UNIVERSITY OF CAPE COAST

EFFECTS OF FAMILY NUCLEATION ON CHILD LEARNING OUTCOMES IN GHANA

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature ……. Date ……

Name: Mahama Abukari

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of the thesis laid down by the University of Cape Coast.

Supervisor's Signature ……Date ……

Name: Dr. Jacob Nunoo

ABSTRACT

The connection between family nucleation and child learning outcomes in Ghana is a significant area of study. The family serves as the foundation for all Ghanaian social structures and plays a crucial role in caring for young individuals. When examining child-related matters such as education, cognitive abilities, and socio-emotional patterns, it is essential to consider the family context. This research investigates the impact of family nucleation on children's learning outcomes. To conduct this study, researchers utilized data from the seventh waves of the Ghana Living Standard Survey (GLSS), specifically focusing on the household roster recode. To address potential self-selection bias related to family nucleation, they employed both the Two-Stage Least Square (TSLS) and Ordinary Least Square (OLS) methods. These approaches allow for the control of observable and unobservable heterogeneity. The study findings confirm a connection between family nucleation and child learning outcomes. However, the magnitude of this impact varies based on the child's gender. Additionally, the research highlights that household spending on child education serves as a mechanism through which family nucleation influences children's learning outcomes. This underscores the importance of considering family dynamics when addressing educational outcomes for young individuals.

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To anyone who contributed to the completion of this study, I sincerely express my gratitude. However, I acknowledge that any errors, inaccuracies, or shortcomings—whether significant or minor—within this work are entirely my responsibility, and I am fully accountable for them.

DEDICATION

To my Family.

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LIST OF ABBREVIATIONS

DCSF	Department of Children, Schools and Families
DOVVSU	Domestic Violence and Victims Support Unit
ECE	Early Childhood Education
GCSE	General Certificate of Secondary Education
GDHS	Ghana Demographic Health Survey
GES	Ghana Education Service
GESPR	Ghana Education Sector Performance Report
GLSS	Ghana Living Standard Survey
GSS	Ghana Statistical Service
HCT	Human Capital Theory
HIV	Human Immune Virus
JHS	Junior High School
LMICS	Low- and Middle-Income Countries
LP	Learning Poverty
LPM	Linear Probability Model
MGCS	Ministry of Gender, Children and Social Protection
MICS	Multiple Indicator Cluster Survey
MOE	Ministry of Education
NHIA	National Health Insurance Authority
NHIS	National Health Insurance Scheme
NST	National Standard Test
OLS	Ordinary Least Square
PL	Poor Learning
SDG	Sustainable Development Goal

SHS	Senior High School
SLD	Specific Learning Disabilities
SSA	Sub-Saharan Africa
STATA	Statistical Software for Data Science
TSLS	Two-Stage Least Square
UNESCO	United Nations Education and Scientific Co-operation
UK	United Kingdom
US	United States

CHAPTER ONE

INTRODUCTION

In this chapter, we delve into the background to the study, statement of the problem, purpose of the study and the specific objectives this study seeks to achieve. Also, the questions the study seeks to answer are dealt with as well as the significance of the study, limitations to the study and organization of the study.

Background to the Study

Education plays an essential role in human development, as it fosters the growth of knowledge and skills. Through education, individuals become well-adapted to various societal contexts (Mante et al., 2021). It is also known to be crucial for economic development, enhancing productivity, creativity, entrepreneurship, and technological advances, while improving income distribution and securing social progress (Muhammad Hussein Noure Elahi *et al*., 2015). Education stakeholders encompass governmental bodies, their agencies, families, and local communities (Mante et al., 2021).

Child education outcomes are an important index for measuring socioeconomic development and are captured in the Sustainable Development Goal (SDG 4, Target 6), which seeks to improve the literacy and numeracy skills of all citizens irrespective of age as part of overall human development (Black *et al*., 2008; UNESCO, 2019). Learning outcome status of children has become an issue of interest to policy makers since poor learning among children, deficiencies in reading, numeracy, and simple calculations are persistent. These dimensions of poor learning and childhood education-related

problems have become global public education concerns, especially in low- and middle-income countries (LMICs) (McCoy *et al*., 2018).

Learning is a multifaceted process that commences at birth and persists throughout life. Parents, as the initial educators and role models, significantly impact their children's learning journey. However, research consistently reveals that many parents remain unaware of their pivotal role in their children's education. Their understanding of this role is often limited (DCSF, 2019). The World Bank (2000) emphasizes that family involvement in a child's education profoundly influences the child's overall learning outcomes. In Ghana, family structures play a critical role in shaping children's academic advancement, serving as socializers and providing essential financial, social, emotional, and educational support (Koomson & Afoakwah, 2023).

Regarding educational outcomes, numerous cross-sectional and longitudinal studies in Western contexts indicate that the presence of parents significantly impacts children's educational achievements. Children raised by two biological, married parents tend to perform better on mathematics and reading tests compared to children from other family structures (Sun & Li, 2011; Formby & Cherlin, 2007; Cavanaugh, Schiller & Riegle-Crumb, 2006; Hofferth, 2006; McLanahan & Sandefur, 1994). Similar trends are observed for self-reported grades, educational expectations, high school completion, and enrollment in post-secondary education (Sun & Li, 2009; Heard, 2007; Sun, 2003; Ermisch & Francesconi, 2001).

Extensive evidence supports the advantages of parental or family involvement in children's education, particularly in literacy-related activities (Ansong et al., 2023). Research consistently demonstrates that parental

engagement positively impacts a child's school performance, both in primary (Jeynes, 2005) and secondary education (Jeynes, 2007). Remarkably, this impact remains consistent across diverse factors such as ethnic background, family income, maternal education level, and the child's gender (Deaher et al., 2006; Jeynes, 2005). Furthermore, numerous studies reveal that children raised in stimulating home environments, emphasizing learning opportunities, achieve better academically, irrespective of socio-economic backgrounds (e.g., van Steensel, 2006). According to Mante *et al*., (2021), "parental involvement has a significant effect on children's achievement and adjustment even after all other factors (such as social class, maternal education, and poverty) have been accounted for between children's aptitudes and their achievement".

Research suggests that simple interactions, such as reading aloud and exposure to various reading materials (books, magazines, newspapers, and environmental print), significantly impact children's reading development. Children from more affluent home environments with abundant literacy resources demonstrate higher levels of reading knowledge and skills when they enter kindergarten. This advantage persists throughout their primary school years (Nord, Lennon, Liu & Chandler, 2000). Parents who actively encourage reading as a valuable and enjoyable activity foster child who are motivated to read for pleasure (Gest, Freeman, Domitrovich and Welsh, 2004). Their engagement in reading activities at home positively affects reading achievement, language comprehension, expressive language skills, interest in reading, attitudes toward reading, and classroom attentiveness. In summary, nurturing a love for reading and creating a literacy-rich environment

significantly contributes to children's educational success and overall development.

Developed countries unlike Africa, have never been supporters of the extended family system (Ayandele *et al.*, 2019). They tend to practice more of the nuclear and other forms of family structure due to their beliefs and style of living. The situation in Ghana is not far from that of Africa in general. The extended family is gradually fading out and individuals are getting accustomed to the new types of living arrangements (Annim *et al*., 2014). Research conducted on the effects of family structure on child education has shown that the kind of family structure a child belongs to could either have a positive or negative impact on their learning outcome, depending on the context in which it is addressed or the geographical area in which the study is conducted.

As societies experience socioeconomic shifts, various socio-demographic factors evolve, including fertility rates, morbidity, mortality trends, and household structures (Omran,1971; Caldwell, 1982, 1998). These changes significantly impact household well-being, particularly concerning children's health and education (Hatton & Martin, 2009; Allendorf, 2013). Regarding changes in the structure of the family systems, it is said that due to industrialization, urbanization, westernization, and modernization, significant changes have occurred in many aspects of families in Africa. The traditional form of family in Africa is the extended family. However, the trend is changing towards the nuclear family system (Ruwali, 2019).

As Ghana undergoes urbanization, educational advancements, and increased social and spatial mobility, household living arrangements are evolving. This transformation is characterized by a process known as

nucleation, which entails a shift in household structure and composition (Twumasi-Ankrah, 1995). The term nucleation refers to the transformation in the structure and composition of households. Initially, households were highly extended, encompassing various generations and interconnected social systems related to production, reproduction, and cultural norms. However, this trend is shifting toward nuclear families, which consist of a husband, wife, and their children as the core unit. This process of nucleation represents the transition from extended-family households to single-family (two-generation) households. Previous household structure was historically, were often highly extended, encompassing multiple generations and interconnected social systems related to production, reproduction, and cultural norms (Nukunya, 2003). However, the trend is moving toward nuclear families, consisting of a husband, wife, and their children as the core unit. This shift reflects changing societal dynamics and values. According to the Ghana Living Standard Survey round seven (GLSS7), a child is any individual who is under the age of 18 years. Per this study, we are focusing on children aged 6 years to 14 years which is in line with the official school entering age in Ghana.

Modernization, urbanization, and education have led to vast changes in the already existing family structures and living arrangements in Ghana (Annim et al., 2014). Households now practice more of the nuclear, cohabiting, and single-family structures. The movement from the traditionally accepted extended family structure has led to the rechanneling of economic resources into the education and health of children in these new forms of household as a result of the decline in dependency. The shift into new forms of

family structure is expected to improve the learning outcomes in most Ghanaian children.

While some studies have hinted at the importance of family dynamics and structure in Ghanaian child development (Ardayfio-Schandorf, 2012), there remains a notable gap in systematic research that examines the relationship between family nucleation and child learning outcomes within the country. As Ghana's educational system continues to evolve, it is essential to understand the unique factors that may enhance or hinder children's educational achievements within different household compositions.

Problem Statement

In the context of Ghana's dynamic socio-cultural landscape, understanding the implications of family nucleation on child learning outcomes is paramount to addressing the persistent educational disparities among its younger generation (Fosu, 2017). The global community faces a learning crisis, which poses a significant challenge to countries striving to build human capital and achieve the Sustainable Development Goals (SDGs) (UNESCO, 2019). Reading Proficiency and Learning Poverty, currently, 80% of children in impoverished countries face challenges in achieving proficient reading skills by the age of 10 or even 12 (Ansong et al., 2023). This issue, commonly referred to as learning poverty, impacts 87% of children in sub-Saharan Africa (SSA) and 53% in low- and middle-income countries globally (World Bank, 2019). The World Bank predicts that by 2030, approximately 43% of children worldwide will still grapple with learning poverty. While the primary focus is on reading proficiency, the higher prevalence of learning poverty suggests that these children have not yet fully realized their potential

in writing and numeracy skills (Koomson et al., 2023). Addressing this crisis is crucial for ensuring equitable opportunities and fostering human development.

A research agenda focusing on learning outcomes has become imperative for two primary reasons. Firstly, compelling evidence indicates that young adults are graduating from school with insufficient learning and an inadequate set of skills necessary for their employability and productivity as citizens. This issue has been highlighted by studies conducted by Afoakwah and Koomson (2021), Nunoo et al. (2023), and the World Bank (2019). Secondly, many countries have either implemented or are in the process of implementing free education policies, which have significantly increased enrollment rates according to UNESCO (2011). As a result, it is crucial to prioritize policies that can enhance children's learning outcomes and equip them with the essential skills required for a productive adulthood. This research agenda aims to address these challenges. It is evident that Ghana as a developing country is no exception to this learning crisis in terms of child development.

However, while international research underscores the significance of family structure in child development (Amato, 2015; Lopoo *et al.*, 2014; Panico, 2012), there is a dearth of empirical investigation specific to the Ghanaian context, where unique cultural, economic, and urbanization factors are at play. In Ghana, for example, a study conducted by Frempong (2013) delved into the impact of family structure on the educational achievements of senior high school students in the Cape Coast Metropolis. The research revealed a significant correlation between the type of family structure a

student belongs to and their academic success. Specifically, students from nuclear families tended to achieve higher academic performance compared to those from extended families. However, it's important to note that this study focused primarily on high school students, overlooking the educational experiences of young children at the basic school level.

Ghana's educational landscape has undergone significant transformation in recent years with government initiatives aimed at increasing access to quality education (Ministry of Education, Ghana, 2019). Yet, educational inequalities persist and many children in Ghana continue to face challenges in achieving optimal learning outcomes. For instance, the Minister of Education, in Ghana, (Dr. Yaw Osei Adutwum), revealed that a study by the National Standardized Test (NST) conducted in 2022 on the reading abilities of primary-2 pupils, showed that 62% of them could not read, a situation he said was even worse in 2015 (Citi newsroom.com, 2023). These disparities are influenced by factors such as income inequality (Fosu, 2017), gender norms (Frempong, 2013), and urbanization trends (Fosu, 2017). Family structure intersects with these factors, either amplifying or mitigating their effects on children's educational attainment.

Education is the cornerstone of individual and societal development, and in Ghana as in many parts of the world, ensuring quality education for all children is a paramount goal. Long before the Sustainable Development Goals (SDGs), past governments in Ghana, have perceived basic education as a key building piece of the economy. The target for SDG 4 is to ensure exhaustive and reasonable quality education and empower long learning chances for all by 2030.

Likewise, the SDG 4 hint a change audit for all children and achieve the target of generally primary and secondary education, cheap vocational training, access to progressive and more. In assessment of this since 2002, the government of Ghana has made conscious effort to implement the SDG 4 into the development plan structures.

In Ghana, there have been numerous educational changes and strategic measure towards making education available to all, such strategic measures include Capitation Grants for Basic Schools, School Feeding Program, Free Text Books and Regalia, Progressing of training colleges to tertiary level, construction of new classrooms blocks to replace ‘’schools under trees’’, outline of information and communication technology at the basic level and giving of incentives to teachers posted to destitute regions. Aside all these efforts by the government and NGOs in Ghana, there is still evidence of poor learning outcomes among children in the society.

Studies conducted by researchers on academic achievements have shown that family structures are significant in determining children’s educational outcomes (Klebanov & Brook- Gunn, 2007). This gave the researcher the need to examine the effect family nucleation has on the learning outcomes of children in Ghana.

However, in this pursuit, it is increasingly recognized that family structure may significantly impact child learning outcomes (Gyimah & Addai, 2019). While numerous studies globally have investigated the role of family structure in child education, the specific implications of family nucleation in the Ghanaian context remain understudied. Ghana, a culturally diverse country with a rich tapestry of family dynamics, is undergoing a discernible shift in

family structure. Traditionally characterized by extended families as the predominant social unit, contemporary Ghana is experiencing a gradual transition towards nuclear family structures. This transition is influenced by various factors, including urbanization, economic pressures, and evolving societal norms (Gyimah, Takyi & Addai, 2006). Within this evolving landscape, it is crucial to explore how the shift towards nuclear families affects child learning outcomes and what specific factors may mediate this relationship.

