & Maddison, R. (2020). The relationship between household chaos and child, parent, and family outcomes: a systematic scoping review. *BMC Public Health*, *20*(1), 513. https://doi.org/10.1186/s12889-020-08587-8

Mechera-Ostrovsky, T., Heinke, S., Andraszewicz, S., & Rieskamp, J. (2022). Cognitive abilities affect decision errors but not risk preferences: A meta-analysis. *Psychonomic Bulletin & Review*, *29*(5), 1719–1750. https://doi.org/10.3758/s13423-021-02053-1

Moe, R. (2019). How to Teach Kindergarten Teacher Education Students about Play? The Perspective of Academic Pedagogy Teachers. *Universal Journal of Educational Research*, *7*(3A), 60–67. https://doi.org/10.13189/ujer.2019.071307

Pakarinen, E., Lerkkanen, M., Viljaranta, J., & von Suchodoletz, A. (2021). Investigating Bidirectional Links Between the Quality of Teacher–Child Relationships and Children's Interest and Pre-Academic Skills in Literacy and Math. *Child Development*, *92*(1), 388–407. https://doi.org/10.1111/cdev.13431

Reed, S. K. (2020). Cognitive Skills You Need for the 21st Century. In *Cognitive Skills You Need for the 21st Century*. https://doi.org/10.1093/oso/9780197529003.001.0001

Richardson, R. (1973). Investment in Human Capital . Theodore W. Schultz . *Journal of Political Economy*, *81*(4). https://doi.org/10.1086/260106

Rocmah, L. I. (2018). The Effect of Games and Self-Confidence For Very Young Learner' Cognitive Ability. *Proceedings of the 1st International Conference on Intellectuals' Global Responsibility (ICIGR 2017)*. https://doi.org/10.2991/icigr-17.2018.39

Sahota, G. S. (1975). Investment in Human Capital: The Role of Education and of Research . Theodore W. Schultz . *Economic Development and Cultural Change*, *23*(3). https://doi.org/10.1086/450818

Sánchez, A. (2017). The structural relationship between early nutrition, cognitive skills and non-cognitive skills in four developing countries. *Economics and Human Biology*, *27*. https://doi.org/10.1016/j.ehb.2017.04.001

Sethy, S. S. (2012). Cognitive skills: A modest way of learning through technology. *Turkish Online Journal of Distance Education*, *13*(3).

Smithers, L. G., Sawyer, A. C. P., Chittleborough, C. R., Davies, N. M., Davey Smith, G., & Lynch, J. W. (2018). A systematic review and meta-analysis of effects of early life non-cognitive skills on academic, psychosocial, cognitive and health outcomes. *Nature Human Behaviour*, *2*(11). https://doi.org/10.1038/s41562-018-0461-x

Uddin, M. R., Shimizu, K., & Widiyatmoko, A. (2020). Assessing secondary level students' critical thinking skills: Inspiring environmental education for achieving sustainable development goals. *Journal of Physics: Conference Series*, *1567*(2). https://doi.org/10.1088/1742-6596/1567/2/022043

Weng, J.-X., Huang, A. Y. Q., Lu, O. H. T., Chen, I. Y. L., & Yang, S. J. H. (2020). The implementation of precision education for learning analytics. *Proceedings of 2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering, TALE 2020*, 327–332. https://doi.org/10.1109/TALE48869.2020.9368432

Wolf, S., Aber, J. L., Behrman, J. R., & Tsinigo, E. (2019). Experimental Impacts of the "Quality Preschool for Ghana" Interventions on Teacher Professional Well-being, Classroom Quality, and Children's School Readiness. *Journal of Research on Educational Effectiveness*, *12*(1), 10–37. https://doi.org/10.1080/19345747.2018.1517199

Yan, S., Li, M., Yan, Z., Hu, B., Zeng, L., & Lv, B. (2023). Associations among teacher-child interaction, children's executive function and children's comprehensible vocabulary. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1077634

Yusuf, H., Fahrudin, A., Budiman, Fahrudi, F. I., & Fahrudin, F. A. (2020). Impact of Single Mother Family on Child Development: A Review Literature. *Palarch's Journal of Archaeology of Egypt/Egyptology*, *17*(10).