Purpose of the Study

The purpose of this study is to investigate the effect of family nucleation, the pathway through which family nucleation affects child learning outcomes and its heterogeneity effects on child's sex, place of residence, type of school, in Ghana from an objective perspective.

The study will specifically;

i. Examine the effect of family nucleation on child learning outcomes in Ghana.
ii. Examine how family nucleation affects child learning outcomes through child educational expenditure in Ghana.
iii. Examine the heterogeneity effect of family nucleation on child learning outcomes by child's sex, place of residence, type of school in Ghana.

Research Questions

The study conducted seeks to answer the following research questions;

i. Does family nucleation affect child learning outcomes?

ii. Does nucleation affect child learning outcomes through child educational expenditure?

iii. Has family nucleation affected child's learning outcomes differently by the child's sex, place of residence and type of school in Ghana?

Significance of Study

This study will at the end of the analysis provide information on how the education (learning outcomes) of a child is shaped by their living arrangements and will recommend policies that can be implemented by Ghana Education Service to enhance its positive effects. The study will also help identify the channels through which the family affects child learning outcomes in the country. Last but not least, the study will add to the handful of literature on this study in developing parts of the world and will focus more on young children

Limitations of the Study

One significant challenge encountered during the study relates to the unavailability of data, which has consistently posed difficulties for previous research, particularly in developing countries. Consequently, this study excluded other intricate family structures, such as cohabiting, foster, and adopted family systems. Additionally, certain variables that literature suggests influence child learning outcomes were unattainable due to data gaps and missing values. As a result, some variables had to be excluded from the empirical model, although the study's findings remain valid.

While acknowledging these limitations, it is essential to recognize that the study's scope and focus were constrained by time and resource limitations.

These constraints do not diminish the research's value; instead, they open avenues for further investigation and exploration.

Organization of the study

The subsequent chapters of the study are structured as follows. Chapter two details literature on family structure and child learning outcomes. It reviews theories and models the study is built on and hammers on some existing studies that have been conducted on the subject with their respective conclusions. It will also contain the trend in family systems. Chapter three describes the dataset, the source of data, the estimation model, and the analytical method employed throughout the study. Chapter four reports the main findings according to the set of child learning outcomes and family nucleation considered. Finally, chapter five closes the thesis by summarizing results, drawing conclusions, and drafting policy recommendations on the subject.

CHAPTER TWO

LITERATURE REVIEW

Introduction

In this chapter, we delve into both theoretical and empirical research concerning family structure and its impact on child learning outcomes. The discussion is organized into three main sections. The first section explores the theoretical foundations that underpin the relationship between family structure and children's learning outcomes. Theories such as human capital theory is reviewed to offer an understanding of the issue. The second section presents empirical literature that relates to family structure and child learning outcomes. The third section presents the trend in the family system in the world and Ghana in particular.

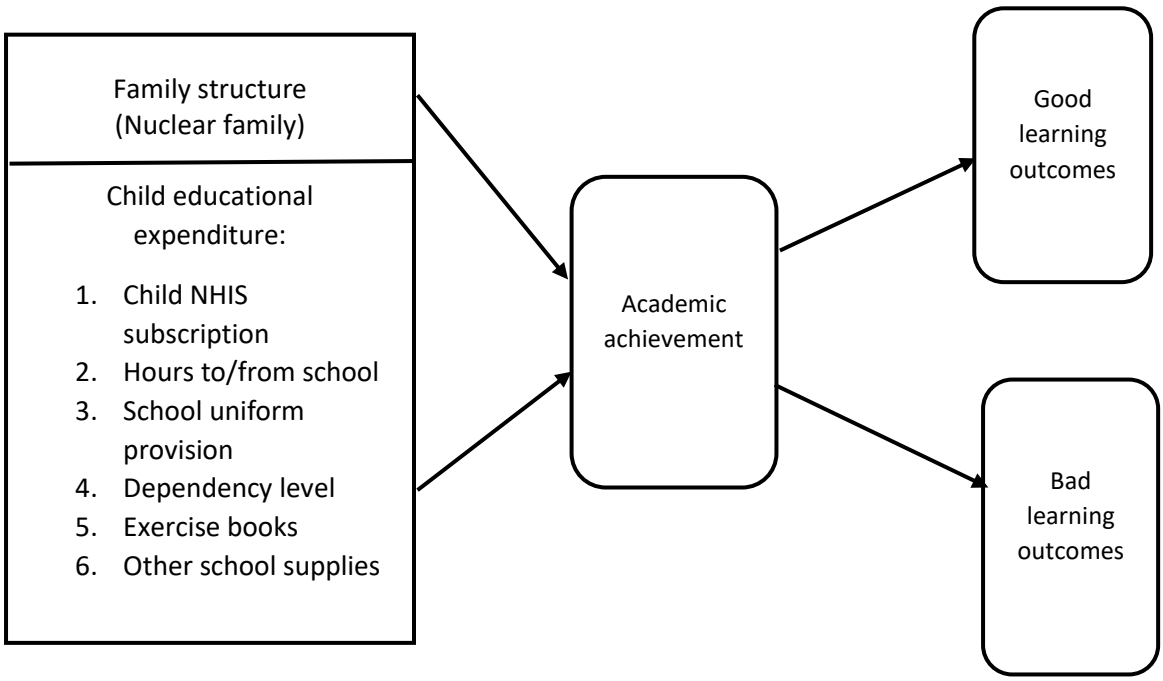

Figure 1: Conceptual Framework of Family Nucleation on child learning outcomes in Ghana.
Source: (Author's conceptualization)

The above conceptual framework depicts how family nucleation affects child learning outcomes through child educational expenditure. The nuclear family, which is composed of father, mother and children as the core unit, is conceived as an entity with wealth in terms of time and economic resources. The nuclear family, as a utility maximizing body in terms of child quality, thus educational outcomes, prioritizes their care and investment in child related educational expenditures, which would in turn lead to academic achievements of their wards either good learning outcomes or bad learning outcomes depending on the direction of the investments in child educational expenditure.

Theoretical Literature Review

The theoretical context of the study is discussed in this section.

Theoretical Model

This study heavily relies on theories proposed by Becker, Michael (1973), Tomes (1981), and Becker (1965, 1981), along with the joint work of Becker and Tomes (1986). These theories consider families' characteristics and household production as key factors influencing child education and learning outcomes.

Econometrically, it can be specified in this household production function:

$$child\ learning\ outcomes = f(Household\ characteristics\ such\ as\ family\ size, parental\ education, employment\ status, income\ level\ etc)$$

From the above household production function, the household characteristics are seen as inputs in the production of child education outcomes in the family.

Human Capital Theory (HCT)

Human Capital Theory posits that investing in education is essential for acquiring skills and training. This, in turn, enhances an individual's capital (Blundell *et a*l., 1999). According to Tan (2014), the acquired knowledge and skills lead to increased productivity in the workplace. Human Capital Theory (HCT) posits that formal education plays a crucial role in enhancing the productive capacity of a population. In essence, HCT proponents argue that an educated populace is a more productive one. This theory emphasizes how education contributes to the efficiency and productivity of workers by bolstering their cognitive abilities. These cognitive capabilities are a result of both innate talents and deliberate investment in human development. Consequently, providing formal education is viewed as an investment in human capital, which some theorists consider to be equally or even more valuable than physical capital (Woodhall, 1997). Ultimately, HCT asserts that investing in human capital yields greater economic outcomes.

Some theoretical literature in economics on the education of a child focuses on the human capital accumulation of the child concerning his or her earnings potential (Conti & Heckman, 2012). This study invokes the idea of utility maximization. The sole aim of every household is to maximize its utility of which child quality is a component. This quality represents the skills and development a child derives from the care direction and investment of the parents (Conti & Heckman, 2012). These skills, as a child grows, contribute to his or her socioeconomic success and even, that of their parents, when children become adults and a source of income to their parents.

Other theoretical literature postulates that the HCT explains the causal relationship between family structure and child education outcomes (Becker, 1991; 1993). They describe households as being resource (time and money) constrained. In situations where there are fewer adults in a household, fewer resources are channeled towards the well-being and education of each child, due to inadequate time spent with children and insufficient resources. Becker's theory suggests that, in a nuclear and cohabiting household, parents can pool their resources and share responsibilities to increase household and overall market productivity. Should a married couple decide to separate or go through with a divorce, mothers and their children usually end up with less than their rightful share of resources pooled by their parents (McLanahan & Sandefur, 1994). Divorce can be mentally and emotionally draining for a couple as well as detrimental to the physical and emotional growth of their children (McLanahan & Sandefur, 1994).

The diminishing available resources directly correspond to a decrease in the parental commitment toward fostering the child's accumulation of human capital. This may be because the mother has to split her portion of the resources between all children and shuffle between work and domestic duties (Fronstin *et al*., 2001). Death of a parent, just like divorce and separation can insight stress causing an emotional breakdown which can harm the learning outcome and overall wellbeing of a child (Amato, 2000).

Older children who belong to the single-family structure as a result of divorce or separation are usually deprived of the opportunity to experience and enjoy their childhood. In their family support role, they are thrust into adult responsibilities, caring for younger siblings. This situation can slow human

capital accumulation as these children are forced to drop out of school and join the labor force at the early stages of their lives which in the long run is viewed as a cost to their education and development (Weiss, 1979). On the other hand, in situations where children are born into abusive households, a change in family structure could be beneficial to their education, growth, and development thereby increasing their chances of productivity later in life. (Amato 2000; Gruber 2004).

Empirical Literature Review

Ghanaian Context

The family is one of the oldest and most significant social institutions in the world (Dzramedo *et al*., 2018). Every individual in one way or the other belongs to a family, either by birth, marriage, adoption, or mere association. Children are raised in various family configurations, including nuclear families with married biological parents, single-parent households, and extended families where other relatives participate in child-rearing. A significant number of children worldwide experience a nuclear family upbringing with both biological parents.

Aside from the extended and normal traditional family structure of two biological parents, children in Ghana now grow up with single, and cohabiting parents which have now become widely accepted forms of family structure in the country (Dzramedo, 2018). Data collected by the Ghana Demographic Health Survey (GDHS) in 2014, shows an increase in the single-family structure from about 30% households in 2008 to about 35% households in 2014 and cohabiting households from 498 to 1,189. Craigie *et al* (2014) reveal that these new forms of family structure tend to have negative effects

on children. They further prove that children born into these households usually have challenges with their education and general well-being. It is safe therefore to assume that the type of household a child grows in, certainly shapes their growth, steers their development, and has an impact on their learning outcomes (Ryan, 2011).

Culturally, in Ghana, marriage does not automatically result in co-residence. Different types and forms of family structures exist among the various ethnic and religious groups. Among the Ga-Adamgbe, a couple could be married, yet reside in different households. Wives from time to time visit their husbands in their homes and children born into these families usually live with their mothers. The Akans who constitute about 50 percent of the Ghanaian population are known for practicing the extended family system. In some cases, couples may reside apart, either within their own matrilineal lineage or within the man's matrilineal household, as documented by Assimeng (1981).

In the Northern part of the country where the patrilineal system is dominant, married couples may live with the man's family. In this type of household, the mother-in-law exhibits some kind of control over the affairs of the home which includes the upbringing of children (Rasheed, 2013). Household composition can be influenced by social and economic factors, as highlighted by Nukunya (2003) and Titchit & Robette (2008). Living arrangements are often shaped by societal norms, including obligations toward various family members (such as a couple's parents) and decisions made during marriage. Additionally, individuals—whether related or not—may

cohabit for economic purposes, pooling resources to enhance the overall household well-being (Freeman, 2005).

In various family structures, including extended households, tangible and intangible resources are provided by a couple's parents, siblings, cousins, and other family members. For instance, they may contribute to childcare while the couple is engaged in productive activities, especially when the woman participates in non-familial economic endeavors (Griggs et al., 2010). Caldwell (1982) highlights that physical and emotional changes lead to shifts in household composition and resource availability. Within extended households, resources flow in multiple directions: upwards to parents, downwards to one's own children, nephews, and nieces, and laterally to siblings.

Caldwell proposed that within an extended family, resources predominantly flow from children to parents. However, in a nucleated family, the primary resource flow is from parents to children, thus directing household resources toward the welfare of the children. Additionally, as couples' distance themselves from their parents, the likelihood of adopting new social values increases. In terms of fertility intentions and actual fertility, such couples are expected to have smaller family sizes compared to their parents and to prioritize their own children more than they themselves received attention from their parents during their own youth. This perspective sheds light on the intricate dynamics of family resource allocation and generational shifts in priorities.

Researchers posit that the impact of family structure on child learning outcomes is not a direct relationship. Instead, it operates through a multitude

of pathways to exert its full influence. These pathways involve various factors, such as psychological support, social interactions, cultural exposure, and economic resources. By understanding these intricate mechanisms, we gain insight into how family structure shapes a child's educational journey. These pathways include economic or financial resources, parental as well as child demographic characteristics (McMunn et al., 2014). Economic resources will be more sufficient in two-parent and sometimes extended family households as individual resources are pooled and collectively used to offset the education needs of a child such as paying for reading materials and private tutoring (McLanahan and Sandefur, 2009). Last but not least, area characteristics such as the type of place of residence, availability of health care services, access to quality education, and crime rate can also have an effect since different family structure forms reside in different neighborhoods (Amato, 2005).

In the Ghanaian context, as in many other countries, the family structure has historically been characterized by extended families, with multiple generation residing together under a single roof. However, societal transformations such as urbanization, economic pressures, and evolving cultural norms have led to the rise of nuclear family structures. These families typically comprise parents and their dependent children, residing independently from extended family members (Amato, 2005). The shift toward nuclear families reflects the dynamic interplay between broader social changes and family configurations. The transformation of family structures in Ghana is noteworthy (Fosu 2017). Historically, extended families played a central role in childcare, providing emotional support, sharing economic resources, and facilitating socialization. Within this extended family structure,

children were often exposed to diverse social networks and sources of knowledge. However, as the nuclear family model gains prevalence, questions arise about its implications for child learning outcomes.

Global Perspective/Context

Studies have concentrated more on comparing the general well-being of children who belong to a family structure of two married biological parents and those who encounter parental divorce. Notably, the distinct types of transitions from one form to another may have different effects on child outcomes. Research indicates that cohabiting families may have adverse effects on child well-being in certain aspects when compared to both single-mother families and married stepfamilies. However, it's essential to recognize that the impact varies across different dimensions and circumstances. Various family structures offer insights into children's living arrangements. Beyond the conventional nuclear family with two biological parents, children encounter different family forms. These alternative structures often lead to greater family instability during childhood. Researchers assess this instability through various metrics, including transition types, frequency, exposure to diverse family setups, and timing of transition.

Previous research conducted on the subject has investigated which form of transition may be more harmful to the learning outcome of a child (Cavanagh & Huston, 2008). Other studies have conducted the analysis of instability based on the period or proportion of time a child spends in a particular family structure (Dunifon & Kowaleski-Jones, 2002; Magnuson & Berger, 2009). When considering family instability, it is important to pay attention to distinct groups for whom family instability is likely to have

different effects. These groups may include, children who belong to a household with unmarried mothers, and children with different racial and ethnic backgrounds.

Raley and Wildsmith (2004) went ahead to consider the issue of race in their study and found that the level of family transitions increases by 30 percent for white families and 100 percent for black families if cohabitation transitions are included in the measure of family instability. Brown (2006) found that the type of family structure a child is initially born into sets a trajectory for successive stability or instability and its effect on their education outcomes. This was confirmed by

Also, Craigie *et al* (2010) using a simple OLS estimation technique, exploit data from the fragile families and child education study to differentiate the effect of family structure on child learning outcome at birth from the effects of family stability over a period of time. After their analysis, they found that the effect of family structure unlike that of family stability is weakened by child and demographic characteristics. They conclude that the learning outcome of a child born into various family structures is more often than not affected by changes that occur to the structure over time. Research conducted directly on the effect of family structure on child education over the years has shown that children born into an unmarried family structure are more likely to experience a number of unfavorable learning outcomes such as deficiency in reading, numeracy, and calculation (Balayla *et al*., 2011; Jacknowitz & Schmidt, 2008; Leo *et al*., 2004; Shah *et al*; 2011).

Most studies in this field focus on the entire wellbeing of a child which includes the cognitive ability, behavioral patterns, and physical health of a

child. From all three categories, behavioral patterns are most linked to family structure, (Hafferth, 2006), partly because a number of these studies were conducted on adolescents. Empirical literature conducted on adolescents, generally concludes that children who belong to a nuclear family structure with two biological married parents end up with a good education and overall well-being (Bass, 2011; Thomson *et al.*, 1994). Children who grow up in non-nuclear households mainly due to parental relationship dissolution face challenges with their emotional, psychosocial, and educational outcomes. (Amato, 2005; Craigie *et al*., 2010). According to Amato (1993) however, the timing of the parental relationship dissolution has no effect on the later life outcomes of these children.

A meta-analysis conducted by Amato and Keith (1991) showed that divorce has a negative impact on the cognitive ability, behavior pattern, and mental well-being of a child. They however observed from the obtained results that, the effect was not exceptional yet quite consistent over time. Also, Amato (2005) found that the improvement in health, behavior, and academic ability would be insignificant if all children lived continuously with married parents. Brown (2004) also employed data from the National Survey of America to investigate the relationship between family structure and child well-being in younger children and teenagers. He finds that children residing with two biological cohabiting parents encounter worse well-being outcomes, as compared to children living with two biological married parents. He observed that, among young children, the effect is lessened by parental characteristics and economic resources.

On the same subject, Krueger (2015) explored the association between family structure and multiple domains of child well-being using data from the National Education Interview Survey. The study concluded that all non-married family structures are linked to unfavorable outcomes among children depending on the type of family structure. Bird *et al*., (2000) however observed that these differences in child education outcomes may be accounted for by the age, educational level, socio-economic position, and relationship status of parents.

Using a logistic and categorical approach with data from the families and well-being study, Bass and Warehime (2011) explored the extent to which family structure impacts children's education outcomes, represented by a child's access to reading materials. They find that as compared to other family structures, children who belong to a family with two married biological parents are more likely to be provided with educational materials. They further took into consideration the family size and observed that children who belong to large family sizes were either provided or had no access. Kessler (1991) on the other hand focused more on the impact family structure has on the future achievement of a child and found that the future income of a child is not significantly affected by the size or birth order of a family. The conclusions of studies conducted in the UK are in line with those conducted in the US. The overall well-being of children living in a single-family structure are worse than children residing in other types of family structures and just as in the US, most studies concentrated more on the emotional rather than physical behaviors of the children.

McMunn *et al* (2001) in their study found that the behavioral patterns of children living with single parents are worse off than children living in other types of family structures. After controlling for home ownership, maternal education, and benefits receipts, however, the disadvantage became insignificant. In one of the few studies conducted on the physical education of children, Panico (2012) investigated the association between family structure and early childhood. After analysis, the study concluded that children who grow up with married parents have better education compared to children raised in other family structures, with single parents recording the worst learning outcomes.

In confirmation, Kumar and Ram (2012) specifically examined the relationship between family structure and child education in India. Child education in this study was measured by reading proficiency and calculation variables of the child. Deploying descriptive statistics, the results show that children who belong to non-nuclear family structures have a high reading proficiency status as compared to those in nuclear family structures. Using multivariate analysis, family structure is seen to have a relatively small effect on child education which becomes totally insignificant after controlling for region and socioeconomic measures. They also concluded that number of children in the household is significant and has a negative effect on child education.

Generally, the empirical literature cannot come to a consensus on whether the causation or selection best explains the relationship between family structure and child learning outcomes. Studies supporting the selection theory are of the view that individuals belonging to non-nuclear family

structures are a selected group of people who may have some specific characteristics that are adverse and distinct from those in nuclear family structures. Children who grow up in these two-family structures are most likely to experience different upbringings and hence achieve different outcomes, with those residing in non-nuclear family structures being at a disadvantage. (Piketty, 2003; Bjorklund and Sundstrom, 2006; Bjorklund *et al.*, 2007).

Corak (2001) and Francesconi *et al* (2005) used the death of a parent as an instrument in their analysis of family structure and child education. They viewed the death of a parent as exogenous to family structure especially when the death is sudden and not preceded by long-term illness. Empirical research conducted on the subject exposes several gaps in the literature that require further research. First, most of the empirical literature focuses more on the cognitive ability and behavioral patterns of a child and ignores the learning aspect of well-being. This study finds it probable to focus on the association between family structure and the education of a child which is the main aim of the study. Secondly, due to the unavailability of extensive data, empirical studies conducted in the field, concentrate more on outcomes of adolescents and adults. Little research is done on younger children which should be of concern because, the effects of family structure on teenagers and adults as well as potential pathways connecting the two, cannot be generalized. This work bridges this gap by concentrating on children from 6-14 years of age. Also, there is little to no research available on the subject in developing and low-income countries. Most of the empirical literature was conducted in developed and high-income countries.

Due to differences in demographic and parental characteristics, results obtained in the already existing literature cannot be generalized. This research is conducted in Ghana, a developing country bound by diverse cultural norms and beliefs. Last but not least, most of the 27 pieces of literature reviewed, relied on logistic, cross-sectional, multivariate, and descriptive techniques in performing their analysis. This work will due to the problem of endogeneity, use contraceptive usage in a household as an instrument to analyze the impact of family nucleation on child learning outcomes.

The Changing Trends in Family Systems:

The Changing Demographic Context of Family Structure

Attention of researchers has recently been drawn to the changing demographic structure and diversity of family living arrangements in comparison with the earlier concept of the traditional nuclear family structure in the 1950s and 1960s. Morgan (2003) believes that these other forms of family structures already existed but previous studies were not able or willing to detect the heterogeneity of family forms. The demographic transition is believed to have begun in France in the late 18th century and gradually spread to Europe and beyond by the mid-19th century.

The nuclear family structure was then birth as a response to wider economic changes as a result of the Industrial Revolution. This newly introduced form of family structure took over the prevailing extended family system possibly because it met the new economic state. Additionally, children became more of an economic cost rather than assets (Hernandez, 1993). Pre the Industrial Revolution era, most regions in the world were dependent on labor-intensive agricultural produce which was usually cultivated by families

on both large and small scales. Children in these agricultural-producing households served as labor for these families and hence having many children in this era was viewed as an economic asset. After the revolution, there was a shift from the agricultural era, and the individual drive for quality of life was birthed. The small nuclear family structure became a more efficient living arrangement (Livi-Bacci, 1997).

Households and families around the world are experiencing changes that are shaping the education and general well-being of individuals especially that of children. Essential changes in the family structure have transformed the daily lives and growth trajectories of many in recent years. The introduction of the nuclear family structure has given rise to the importance of apportioning enough economic resources and time to the education and development of children in the household. Family living arrangements are by the day, becoming more varied and complex. In the United States, for example, cohabitation is surprisingly the typical first type of union in society. Remarriage and divorce remain prevalent, and births to unmarried women have increased rapidly, from 5 percent in 1960 to about 40.5 percent in 2020 (Schweizer *et al*., 2020).

According to Brown (2006), changing family dynamics in recent times will have major implications on the living arrangements of children and may result in major education and well-being challenges. Half of the 40 percent of children born outside marriage are found to be born to unmarried cohabiting parents (Martin *et al.,* 2009). The fertility rates of married and cohabiting women now are relatively equal and as a result, many children are expected to grow in family structures formed outside marriage (Bachrach, 1988). Children

in unmarried families such as the single parent structure and the cohabiting structure were on average, found to experience greater family instability (Brown, 2010).

Research conducted across the world denotes that family structure is more subjective than researchers might assume. In the National Longitudinal Study of Adolescent Health, mothers and their adolescent children were interviewed on family structure (Harris, 2009). The gathered information revealed that in families with two biological parents, 99 percent of the responses were the same, families with married stepparents, single mothers, and cohabiting parents had about 30.2 percent, 11.6 percent, and 65.9 percent differences in their responses (Brown and Manning, 2009). The complexity of the other forms of family structure, according to Brown, breeds family boundary ambiguity. This ambiguity if not clearly defined may affect how family structure is measured, depending on whom questions about the family structure are directed to.

Demographic Context of Family in Ghana

The Ghanaian family system has a rich diversity of marriage, as well as cultural and traditional systems of family ties. These include the matrilineal lineage system prominent among the Akans, the patrilineal system practiced among the southern and northern ethnic groups, and the Gonjas who lack bounded descent groups (Fortes,1970). These systems are characterized by the separation of marital roles, concerning shared responsibilities, ownership, management, and inheritance of material assets. The relative separation of marital responsibilities and interests is more pronounced among some ethnic

groups than others, due to different levels of education (Kutsoati & Morck, 2014).

For some tribes such as the Ga-Adamgbe and sometimes the Akans, segregation includes separate living arrangements for couples (Takyi et al., 2007). For most tribes and ethnic groups, parental, and caregiver roles are played across the boundaries of the conjugal family. Thus, other family members such as aunts and uncles act as parents and sometimes contribute both financially and socially to the education and well-being of the child (Clark et al., 2017).

Recently, Sub-Saharan African countries have recorded changes in the traditional family system. Two potential trends of domestic change have transpired in other 14 developed and high-income countries. One is the disintegration of the lineage systems as the result of migration, salaried labor, and a shift away from traditional subsistence economies. The other tendency involves the introduction of gender equality with marital responsibilities as well as an increase in conjugal relationships among the educated elite (Ekane, 2013). These factors are believed to have led to isolation and individualism and the birth of the nuclear family system.

A Good Education Start Matters

Family economic researchers have employed the use of various econometric techniques to draw causal inferences concerning the effect of child education on later life outcomes. Poor learning (PL) found in children, predicts poor education in later childhood, adolescence, and adulthood (Haas, 2007). It is also found to predict low educational achievement Conley (2000). Other studies also found a strong correlation between (PL) and unemployment

as well as reduced economic incomes (Currie & Hyson, 1999). It is therefore important to focus on eradicating the problem of (PL) and other child education issues not only because of its importance to child education but also because the education of a child will in the long run affect their life trajectories.

Conclusion

This chapter provided insights into the theoretical underpinnings of the study, that is both theoretical and empirical literature review as well as the changing trends of family system in Ghana and the world at large. The theoretical review discussed theories such human capital theory, while the empirical review delved into empirical works/studies done in Ghana and the global perspective. The chapter finally provided insights into the changing trends of family system in Ghana and the world at large.

CHAPTER THREE

RESEARCH METHODS

Introduction

In this chapter, we explore the methods, data, and estimation techniques employed to achieve the study's objectives. The initial section introduces the research design utilized for the study. Subsequently, we delve into the theoretical models applied in this research. The third section elucidates the estimation techniques, while the fourth section presents empirical models examining the impact of family nucleation on child learning outcomes in Ghana. Additionally, we define relevant variables and discuss their expected effects. Finally, we outline the data source, sampling approach, sample size, and data analysis procedure.

Research Design

Research design serves as the conceptual framework guiding a research project. It acts as the cohesive 'glue' that binds the various components of a study together. Given the study's overarching goals and the advantages of quantitative research design—such as increased reliability, objectivity, and broad applicability—the quantitative approach is chosen to estimate the study's objectives. This study employs a quantitative approach, which aims to maintain objectivity by setting aside the researcher's personal experiences, perceptions, and biases. Quantitative research involves collecting data in numerical form, allowing for rigorous analysis. It can be further categorized into inferential (inferring population characteristics or relationships), experimental (with controlled variables), and simulation (using numerical models to represent dynamic processes) (Kothari, 2004).

The quantitative research design allows for objective measurement and quantification of variables, providing clear and concrete data that can be statistically analyzed. It also involves large sample sizes which can lead to findings that are more generalizable to a wider population and also means that studies can be replicated by other researchers, which is crucial for validating findings.

Empirical Model Specification

Baseline models:

Ordinary Least Square (OLS)/ Linear Probability Model (LPM)

To examine the relationship between family size and children's educational outcomes, we employ a linear probability model (LPM) or ordinary least squares (OLS) regression. The choice of LPM as our baseline model is twofold: first, its marginal effects are straightforward to interpret (as demonstrated by Afoakwah, Deng, and Onur in 2020, and Afoakwah and Koomson in 2021); second, its coefficients can be directly compared with those obtained from the two-stage least squares (2SLS) method. However, the OLS estimates are biased to the extent that there is potential endogeneity which can make the results not reliable and valid measures of the effect of family nucleation on child learning outcomes.

Endogeneity in regression analysis occurs when one or more independent variables are correlated with the error term. This can lead to biased and inefficient parameter estimates. In the context of studying the effect of family nucleation on child learning outcomes in Ghana, the potential source of endogeneity may emanate from omitted variables in the model such as parental education, household income, access to educational resources may be

unobserved factors that influence both family nucleation and child learning outcomes. It is also possible that child learning outcomes could influence family nucleation rather than the other way round. For example, families with better performing children might be more likely to adopt a nucleated family structure. Also, family nucleation and child learning outcomes might be determined simultaneously by some unobserved factors such as parental involvement in education could affect both family nucleation and child learning outcomes.

Econometrically, the linear relation between family nucleation and child learning outcomes is stated below:

The models are specified as follows:

The link between family nucleation and child learning outcomes is stated in the econometric model below:

$$Child\ learning\ outcome = \beta_0 + \beta_1 family\ nucleation + \sum_{i=0}^{n} \beta_i\ control\ variables + \varepsilon_i \qquad (1)$$

Where, the child's learning outcome is the dependent variable, family nucleation is the independent variable, and ε_i is the error term.

$\sum_{i=0}^{n} \beta_i$ is the summation of coefficients of the control variables such as child age, child gender, family size, mother's educational status, father's educational status, the place of residence, household income, child disability, grade completed by a child, type of school, NHIS subscription, employment status, and work done by child's father. β_0 is the intercept of the equation and β_1 is the coefficient of family nucleation.

Two-Stage Least Square (TSLS)

The study employs the Two-Stage Least Square (TSLS) technique to assess the impact of family nucleation on child learning outcomes. The model is deemed appropriate to deal with the issues of self-selection bias in the choice of family nucleation. The TSLS utilizes an instrumental variable technique to address the issue of endogeneity whilst controlling for unobservable and observable heterogeneities. According to Zegeye and Meshesha (2022) unlike the other regression models like (LPM, OLS), the TSLS has potential in controlling the problem of selection bias, endogeneity, and unobserved heterogeneity.

TSLS is a technique commonly used to address endogeneity in regression models. In the context of studying the effect of family nucleation on child learning outcomes in Ghana, the following necessary conditions for implementing TSLS are met. Firstly, there should be a reason to suspect endogeneity in the relation between family nucleation and child learning outcomes. This could be due to unobservable factors that affect both family nucleation and child learning outcomes simultaneously. Secondly, there should be at least one valid instrumental variable. An instrumental variable is a variable that is correlated with the endogenous variable (family nucleation) but is not directly related to the dependent variable (child learning outcomes). It should satisfy the relevance condition, meaning that it is correlated with the endogenous variable.

Thirdly, the instrumental variables must be exogenous, meaning they are uncorrelated with the error term in the equation that models child learning

outcomes after accounting for family nucleation. This ensures that the instrument is not directly influencing the dependent variable

In correcting the endogeneity associated with the endogenous variable (family nucleation), we instrumented through contraceptive use. Contraceptive use can be a plausible instrument as it is associated with family size but does not directly impact child learning outcomes. For instance, families using contraceptives are more likely to plan their pregnancies, leading to smaller family sizes and if the learning outcomes of children are influenced by family size, then contraceptive use becomes a relevant and excludable instrument. In addition, contraceptive use is a relevant instrument to the extent that it correlates with the endogenous variable (family nucleation).

Contraceptive use could be relevant to family nucleation as it affects the decision to have more children. For example, families that use contraceptives tend to have fewer children. Contraceptive use as an instrument, affects the dependable variable (child learning outcomes) only through its impact on the endogenous variable (family nucleation). In the context of Ghana, it is crucial to ensure that contraceptive use influences child learning outcomes only through its effect on family size and not through any other direct channels hence it satisfy the assumption of excludability and also to a large extent a good instrument.

First stage regression equation:

Here we are estimating the impact of the endogenous variable (family nucleation) on the valid instrument (contraceptive use)

$$X_i = \alpha + \beta Z + \varepsilon_i \qquad (2)$$

Where; X_i is the endogenous variable (family nucleation), Z is the valid instrument (contraceptive use), and ε_i is the error term.

Second stage regression equation:

The second stage regression estimates the effect of family nucleation on child learning outcomes while controlling for potential endogeneity. It is specified as follows:

$$Y = \alpha + \beta X_1 + \gamma X_2 + \varepsilon_2 \qquad (3)$$

Where; Y is child learning outcomes, X_1 is family nucleation predicted by the instrumental variable from the first stage, X_2 is control variables that may affect child learning outcomes, and ε_2 is error term.

The empirical model estimated is captured in equation 4 as;

$$Y = \alpha + \beta X_1 + \gamma X_2 + \theta X_3 + \vartheta X_4 + \mu X_5 + \sigma X_6 + \tau X_7 + \delta X_8 + \varepsilon_i \qquad (4)$$

Where X_1 is family nucleation, X_2 is child age, X_3 is child gender, X_4 is family size, X_5 is mother's educational status, X_6 is father's educational status, X_7 is the place of residence (rural or urban), X_8 is household income and ε_i is the error term.

Channel analysis

The research utilizes the Two-Stage Least Squares (TSLS) method to evaluate how family nucleation affects child learning outcomes by influencing household spending on child education. This approach aims to disentangle the causal relationship between family structure changes and educational investment, without compromising originality.

Robustness check

To enhance the robustness of our analysis, we conducted a Lewbel model estimation, we explored the marginal effects of a primary model and validated the results. To achieve this, we employed the Lewbel (2012) technique, which incorporates heteroscedasticity. This method generates both internal and external instruments for the Two-Stage Least Squares (2SLS) regression. Notably, the Lewbel method allows for a combination of these instruments, making it a powerful tool. Previous research studies by Churchill and Marisetty (2020), Koomson, Abdul-Mumuni, and Abbam (2021), and Koomson and Danquah (2021) have successfully applied this approach. Our findings are based on a regression that utilizes both internal and external instruments, ensuring the robustness of our 2SLS estimates.

Definition and measurement of key variables (Variable Description)

Dependent Variable

Learning outcomes

In our study, we assess children's learning outcomes using a set of five related variables that capture literacy and numeracy abilities. These variables include: Reading in English or French, writing in English or French, reading in the native (Ghanaian) language, writing in the native language, and Ability to perform written calculations.

The children who participated in our study and answered questions related to learning outcomes are aged 6 years and above. Notably, relying solely on self-reported literacy has been found to be an inadequate measure (GSS, 2018). Therefore, in our research, we evaluate the child's ability to perform simple arithmetic and read a basic sentence either in English or a

local language. Specifically, if a respondent (child) can read the flashcard in English or French, we record a “Yes” response; otherwise, we code it as “No” using a binary measure. A child who demonstrates proficiency in any of these learning outcomes receives a value of 1, while those who do not are assigned a value of 0. On the other hand, specifically, if a respondent (child) can write a sentence on a flashcard in English or French, we record a ‘’Yes’’ response; otherwise, we code it as ‘’No’’ using a binary measure. A child who demonstrates proficiency in any of these learning outcomes receives a value of 1, while those who do not are assigned a value of 0. Also, specifically, if a respondent (child) can read a flashcard in Ghanaian Language, we record a ‘’Yes’’ response; otherwise, we code it as ‘’No’’ using a binary measure. A child who demonstrates proficiency in any of these learning outcomes receives a value of 1, while those who do not are assigned a value of 0. Furthermore, specifically, if a respondent (child) can write a sentence on a flashcard in Ghanaian Language, we record a ‘’Yes’’ response, otherwise, we code it as ‘’No’’ using a binary measure. A child who demonstrates proficiency in any of these learning outcomes receives a value of 1, while those who do not are assigned a value of 0. Lastly, specifically, if a respondent (child) can perform a simple written calculation on a flashcard in mathematics, we record a ‘’Yes’’ response, otherwise, we code it as ‘’No’’ using a binary measure. A child who demonstrates proficiency in any of these of learning outcomes receives a value of 1, while those who do not are assigned a value of 0.

Our focus for learning outcomes centers on children in basic school (year 6 and above), given the existing evidence that many young adults leave school with insufficient basic literacy and numeracy skills (World Bank,

2019). These variables play a crucial role in our study because they are integral to the core curriculum. Children at the basic education level must pass both written English and mathematics exams to progress to secondary or tertiary education levels (Afoakwah, Deng, & Onur, 2020). These learning outcomes are carefully chosen because they equip children with the strategic skills necessary for effective study and functioning as adults, contributing to societal productivity (World Bank, 2019).

Enhancing children's basic literacy and numeracy outcomes (as outlined in Sustainable Development Goal 4, Target 6) has significant long-term implications. It leads to higher rates of employment, increased productivity, and greater earnings. Additionally, it contributes to poverty reduction, improved health outcomes, and enhanced civic engagement. At the community level, a well-educated population fosters innovation, social mobility, trust, and institutional functioning, while reducing the likelihood of conflict (Pritchett, 2013; World Bank, 2018). In a multilingual country like Ghana, where English serves as a formal language, children's ability to read and write English enables effective interaction in schools, society, and prepares them for future workplace interactions.

Independent Variable

Family nucleation

Let's delve into the concept of household living arrangements. Traditionally, households were often extended, encompassing multiple generations and extended family members. These extended households were intricately linked to their socioeconomic systems, production methods, and social norms. However, over time, there has been a shift toward single-family

households, particularly the nuclear family—comprising a husband, wife, and their children. This transformation reflects changes in social behaviour, values, and family structures.

Index of nucleation:

The concept of nucleation is employed to construct an index that spans a range from 0 to 1. This index quantifies the degree of nucleation within children's living arrangements. Here's how it's calculated: Core Members: The index considers the number of core members in a household. These core members include parents and children and are categorized as either core nuclear or semi-nuclear. Household Size: The numerator of the index is the count of core members, while the denominator is the overall household size. A value closer to 1 indicates a higher level of nucleation within the household. Conversely, a value closer to 0 signifies a higher level of non-nucleation. This derived nucleation index is a continuous variable, distinct from the nominal categorical variable representing household composition. Researchers use this index to analyze the specific impact of nucleation (Annim et al., 2014).

Family nucleation, in this study, is the main independent variable. The type of family structure children belongs to shapes their development and affects their education outcomes. The GLSS does not collect direct information on the type of family structure a child belongs to, however, it contains information on the relationship to the household head and sex of the household head which is used to construct family structure variables. The family structure variable is constructed from the household membership roster. The family variable is categorized into the number of children from age 6-14 years who live in a nuclear; children living with married parents, single;

children living with a parent and extended; children living with parents and other family members including grandparents, uncles, and aunties. A child residing in a single-family structure is expected to experience poor education while those living in the nuclear and extended family structures are expected to have better learning outcomes (Anderson, 2014). The extent of the impact will however depend on the type of family structure.

Control Variables

Child's sex

The sex or gender of a child which serves as a major child characteristic is classified as a dummy variable where "1" represents male children and "0" represents female children. The sex of a child is a strong determinant of family structure and is expected to have a positive relationship with child education outcomes with female children showing greater vulnerability (Tioseco et al., 2006). Males in this case serve as the reference category.

Child's age

The age of children in the survey population was expressed in the year in the GLSS dataset. The study utilizes the variable exactly how it is measured in the data set. The age of a child is significantly associated with the risk of being uneducated such that, young children are more likely to experience learning-related issues (Kumar & Ram, 2013) and also inform the choice of a specific type of family structure.

Child disability

This is a binary variable. With a binary measure, in the GLSS, a child with a disability is assigned a value of "1", and "0" is assigned when a child does not have any disability.

Grade completed by a child

This is also a binary variable. In the GLSS, if a child completes or attains any grade at the lower primary, upper primary, JHS, and SHS and above, a value of "1" is assigned, and" 0" is assigned if a child does not complete any grade.

Type of school

This is a binary variable. In the GLSS, if a child attends a private school, then a value of "1" is assigned and when a child attends a public school, a value of "2" is assigned.

NHIS Subscription

This is also a binary variable. With a binary measure, in the GLSS, if a child is subscribed with NHIS, he/she is assigned a value of "1", and "0" is assigned when the child is not subscribed with NHIS.

Family Size

Family size is measured by the number of siblings in a particular household. Research indicates that children who belong to small-sized families have development and learning advantages over children in large family sizes (Aslund & Gronqvist, 2010). The number of siblings in the study is a continuous variable indicating exactly how many children aside the focal child resides in a particular household. It is also noted to inform the choice of family structure.

Mother and Father's Education

Education in the GLSS dataset is categorized into four categories; no education, primary, secondary, and tertiary education. For simplicity and easy interpretation, this study categorizes the variable into a dummy where "1" represents an individual with education and "0" represents an individual with no level of education. Education is also to some extent considered a determinant of family structure. According to Maarten et al., (2009), directly, parents' education has a marginally small effect on the education of their children but are of the view that higher education improves economic opportunities by reducing financial challenges among households which may influence child education outcomes. A child living in a household with educated parents is therefore more likely to experience better learning outcomes compared to a child residing with uneducated parents (Asalam & Kingdon, 2012). Uneducated is used as the reference category in this case.

Employment Status

The employment status of a mother is measured as "1" if the mother is employed and "0" if she is unemployed. Employed mothers are observed from other studies to spend less time than required with their children and hence are unable to see to the essential development and good education of their children. Unemployed mothers on the other hand spend most of their time with their children and are quick to recognize changes in their learning outcomes. Mother's employment has a negative effect on a child's education (Shahraki et al., 2016). The employment status of a mother is also found to significantly influence her choice of family structure.

Work done by the child's father

This is also a binary variable or categorical variable. In the GLSS, it is measured as "1" when a child's father is engaged in any work, and "0" when a child's father is not engaged in any work.

Type or Place of Residence

Type of residence is measured as a binary variable taking on values of 1 if the child is resident in an urban community or 0 if otherwise. According to official reports from the GLSS, the majority of the respondents live in urban areas relative to the rural setting in both surveys (2017). A child living in an urban area is expected to have better learning outcomes due to the availability of resources such as reading materials which may lead to improved education and wellbeing (Fink & Hill, 2014). The location of a household or the environment in which households reside also determines the type of family structure they adopt (Ansong et al., 2023).

Income

The wealth index, a proxy for household income, is used to measure inequalities in household characteristics, and in this study, education outcomes. It is an indicator of wealth, consistent with the income and expenditure of a particular household. The index was constructed using assets, consumables, such as a car, a television or radio set, and the availability of electricity, source of drinking water, and sanitation facilities. The index has a mean of 0 and a standard deviation of 1. Household scores are assigned to each household member once the index is computed and divided into poorest, poor, middle, rich, and richest. In this study, the wealth index is used as a measure of economic resources, a transmission mechanism through which

family structure affects education. It is expected to positively affect any type of family structure and hence have a positive impact on child learning outcomes (Koomson & Afoakwah, 2023).

Data Analysis

Both descriptive and quantitative analyses were employed. Descriptive analysis involved the use of tables and graphs. For quantitative analysis, the STATA 14.0 software package was utilized.

Data Type and Source

This research relies on secondary data from The GLSS7. The Ghana Living Standards Survey (GLSS) is a nationally representative household survey which provides reliable, disaggregated and internationally comparable welfare and living conditions statistics in Ghana. It was carried out over a period from October 22, 2016, to October 17, 2017, is a nationwide household survey aimed at measuring the living conditions and well-being of the population in Ghana. The survey employs a two-stage probability sampling approach and covers a diverse range of topics, including Education outcomes, Demography, Housing conditions, Employment, Water and sanitation, Health, Access to financial and insurance services, Remittances, Household assets, Disability, Migration, Agriculture, Non-farm activities, and Governance (GSS, 2019). This comprehensive dataset provides valuable insights for policymakers and stakeholders, aiding in the formulation of effective policies to improve the lives of the population and address poverty-related challenges in Ghana.

The survey sample, which represents the entire nation, includes 15,000 households across 1,000 enumeration areas (clusters), spanning Ghana's 10

(now 16) regions. Despite the increase in the number of regions from 10 to 16 after the GLSS7, the survey covered all geographical areas within the 16 regions that were originally part of the 10 regions. The final sample size, achieved with an impressive 93.4% response rate, comprised 14,009 households, totaling 59,864 individuals. After merging files containing the relevant variables, the sample size was further refined to 13,844 households. Among these households, 6,238 children had information available on learning outcomes.

The Household Questionnaire gathered essential demographic details for each individual listed. These included information on age, gender, marital status, relationship to the household head, and education level. Additionally, the questionnaire covered aspects related to child education and characteristics of the household's housing unit. These characteristics encompassed details about the water source, toilet facilities, floor materials, and ownership of durable goods.

Conclusion

This chapter outlined the methodology that is used in the study. It has presented the analytical framework, theoretical model, and also the derivation of the empirical estimation model and how it is employed. Furthermore, the specification of the model as well as the definition and justification of the variables used in the study have been discussed. The chapter further discusses the data used and presents the diagnostic test or post-estimation tests conducted in the study. The next chapter presents the descriptive statistics, the results of the study, and discussions of the findings.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

In this chapter, the study's outcomes and empirical discoveries are presented. Specifically, it includes descriptive statistics related to the study's variables and an analysis of the trends in family systems within Ghana. Again, econometric analysis from OLS and 2SLS methods are presented. The results and findings obtained from the analysis are then interpreted and elucidated.

Descriptive Statistics

Table 1: Summary statistics of variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Overall learn outcome	6238	3.02	1.847	0	5
Nucleation	6238	0.318	0.256	0	1
Child age	6238	13.982	1.943	11	17
Dependency	5452	1.64	0.828	1	5
Age start school	6238	5.271	3.11	0	14
Hours in class	6238	38.716	36.536	0	99
Hours on homework	6238	0.705	2.14	0	60
Household head age	6238	29.868	18.545	12	99
Household exp	6238	10474.317	9019.065	93.117	208868.13
log household exp	6238	8.958	0.821	4.534	12.249
Total exp education	6238	2115.416	3763.669	0	106784.83
log total exp education	6238	6.571	1.965	0	11.579

Source: Field Survey (2024)

The descriptive statistics for the variables are summarized in Table 1. In the Table, it is observed that the mean of overall learning outcome is 3.02 and families that are nucleated are 31.8% of the sampled data. Also, the mean child age is 14 years with a minimum of 11 years and a maximum of 17 years. Also, the mean age at which a child starts schooling is about 5years while the mean hours a child spends in class is about 39 hours as against less than one hour spent on homework. The mean age of household heads is about 30 years

with a minimum and maximum ages of 12 years and 99 years respectively. Household expenditure has a mean value of 10,474.32 while the log of household expenditure is 8.96 and mean of household expenditure on education is 2,115.42 and its log form is 6.571.

Figure 2, the data reveals that among the sampled children: 73.9% are capable of reading either English or French, 71.6% possess the ability to write in English or French. Approximately 40.2% can read in any native language. Only 36.0% can write in their native language (Ghanaian language). A significant proportion, 79.4%, can perform written calculation tasks. The average age of the children in the sample is approximately 14 years. The graph also indicates that 0.6% of the sampled children are disable while 99.4% of the sampled children are not disable. Also, from the graph, 81% of the sampled children had NHIS subscription while 19 % of sampled children did not have NHIS subscription.

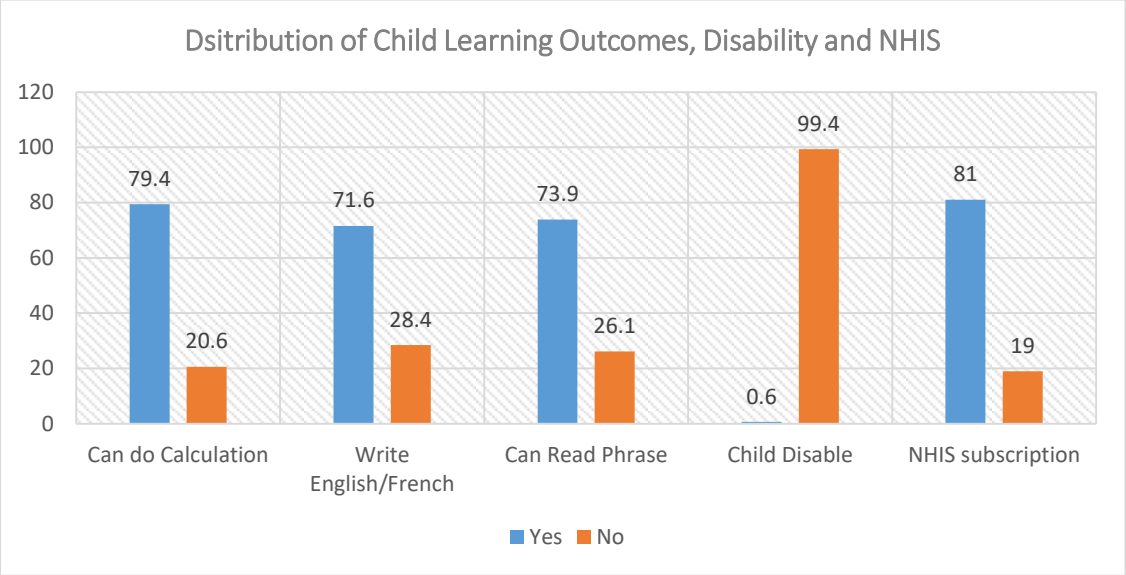

Figure 2: Distribution of children learning competence, disability status and NHIS subscription.
Source: GLSS7

Trend of Family System in Ghana from 2013 to 2017

Every Ghanaian child belongs to at least one of the three categories of family structure. As shown in Figure 3, the nuclear family structure happens to be dominant among the three accounting for about 50 percent and 55 percent respectively in 2013 and 2017 of the children in the survey. The single family or the semi nuclear structure follows, accounting for about 45 percent and 39 percent respectively in 2013 and 2017 of the children. The extended family structure happens to be the least practiced living arrangement in the country with only 5 percent and 6 percent respectively in 2013 and 2017 of children residing in it. This indicates that the Ghanaian family setting has completely adjusted to modernization and urbanization so much that the extended family system around which our norms and values were built is rapidly fading out (Annim et al., 2014). This is illustrated on the graph below:

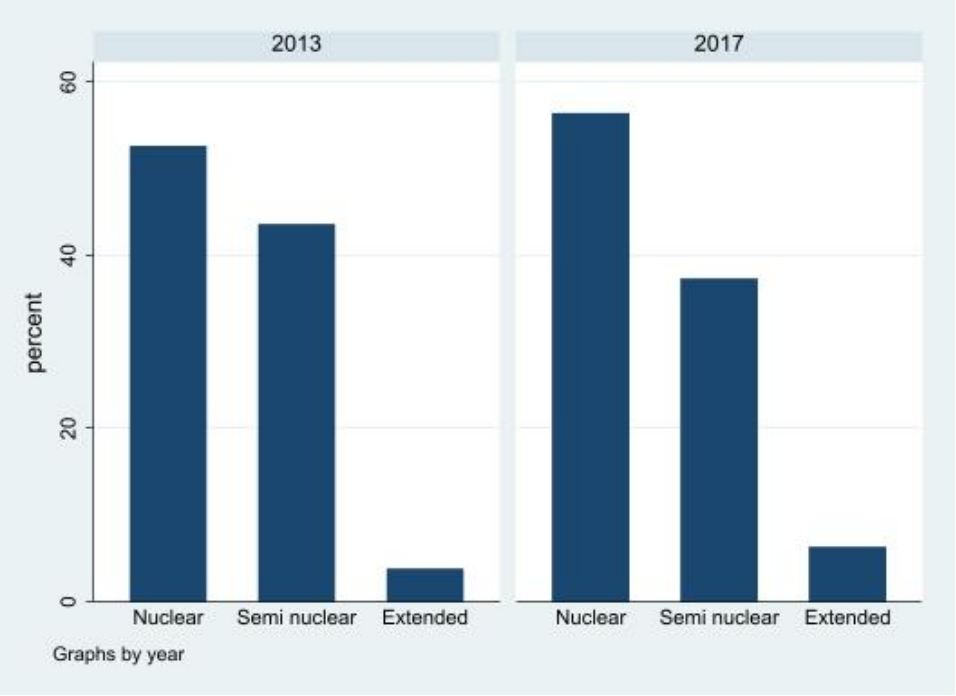

Figure 3: Trend of family system in Ghana from 2013 to 2017.
Source: Field Survey (2024).

Distribution of Family System across Ecological Zones in Ghana

The ecological zones of Ghana are divided into three zones comprising the coastal, forest and savannah zones. The coastal zone includes areas such as Greater Accra region, Central region, Volta region, Western region and Western North region. The forest zone on the other hand, comprises areas such as Brong Ahafo region, Bono East region, Ashanti region, Eastern region, and some parts of Oti regions. While the savannah zone comprises areas such as Northern region, Savannah region, North East region, Upper West and Upper East regions of Ghana.

As indicated in Figure 4, the coastal zone accounts for 41% of nuclear, 40% of semi nuclear and 19% of extended family of the sampled children living arrangements. Also, the forest zone accounts for 50% of nuclear, 40% of semi nuclear and 10% of extended family of the sampled children living arrangements. While the northern zone accounts for 60% of nuclear, 30% of semi nuclear and 10% of extended family of the sampled children living arrangements. The general observation from the graph indicates the persistent increase in the practice of nuclear and semi nuclear family systems among the ecological zones in Ghana, as against the continuous decline in the practice of extended family system, although there are differences in cultural norms and practices regarding child rearing and upbringing. This is illustrated on the graph below:

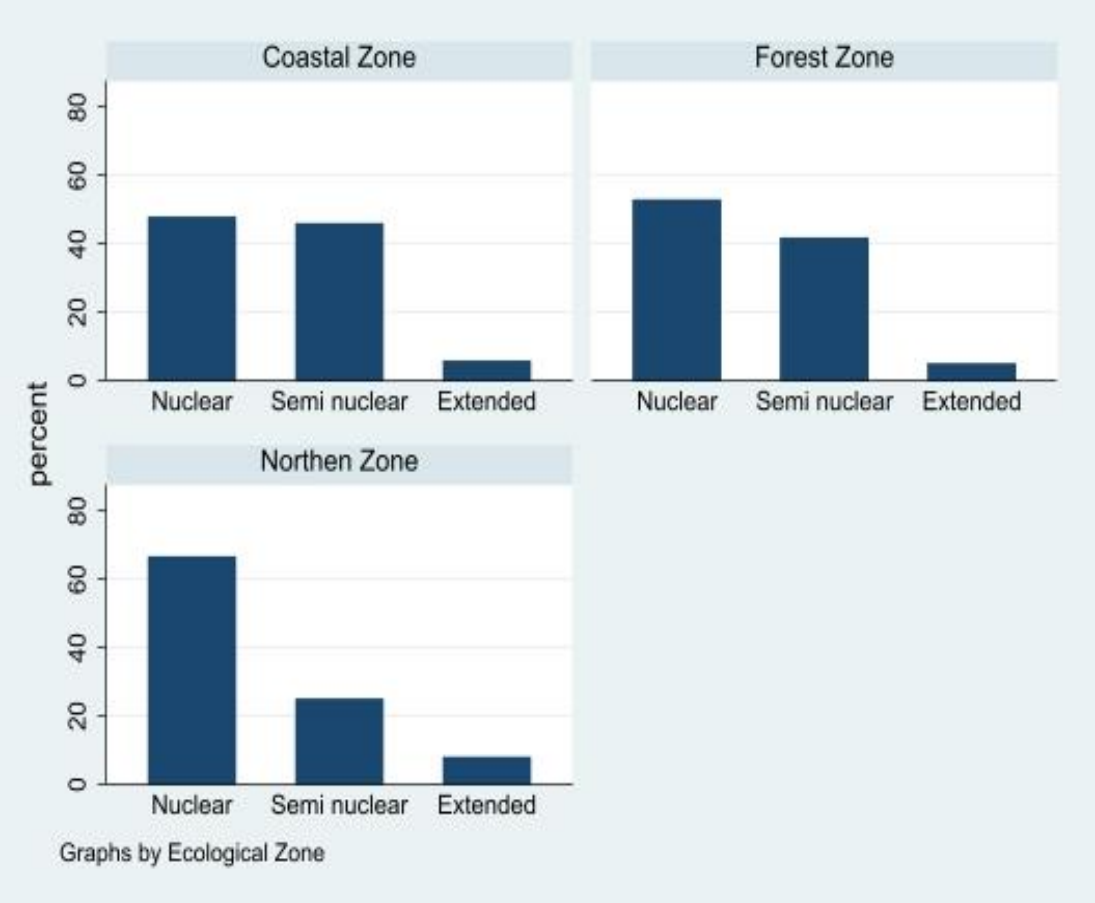

Figure 4: Distribution of family system across ecological zones.
Source: Field Survey (2024).

Distribution of Learning Outcomes by Family System

From Figure 5, it is clear that children from the nuclear family accounts for a greater percentage of the overall child learning outcome in the country, accounting for 58% of the overall child learning outcome. Children from the semi nuclear family also accounts for a lower percentage of the overall child learning outcome in the country, accounting for 39% of the overall child learning outcome. While children from the extended family accounts for the least percentage of overall child learning outcome in the country, accounting for 3% of the overall child learning outcome. The graph therefore suggests that children from the nuclear family have better learning

outcomes as compared to children from other family systems. This is shown in the figure below:

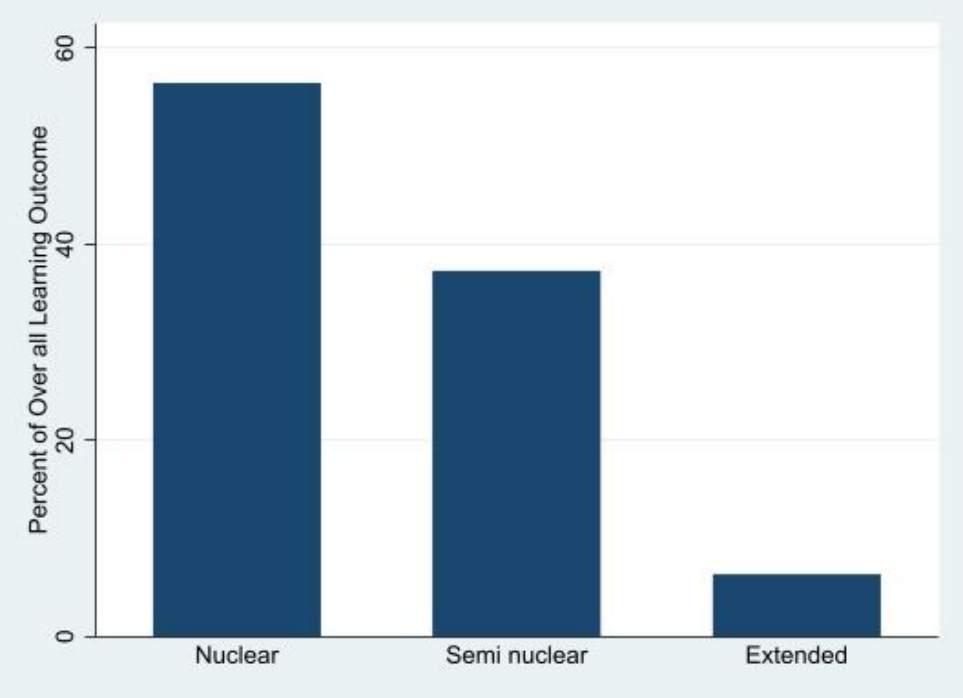

Figure 5: Distribution of learning outcomes by family system
Source: Field Survey (2024).

Regression Results:

Bivariate Analysis: Child learning outcomes and nucleation

Table 2: Child learning outcomes and nucleation

Table 2: Bivariate analysis: child learning Outcomes and nucleation

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Variables	Overall learning Outcome	Maths	Reading (E/F)	Writing (E/F)	Reading (GH)	Writing (GH)
Nucleation	0.555***	0.093***	0.105***	0.127***	0.113***	0.117***
	(0.088)	(0.019)	(0.021)	(0.021)	(0.025)	(0.024)
Constant	2.843***	0.764***	0.706***	0.676***	0.367***	0.331***
	(0.037)	(0.008)	(0.009)	(0.009)	(0.010)	(0.009)
Observations	6,238	6,238	6,238	6,238	6,238	6,238
R-squared	0.006	0.003	0.004	0.005	0.003	0.004

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Field Survey (2024).

A bivariate analysis is captured in Table 2. The analysis is on the relationship between family nucleation and five child learning outcome variables. The table shows that nucleation has a positive and statistically significant relationship with overall learning outcome. Thus, a point increase in nucleation, will increase overall learning outcome by approximately 0.555. Also, nucleation is observed to have a positive and significant effect on the five child's learning outcomes. Thus, the likelihood of a child being in a nucleated household, increases the probability of a child knowing how to do written calculation in maths by approximately 0.093. Also, the likelihood of a child being in a nucleated household, increases the probability of a child's ability to read in English/ French by approximately 0.105. Furthermore, the likelihood of a child being in a nucleated household as his or her living arrangement, increases the probability of a child's ability to write in English/French by approximately 0.127. Moreover, the likelihood of a child being in a nucleated household, increases the probability of a child's ability to read in Ghanaian language by approximately 0.113. Lastly, the likelihood of a child being in a nucleated household, increases the probability of a child's ability to write in Ghanaian language by approximately 0.117. However, nucleation has a greater positive effect on children's overall learning outcome and the least effect on children's maths performance. With these relationships, I further explored OLS models with covariates to understand the effects of those covariates on child learning outcomes.

Table 3: Learning Outcomes and Covariates (OLS/LPM)

Variables	(1) Overall learning Outcome	(2) Maths calculation	(3) Reading (E/F)	(4) Writing (E/F)	(5) Reading (GH)	(6) Writing (GH)
Nucleation	0.494***	0.088***	0.096***	0.117***	0.094***	0.100***
	(0.076)	(0.019)	(0.020)	(0.020)	(0.022)	(0.022)
Female child	0.032	-0.001	0.014	0.013	-0.000	0.006
	(0.036)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Child age	0.138	0.004	0.026	0.006	0.042	0.059
	(0.156)	(0.039)	(0.040)	(0.041)	(0.045)	(0.045)
Child age_sq	-0.005	0.000	-0.001	-0.000	-0.002	-0.002
	(0.006)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Age start school	0.156***	0.051***	0.053***	0.045***	0.005	0.001
	(0.030)	(0.007)	(0.008)	(0.008)	(0.009)	(0.009)
Age start school_sq	-0.014***	-0.005***	-0.004***	-0.004***	-0.001	-0.001
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Public school	0.611***	0.158***	0.170***	0.158***	0.058***	0.067***
	(0.042)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Grade completed by the child						
Lower Primary	-1.567***	-0.258***	-0.413***	-0.406***	-0.256***	-0.233***
	(0.102)	(0.025)	(0.026)	(0.027)	(0.030)	(0.030)
Upper Primary	-0.506***	-0.031	-0.112***	-0.111***	-0.134***	-0.119***
	(0.100)	(0.025)	(0.026)	(0.026)	(0.029)	(0.029)
JHS	0.529***	0.058**	0.063**	0.084***	0.159***	0.165***
	(0.101)	(0.025)	(0.026)	(0.027)	(0.029)	(0.029)
SHS and above	0.686***	0.014	0.041	0.069*	0.263***	0.299***
	(0.144)	(0.036)	(0.037)	(0.038)	(0.042)	(0.042)
NHIS subscription	0.313***	0.063***	0.057***	0.047***	0.073***	0.073***
	(0.047)	(0.012)	(0.012)	(0.013)	(0.014)	(0.014)

Table 3 Continued:

Child father work						
Agric	0.032	0.004	0.005	0.007	0.006	0.011
	(0.046)	(0.011)	(0.012)	(0.012)	(0.013)	(0.013)
Not agric	0.251***	0.055***	0.063***	0.056***	0.040***	0.037**
	(0.051)	(0.013)	(0.013)	(0.014)	(0.015)	(0.015)
Child disbi1ity	-1.265***	-0.248***	-0.257***	-0.233***	-0.295***	-0.231***
	(0.230)	(0.057)	(0.059)	(0.061)	(0.067)	(0.067)
Hours in class	0.003***	0.001***	0.001***	0.001***	0.000**	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hours on homework	0.059***	0.011***	0.011***	0.012***	0.013***	0.011***
	(0.009)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Grade completed by mother						
Lower primary	-0.010	0.002	-0.015	-0.048	0.037	0.013
	(0.204)	(0.051)	(0.052)	(0.054)	(0.059)	(0.059)
Upper primary	0.193*	0.052*	0.022	0.036	0.052	0.031
	(0.114)	(0.028)	(0.029)	(0.030)	(0.033)	(0.033)
JHS	0.113	0.025	0.020	0.017	0.035	0.016
	(0.083)	(0.021)	(0.021)	(0.022)	(0.024)	(0.024)
SHS and above	0.441**	0.091**	0.069	0.087*	0.099*	0.094*
	(0.182)	(0.045)	(0.047)	(0.048)	(0.053)	(0.053)
Head age	-0.001	-0.000	-0.000	-0.000*	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Head employed	-0.112***	-0.009	-0.036***	-0.034***	-0.014	-0.019*
	(0.039)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)

Table 3 Continued:

Insurance cover	**-0.121*** **	**-0.023** **	**-0.030*** **	**-0.040*** **	**-0.010**	**-0.018**
	(0.044)	(0.011)	(0.011)	(0.012)	(0.013)	(0.013)
Log household exp	0.133***	0.018***	0.024***	0.031***	0.031***	0.029***
	(0.026)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
Rural location	-0.436***	-0.078***	-0.102***	-0.110***	-0.073***	-0.072***
	(0.043)	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)
Ecological zone						
Forest zone	-0.007	-0.034***	-0.029**	-0.020	0.039***	0.037***
	(0.047)	(0.012)	(0.012)	(0.012)	(0.014)	(0.014)
Northern zone	-0.989***	-0.151***	-0.161***	-0.159***	-0.268***	-0.250***
	(0.054)	(0.014)	(0.014)	(0.014)	(0.016)	(0.016)
Constant	0.696	0.427	0.282	0.384	-0.137	-0.259
	(1.127)	(0.281)	(0.289)	(0.298)	(0.328)	(0.327)
Observations	6,238	6,238	6,238	6,238	6,238	6,238
R-squared	0.421	0.252	0.324	0.319	0.305	0.286

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Field Survey (2024)

Table 3 presents the results of an OLS regression on the effects of family covariates and other socioeconomic variables as well as the child's characteristics on child learning outcomes. On nucleation, it is again seen that it has positive and significant effects on overall learning outcome. Thus, a point increase in nucleation results in the increase of overall learning outcome by approximately 0.494. Also, nucleation is observed to have a positive and significant effects on the five learning outcomes. Thus, a point increase in nucleation results in increase of children's ability to do written calculation in maths, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 0.88, 0.96, 0.117, 0.94, and 0.100 respectively. This finding may be biased as the independent variable (nucleation) would have correlated with the error term indicating the presence of endogeneity in the estimation. Table 3 revealed that the gender of the child does not matter much in the child's learning outcome. Similarly, children who start school early have better learning outcomes as against those who start school late.

Again, Table 3 shows that children who are in public schools have better learning outcomes as against those children who are in private schools. Thus, children who are in public schools have better learning outcomes of overall learning outcome of 0.611 better than children in the private schools. Also, children in public schools are observed to have a better learning outcome on the five child learning outcomes. Thus, children who are in public schools have better learning outcomes of ability to do written calculation in maths, read in English/French, write in English/French, read in Ghanaian language and write in Ghanaian language of approximately 15.8, 17.0, 15.8,

5.8, and 6.7 percentage points respectively better than children in private schools. On a child's grade completion, as a child moves from lower grade to (say lower primary) to a higher grade (say SHS or above) it increases the child's learning outcome score better than those who have not attained any grade. Children who have completed lower primary and upper primary have reduced learning outcomes (negative outcomes) as against those who have completed JHS, SHS and above. However, children who have completed SHS or above have better learning outcomes for all learning outcomes except maths and reading (E/F) which are not significant.

Also, households that have health insurance (NHIS subscription) enhance the child's learning outcome better than those children that do not have NHIS subscription. Thus, children who have health insurance cover have better learning outcomes of overall learning outcome of 0.313 than children who do not have health insurance cover. Also, children who health insurance cover have better learning outcomes of 3 out of the five child learning outcomes of the ability to do written calculation, read in Ghanaian language, and write in Ghanaian language by approximately 6.3, 7.3, and 7.3 percentage points respectively than children who do not have health insurance cover

Table 3 further shows that the father's nature of employment affects the child's learning outcome. Fathers who are employed in non-Agric employment enhance their children learning outcomes better than children whose fathers were engaged in the Agric sector employment. Children whose fathers were engaged in the non-Agric sector have better learning outcomes of the overall learning outcome by 0.251 than those children whose fathers were engaged in the Agric sector. Also, children whose fathers were engaged in the

non-Agric sector employment have better learning outcomes of the five child learning outcomes of children's ability to do a written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 5.5, 6.3, 5.6, 4.0, and 3.7 percentage points respectively than children whose fathers were engaged in the Agric sector employment.

Children who are with disabilities have lower learning outcomes as against children without disabilities. Thus, children who are disable have reduced form of learning outcomes of the overall learning outcome of 1.265 decimal points lower than non-disabled children. Also, children are disable have reduced form of learning outcomes of the five child learning outcomes of children's ability to do a written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 24.8, 25.7, 23.3, 29.5, and 23.1 percentage points respectively lower than non-disabled children.

The hours a child spend on learning is positively related to learning outcome. A child that spends one hour more in the classroom achieves increases in learning outcome of 0.003 in overall learning outcome. Also, a child that spends one hour more in the classroom achieves increases in learning outcome of 3 out of the five child learning outcomes of children's ability to do written calculation in math, read in English/French, and read in Ghanaian language by approximately 0.001, 0.001, and 0.001 respectively. Hours spent on homework is observed to have a positive and significant effects on child learning outcomes. Thus, an increase in the hours a child spent on homework increases overall learning outcome by approximately 0.059.

Also, an increase in the hours that a child spends on homework increases the probability of a child knowing how to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 0.011, 0.011, 0.012, 0.013, and 0.011 respectively.

The mother's educational level is also observed to influence the child's learning outcome. Mothers who have completed SHS and above have their children having better learning outcomes as against children whose mothers have completed either lower or upper primary school. Thus, mothers who have completed SHS and above have their children having better learning outcome of the overall learning outcome by 0.0441than children of mothers who have completed either lower or upper primary school. Also, children whose mothers have completed SHS and above have their children having better learning outcomes of the five child learning outcomes of children's ability to do written calculation in math, read I English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 9.1, 6.9, 8.7, 9.9,and 9.4 percentage points respectively than children whose mothers have completed either lower, upper primary school, and mothers with no education.

Again, rurality affects children's learning outcomes. Children that are in rural areas have reduced overall learning outcomes by up to 0.436 lower than children who are in the urban areas. Thus, children who are resident in rural areas have reduced forms of learning outcomes of the five children learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and

write in Ghanaian language by approximately 7.8, 10.2, 11.0, 7.3, and 7.2 percentage points respectively lower than children who reside in urban areas.

Learning Outcomes and Covariates (TSLS)

Owing to the fact that the OLS and LPM estimates are likely to be biased due to a possible endogeneity emanating from the correlation between the independent variable and the error term in the estimation, we further explored two-stage least square (TSLS) models with covariates to understand the effects of those covariates on child learning outcomes. We used contraceptive use as a valid instrument to determine the predicted effect of family nucleation on child learning outcomes to cater to the endogeneity associated with nucleation. This is reported in Table 4.

Table 4:
Learning outcomes and covariates (TSLS)
Table 4: Learning outcomes and covariates (TSLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Overall learning Outcome	Maths calculation	Reading (E/F)	Writing (E/F)	Reading (GH)	Writing (GH)
Nucleation	1.414***	0.313**	0.401***	0.350**	0.259	0.091
	(0.534)	(0.136)	(0.140)	(0.144)	(0.160)	(0.157)
Female child	0.031	-0.001	0.013	0.013	-0.000	0.006
	(0.036)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Child age	0.220	0.024	0.053	0.027	0.057	0.058
	(0.171)	(0.043)	(0.045)	(0.046)	(0.047)	(0.047)
Child age_sq	-0.008	-0.001	-0.002	-0.001	-0.002	-0.002
	(0.006)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Age start school	0.154***	0.051***	0.053***	0.044***	0.005	0.001
	(0.029)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Age start school_sq	-0.014***	-0.005***	-0.004***	-0.004***	-0.001	-0.001
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Public school	0.628***	0.162***	0.175***	0.163***	0.061***	0.067***
	(0.044)	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)

Table 4 Continued:

Grade completed by the child						
Lower Primary	-1.533***	-0.250***	-0.401***	-0.398***	-0.250***	-0.233***
	(0.098)	(0.027)	(0.025)	(0.026)	(0.029)	(0.029)
Upper Primary	-0.506***	-0.031	-0.112***	-0.111***	-0.134***	-0.119***
	(0.093)	(0.025)	(0.023)	(0.025)	(0.029)	(0.029)
JHS	0.525***	0.057**	0.062***	0.082***	0.158***	0.165***
	(0.090)	(0.024)	(0.022)	(0.023)	(0.030)	(0.029)
SHS and above	0.653***	0.006	0.030	0.060**	0.257***	0.299***
	(0.124)	(0.028)	(0.027)	(0.028)	(0.043)	(0.042)
NHIS subscription	0.281***	0.055***	0.046***	0.039***	0.067***	0.073***
	(0.054)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
Child father work						
Agric	0.158*	0.034	0.046**	0.038	0.029	0.010
	(0.087)	(0.022)	(0.023)	(0.024)	(0.025)	(0.025)
Not agric	0.325***	0.073***	0.087***	0.075***	0.054***	0.037*
	(0.065)	(0.015)	(0.016)	(0.017)	(0.021)	(0.021)
Child disbi1ity	-1.309***	-0.259***	-0.272***	-0.245***	-0.303***	-0.230***
	(0.280)	(0.080)	(0.076)	(0.075)	(0.056)	(0.056)
Hours in class	0.003***	0.001***	0.001***	0.001***	0.000*	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hours on homework	0.058***	0.011***	0.011***	0.012***	0.013***	0.011***
	(0.014)	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)

Table 4 Continued:

Grade completed by mother						
Lower Primary	0.142	0.039	0.035	-0.009	0.065	0.012
	(0.219)	(0.057)	(0.057)	(0.056)	(0.064)	(0.061)
Upper Primary	0.358**	0.092***	0.076**	0.078**	0.082*	0.029
	(0.141)	(0.032)	(0.036)	(0.038)	(0.046)	(0.046)
JHS	0.266**	0.062**	0.070**	0.056*	0.063*	0.014
	(0.121)	(0.029)	(0.031)	(0.031)	(0.038)	(0.037)
SHS and above	0.591***	0.128***	0.118***	0.126***	0.126**	0.093
	0.142	0.039	0.035	-0.009	0.065	0.012
Head age	-0.002	-0.001*	-0.001	-0.001**	-0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Head employed	-0.181***	-0.026*	-0.059***	-0.051***	-0.027	-0.019
	(0.057)	(0.014)	(0.015)	(0.015)	(0.016)	(0.016)
Insurance cover	-0.113**	-0.021**	-0.027**	-0.038***	-0.008	-0.018
	(0.044)	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)
Log household exp	0.157***	0.024***	0.032***	0.037***	0.036***	0.029***
	(0.031)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)
Rural location	-0.403***	-0.070***	-0.092***	-0.102***	-0.068***	-0.073***
	(0.047)	(0.011)	(0.012)	(0.012)	(0.015)	(0.014)
Ecological zone						
Forest zone	0.014	-0.029***	-0.022**	-0.015	0.043***	0.037**
	(0.049)	(0.011)	(0.011)	(0.012)	(0.015)	(0.015)
Northern zone	-0.928***	-0.136***	-0.141***	-0.143***	-0.257***	-0.251***
	(0.065)	(0.016)	(0.017)	(0.018)	(0.019)	(0.019)
Constant	-0.470	0.142	-0.104	0.087	-0.347	-0.248
	(1.374)	(0.347)	(0.361)	(0.369)	(0.383)	(0.376)
Observations	6,238	6,238	6,238	6,238	6,238	6,238
R-squared	0.407	0.235	0.298	0.304	0.299	0.286

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Field Survey (2024)

Table 4 presents the results of a TSLS regression on the effects of family covariates and other socioeconomic variables as well as the child's characteristics on child learning outcomes. On nucleation, it is again seen that it has positive and significant effects on overall learning outcome. Thus, a point increase in nucleation results in the increase in overall learning outcome

by approximately 1.41. Also, nucleation is observed to have a positive and significant effects on three child learning outcomes. Thus, a point increase in nucleation results in the increase in children's ability to do written calculation in math, read in English/French, and write in English/French by approximately 0.313, 0.401, and 0.350 respectively. And positive but not significant on two learning outcomes. This shows an increase in the magnitude of the percentage change in the four learning outcomes with the TSLS over the OLS/LPM results. This finding could be attributed to the anecdotal evidence that the nuclear family seems to promote Mathematics, English, and French in their households while neglecting the native Ghanaian language in their children's schooling and performance. This finding is consistent with Peterson *et al* (2003), who found that nuclear families are often considered optimal environments for children due to their mutual support, shared responsibilities, long-term biological ties, and socioeconomic advantages. And these conditions which are at the core of nuclear family impact so positively on children's educational outcomes.

Similarly, children who start school early have better learning outcomes as against children who start school late. Thus, children who start school early have better learning outcomes of the overall learning outcome by approximately 0.154 than children who start school late. Also, children who start school early have better learning outcomes of 3 out of the five child learning outcomes of children's ability to do written calculation in math, read in English/French, and write in English/French by approximately 0.051, 0.053, and 0.044 respectively than children who start school late. This finding could be attributed to the anecdotal evidence that children who start school during

their formative years have high retentive memory of math calculation, reading, and writing in (English/French). This research aligns with the finding that early childhood education (ECE) has substantial positive effects. Specifically, participation in ECE leads to statistically significant reductions in special education placement and grade retention, while simultaneously increasing high school graduation rates. These outcomes underscore the value of ECE in both cost savings for education and the enhancement of child well-being (McCoy et al., 2017).

Again, Table 4 indicates that children in public schools have better learning outcomes as against children who are in private schools. Thus, children who are in public schools have better learning outcomes of the overall learning outcome by 0.628 than children who are in private schools. Also, children who are in public school have a better learning outcome of the five child learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 16.2, 17.5, 16.3, 6.1, and 6.7 percentage points respectively than children who are in private schools. This finding could be attributed to the fact that public schools in Ghana always get trained and qualified teachers with the requisite pedagogical skills to teach students, as compared to private schools which hire the services of untrained teachers without the requisite pedagogical skills. This research aligns with the finding that a school environment characterized by health policies, antismoking policies, a positive school climate, high average socioeconomic status, and an urban location has a beneficial impact on pupils' outcomes.

These outcomes encompass smoking habits, well-being, problem behaviour, and school achievement (Sellstrom et al., 2006).

On a child's grade completion, as a child moves from a lower grade to (say lower primary) to a higher grade (say SHS or above), it increases the child's learning outcome score. Children who have completed lower primary have reduced learning outcomes (negative outcomes) in overall learning outcome, and all the five learning outcomes studied. However, children who have completed SHS or above have better learning outcome than children who have completed lower, upper primary and no grade attained. Thus, children who completed SHS and above have better learning outcomes of the overall learning outcome by 0.653 than children who have not completed any grade. Also, children who have completed SHS and above have better learning outcomes of 3 out of the five child learning outcomes of children's ability to write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 6.0, 25.7, and 29.9 percentage points respectively than children who have not completed any grade.

Also, households that have health insurance cover (NHIS subscription) for children enhance their children's learning outcomes better than children who do not have health insurance cover. Thus, children who have health insurance cover have a better learning outcome of the overall learning outcome by approximately 0.281 than children who do not have NHIS subscription. Also, children who have health insurance cover have better learning outcomes of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language

by approximately 5.5, 4.6, 3.9, 6.7, and 7.3 percentage points respectively than children who do not have health insurance cover. This research aligns with the finding that households providing medical or health insurance coverage for their children contribute positively to the child's learning and growth. Specifically, children from families with two married biological parents are more likely to be enrolled in private health insurance (Warehime, 2011).

Table 4 further shows that the father's nature of employment affects the child's learning outcomes. Fathers who are employed in non-agric employment have their children having a better learning outcome as against children whose fathers were employed in the Agric sector. Thus, fathers are employed in the non-Agric sector have their children having better learning outcome of the overall learning outcome by approximately 0.325 than children whose fathers were employed in the Agric sector. Also, fathers who are employed in the non-Agric sector have their children having better learning outcomes of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 7.3, 8.7, 7.5, 5.4, and 3.7 percentage points respectively than children whose fathers were engaged in the Agric sector. This finding could be attributed to the anecdotal evidence that parents (fathers) who are employed in the non-agricultural sector do have a regular source of income unlike the agricultural sector which is seasonal, hence parents who are employed in the non-agricultural sector stand a better chance of providing the educational needs of their wards throughout the year. Research indicates that parental involvement in the labour market has a positive effect on children's exam performance.

However, it's worth noting that children with parents who work long hours tend to perform worse at the GCSE level (Rokicka et al., 2016).

Children with disabilities have lower forms of learning outcomes as against children who are non-disabled. Thus, children who are disabled have lower forms of learning outcome of the overall learning outcome by 1.309 than children who are not disabled. Also, children who are disabled have worst forms of learning outcomes of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 25.9, 27.2, 24.5, 30.3, and 23.0 percentage points respectively than children who are non-disabled. This finding is expected, as disabled children will automatically face challenges in learning both at school and at home. This research finding is consistent with Patten *et al (*1983), who have established that disabled children score low in classroom assessments and overall exams if such students are not given special care. They asserted that children with disabilities have lower self-esteem and higher general anxiety levels, which may affect their performance in mathematics, reading recognition, and general information achievement scores.

The hours a child spends on learning is positively related to learning outcome. A child who spends one hour more in the classroom achieves increase in learning outcome of the overall learning outcome by approximately 0.003. Also, a child who spends one hour more in the classroom achieves increases in learning outcome of 3 out of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, and write in English/French by approximately 0.001, 0.001, and 0.001

respectively. In addition, an increase in hours spent on homework increases children's learning outcomes of the overall learning outcome by approximately 0.058 decimal points. Similarly, an increase in hours spent on homework by a child increases children's learning outcome of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 0.011, 0.011, 0.012, 0.013, and 0.011. Intuitively, households that devote a lot of time to their children on their assignments and other exercises have the potency to improve children's learning outcomes positively.

The educational grade attained by a child's mother influences the child's learning outcome. Mothers who have completed upper primary, JHS, and SHS or above have their children having better learning outcomes as against children whose mothers do not attain any grade. Thus, mothers who have completed upper primary, JHS, and SHS or above have their children having better learning outcome of the overall learning outcome by 0.591 than children whose mothers do not attain any grade. Also, mothers who have completed upper primary, JHS, and SHS or above have their children having better learning outcomes of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 11.8, 12.6, 12.6, and 9.3 percentage points respectively than children whose mothers do not attain any grade. This finding could be attributed to the anecdotal evidence that women who have attained educational grades at the SHS or above get very involved in their children's academic

activities, especially at home. This finding is consistent with Katherine *et al* (2007), who found out that increased maternal education improves children's academic achievement and home environments, particularly for reading, but does not affect older or more highly educated mothers.

Furthermore, the household head employed and insurance cover coefficients are not intuitive. The fact is that if the household head is employed, we expect that the head would be able to take care of the child's educational needs and thus child's learning outcome be improved, but the results are negative. The same applies to the insurance cover.

Finally, rurality affects children's learning outcomes. Children who are in rural areas have reduced learning outcomes of the overall learning outcome by approximately 0.403 than children who are resident in the urban areas. Also, children who are in rural areas have worst forms of learning outcomes of the five child's learning outcomes of children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 7.0, 9.2, 10.2, 6.8, and 7.3 percentage points respectively than children who are in urban areas. This finding might be attributed to the fact that children who reside in the rural areas of Ghana, do not have equal access to educational learning materials and other richer resources such as access to ICT (laptops, tablets, internet) as compared to their urban counterparts. Research indicates that children in large urban and rural areas start kindergarten with less advanced academic skills compared to those in small urban areas and suburbs. This disparity is partly attributed to less favourable home environments and greater reliance on home-based preschool (Portia Miiler et al., 2013). Also, Baeck *et al* (2016), found

out that rural location significantly impacts academic success, with factors like school size, local adaptation, population composition, parent involvement, and rural approaches to learning influencing success.

Potential Channels Analysis

In this subsection, we explore the potential role of household expenditure on child education as an important pathway through which family nucleation influences children's learning outcomes. To remove outliers from the household expenditure on child education variable and avoid biased estimates, we use the logged version of the household expenditure on child education.

Following the two-step approach used in the literature, we examine the possible role of household expenditure on child education (Alesina & Zhuravskaya, 2011, Koomson & Awaworyi Churchill, 2021; Koomson & Danquah, 2021). As a first step, we need to ensure that household expenditure on child education is significantly associated with family nucleation. In column 1 of Table 5, step 1, we observed that household expenditure on child education is associated with an increase in nucleation by approximately 0.180, based on gender, we see that household expenditure on child education is associated with increases in nucleation by approximately 0.263 for female children/

Table 5:

Nucleation and household expenditure on child education

Table 5: Step 1 (Nucleation and household expenditure on child education)

	(Full model)	(Female child)	(Male child)	(Urban)	(Rural)
Variables	log Total exp education	log Total exp education	log Total exp education	log Total exp education	log Total exp education
Nucleation	0.180**	0.263**	0.094	0.108	0.160
	(0.081)	(0.121)	(0.110)	(0.128)	(0.103)
Female child	-0.026	No	No	-0.084	0.003
	(0.040)			(0.061)	(0.050)
Child age	-0.407**	-0.589**	-0.246	-0.798***	-0.245
	(0.178)	(0.255)	(0.249)	(0.279)	(0.223)
Child age_sq	0.015**	0.021**	0.010	0.028***	0.011
	(0.006)	(0.009)	(0.009)	(0.010)	(0.008)
Age start school	0.106***	0.081*	0.126***	-0.005	0.140***
	(0.029)	(0.043)	(0.040)	(0.046)	(0.039)
Age start school_sq	-0.010***	-0.009**	-0.011***	-0.001	-0.014***
	(0.003)	(0.004)	(0.004)	(0.005)	(0.003)
Public school	0.487***	0.468***	0.511***	-0.018	0.757***
	(0.055)	(0.082)	(0.074)	(0.071)	(0.077)
Grade completed by the child					
Lower Primary	-0.265**	-0.267*	-0.274**	-0.443***	-0.185
	(0.105)	(0.159)	(0.140)	(0.154)	(0.141)
Upper Primary	0.081	0.116	0.043	-0.091	0.112
	(0.097)	(0.141)	(0.132)	(0.128)	(0.134)
JHS	0.248**	0.288**	0.230*	0.100	0.341**
	(0.098)	(0.140)	(0.136)	(0.128)	(0.137)
SHS and above	0.679***	0.713***	0.651***	0.752***	0.916***
	(0.129)	(0.173)	(0.186)	(0.161)	(0.198)
Child NHIS	0.606***	0.523***	0.683***	0.203**	0.748***
	(0.064)	(0.093)	(0.089)	(0.101)	(0.078)
Employed head	-0.153***	-0.151**	-0.152***	-0.149**	-0.141***
	(0.042)	(0.060)	(0.058)	(0.063)	(0.053)
Child disbi1ity	0.238	0.276	0.202	-0.093	0.297
	(0.244)	(0.382)	(0.313)	(0.639)	(0.226)
Hours to/from sch	0.384***	0.249***	0.518***	0.243***	0.419***
	(0.050)	(0.074)	(0.066)	(0.073)	(0.064)

Table 5 Continued:

Grade completed by mother					
Lower primary	0.091	0.038	0.168	0.269	-0.102
	(0.162)	(0.193)	(0.247)	(0.230)	(0.202)
Upper primary	0.096	0.132	0.066	0.118	0.106
	(0.120)	(0.195)	(0.141)	(0.201)	(0.145)
JHS	0.021	0.106	-0.084	-0.032	0.079
	(0.078)	(0.101)	(0.122)	(0.115)	(0.104)
SHS and above	0.247	0.293	0.111	0.135	0.287
	(0.176)	(0.207)	(0.316)	(0.205)	(0.271)
Free uniform	-0.230**	-0.265**	-0.199	-0.058	-0.278***
	(0.096)	(0.127)	(0.143)	(0.245)	(0.104)
Dependency	0.239***	0.204***	0.266***	0.230***	0.256***
	(0.025)	(0.037)	(0.034)	(0.040)	(0.030)
Free exercise books	0.040	0.004	0.076	-0.098	0.051
	(0.065)	(0.089)	(0.095)	(0.104)	(0.075)
Log household exp	0.780***	0.845***	0.715***	0.790***	0.754***
	(0.030)	(0.043)	(0.043)	(0.046)	(0.038)
Rural location	-0.541***	-0.457***	-0.631***	No	No
	(0.045)	(0.066)	(0.062)		
Ecological zone					
Forest zone	-0.255***	-0.141**	-0.369***	0.013	-0.428***
	(0.048)	(0.070)	(0.066)	(0.066)	(0.067)
Northern zone	-1.002***	-0.862***	-1.131***	-0.449***	-1.196***
	(0.060)	(0.090)	(0.082)	(0.099)	(0.075)
Constant	1.597	2.426	0.917	5.454***	-0.311
	(1.260)	(1.766)	(1.796)	(2.024)	(1.566)
Observations	5,452	2,633	2,819	1,755	3,697
R-squared	0.393	0.390	0.403	0.238	0.361

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Field Survey (2024)

Table 6:

Learning outcomes with household expenditure on learning as an extra covariate.

Table 6: Step2 (learning outcomes with household expenditure on education as an extra covariate).

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Overall learning Outcome**	**Maths calculation**	**Reading (E/F)**	**Writing (E/F)**	**Reading (GH)**	**Writing (GH)**
Nucleation	0.937*	0.206	0.284**	0.234*	0.187	0.025
	(0.516)	(0.132)	(0.135)	(0.140)	(0.159)	(0.157)
Female child	0.041	0.001	0.015*	0.015*	0.001	0.008
	(0.035)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
Child age	0.180	0.015	0.043	0.018	0.051	0.053
	(0.166)	(0.042)	(0.044)	(0.045)	(0.047)	(0.047)
Child age_sq	-0.006	-0.000	-0.002	-0.001	-0.002	-0.002
	(0.006)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Age start school	0.142***	0.048***	0.050***	0.042***	0.003	-0.000
	(0.028)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Age start school_sq	-0.013***	-0.004***	-0.004***	-0.003***	-0.001	-0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Public school	0.511***	0.136***	0.147***	0.134***	0.044***	0.051***
	(0.043)	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)
Grade completed by child						
Lower Primary	-1.518***	-0.247***	-0.398***	-0.394***	-0.248***	-0.231***
	(0.096)	(0.027)	(0.025)	(0.026)	(0.029)	(0.029)
Upper Primary	-0.526***	-0.035	-0.117***	-0.116***	-0.137***	-0.122***
	(0.090)	(0.024)	(0.023)	(0.024)	(0.029)	(0.029)
JHS	0.480***	0.047**	0.051**	0.072***	0.151***	0.159***
	(0.087)	(0.023)	(0.021)	(0.023)	(0.030)	(0.029)
SHS and above	0.512***	-0.025	-0.005	0.026	0.236***	0.280***
	(0.119)	(0.027)	(0.025)	(0.027)	(0.042)	(0.042)
NHIS subscription	0.196***	0.036***	0.026*	0.018	0.054***	0.062***
	(0.053)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)

Table 6 Continued:

Child father work						
Agric	0.130	0.028	0.040*	0.032	0.024	0.006
	(0.084)	(0.021)	(0.022)	(0.023)	(0.025)	(0.025)
Not agric	0.283***	0.063***	0.077***	0.064***	0.047**	0.031
	(0.063)	(0.014)	(0.015)	(0.016)	(0.021)	(0.021)
Child disbi1ity	-1.337***	-0.265***	-0.279***	-0.251***	-0.308***	-0.234***
	(0.274)	(0.078)	(0.074)	(0.073)	(0.056)	(0.057)
Hours in class	0.002***	0.001***	0.001***	0.001***	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hours on homework	0.050***	0.009***	0.009***	0.010***	0.012***	0.010***
	(0.013)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Grade completed by mother						
Lower Primary	0.043	0.017	0.011	-0.033	0.050	-0.002
	(0.217)	(0.056)	(0.056)	(0.056)	(0.064)	(0.061)
Upper Primary	0.312**	0.082***	0.065*	0.067*	0.075*	0.023
	(0.139)	(0.032)	(0.036)	(0.038)	(0.045)	(0.046)
JHS	0.201*	0.047*	0.055*	0.040	0.053	0.005
	(0.118)	(0.028)	(0.030)	(0.031)	(0.038)	(0.037)
SHS and above	0.494***	0.107***	0.095***	0.102***	0.112*	0.079
	(0.156)	(0.030)	(0.034)	(0.034)	(0.061)	(0.063)
Head age	-0.001	-0.000	-0.000	-0.001*	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Head employed	-0.123**	-0.013	-0.045***	-0.037**	-0.018	-0.011
	(0.055)	(0.014)	(0.015)	(0.015)	(0.016)	(0.016)
Insurance cover	-0.108**	-0.020*	-0.026**	-0.037***	-0.008	-0.018
	(0.043)	(0.010)	(0.011)	(0.011)	(0.013)	(0.013)
Log household exp	-0.007	-0.013	-0.008	-0.003	0.011	0.006
	(0.032)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Log total Educ exp	0.183***	0.041***	0.045***	0.044***	0.028***	0.025***
	(0.011)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Rural location	-0.338***	-0.055***	-0.076***	-0.086***	-0.058***	-0.064***
	(0.046)	(0.011)	(0.011)	(0.012)	(0.015)	(0.014)

Table 6 Continued:

Ecological zone						
Forest zone	0.057	-0.020*	-0.012	-0.005	0.050***	0.043***
	(0.047)	(0.010)	(0.011)	(0.012)	(0.015)	(0.015)
Northern zone	-0.800***	-0.107***	-0.110***	-0.112***	-0.237***	-0.233***
	(0.063)	(0.016)	(0.017)	(0.017)	(0.019)	(0.019)
Constant	0.289	0.312	0.081	0.272	-0.232	-0.143
	(1.333)	(0.339)	(0.351)	(0.361)	(0.379)	(0.375)
Observations	6,238	6,238	6,238	6,238	6,238	6,238
R-squared	0.442	0.273	0.340	0.339	0.311	0.291

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Field Survey (2024)

In the second step, we incorporate the household expenditure on child education as an extra covariate in the model to observe how it is associated with the five child's learning outcomes. In column 25 of Table 6, step 2, it is observed that total household education expenditure is positively and significantly associated with overall learning outcome. Thus, a point increase in total education expenditure results in an increase of 0.183 in children's overall learning outcome. Also, it is observed that total household education expenditure is positively and significantly associated with the five child's learning outcomes. Thus, a point increase in total household education expenditure results in an increase in children's ability to do written calculation in math, read in English/French, write in English/French, read in Ghanaian language, and write in Ghanaian language by approximately 0.041, 0.045, 0.044, 0.028, and 0.025 respectively.

This finding is consistent with Reham Rizk *et al* (2014), who found that household expenditure on children's education significantly increases

with higher income levels and household head education levels, suggesting the need for educational subsidies or scholarships for less well-off households. This finding too is consistent with Emillana Vegas *et al* (2015), who found that education spending is associated with increased student performance in mathematics only in systems spending below US$ 8,000 per student annually, with a mean achievement of 14 points higher for an additional US$1,000 spent. We conclude that, based on these findings, household expenditure on child education is an important channel through which family nucleation influences child's learning outcomes.

Table 7:

Robustness Checks

Table 7: child learning outcomes and covariates (Lewbel)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Overall learning Outcome	Maths calculation	Reading (E/F)	Writing (E/F)	Reading (GH)	Writing (GH)
Nucleation	0.406***	0.092***	0.123***	0.106***	0.041	0.043
	(0.134)	(0.030)	(0.032)	(0.034)	(0.039)	(0.039)
Female child	0.068*	0.003	0.022**	0.019*	0.010	0.014
	(0.038)	(0.009)	(0.010)	(0.010)	(0.011)	(0.011)
Child age	0.728***	0.113***	0.186***	0.153***	0.137***	0.139***
	(0.165)	(0.040)	(0.042)	(0.043)	(0.046)	(0.046)
Child age_sq	-0.023***	-0.003**	-0.006***	-0.005***	-0.004**	-0.004***
	(0.006)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Age start school	-0.158***	0.008	-0.019**	-0.030***	-0.057***	-0.060***
	(0.029)	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)
Age start school_sq	0.001	-0.003***	-0.001	-0.000	0.002***	0.002***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Public school	0.583***	0.148***	0.156***	0.144***	0.063***	0.072***
	(0.044)	(0.010)	(0.011)	(0.011)	(0.013)	(0.013)

Table 7 Continued:

Child Grade complted	0.576***	0.079***	0.117***	0.125***	0.128***	0.127***
	(0.029)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
NHIS subscription	0.328***	0.059***	0.068***	0.057***	0.072***	0.071***
	(0.053)	(0.013)	(0.014)	(0.014)	(0.015)	(0.014)
Father's work	0.116***	0.027***	0.031***	0.027***	0.017**	0.015*
	(0.025)	(0.005)	(0.006)	(0.006)	(0.008)	(0.008)
Child disbi1ity	-1.347***	-0.290***	-0.305***	-0.282***	-0.267***	-0.204***
	(0.272)	(0.076)	(0.072)	(0.071)	(0.052)	(0.054)
Hours in class	0.004***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hours on homework	0.068***	0.012***	0.013***	0.014***	0.015***	0.013***
	(0.016)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
Child mother's grade	0.071***	0.015***	0.013**	0.013**	0.018**	0.012
	(0.024)	(0.005)	(0.005)	(0.006)	(0.008)	(0.008)
Head age	0.002	0.000	0.000	0.000	0.001**	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Head employed	-0.150***	-0.016	-0.051***	-0.056***	-0.014	-0.014
	(0.043)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Insurance cover	-0.129***	-0.024**	-0.023**	-0.037***	-0.017	-0.029**
	(0.045)	(0.010)	(0.011)	(0.012)	(0.013)	(0.014)
Log household exp	0.189***	0.026***	0.033***	0.040***	0.046***	0.043***
	(0.029)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
Rural location	-0.486***	-0.079***	-0.110***	-0.116***	-0.091***	-0.090***
	(0.045)	(0.010)	(0.011)	(0.011)	(0.014)	(0.014)
Ecological zone	-0.524***	-0.079***	-0.085***	-0.085***	-0.143***	-0.132***
	(0.029)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Constant	-3.403***	-0.318	-0.879***	-0.632**	-0.788**	-0.785**
	(1.209)	(0.299)	(0.310)	(0.319)	(0.332)	(0.330)
Observations	6,202	6,202	6,202	6,202	6,202	6,202
R-squared	0.355	0.217	0.266	0.261	0.248	0.230

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: Field Survey (2024)

In assessing the robustness of 2SLS (Two-Stage Least Squares) estimates, researchers employ the Lewbel (2012) method. To address heteroscedasticity in the data and create instruments for the Two-Stage Least Squares (2SLS) regression, researchers have explored both internal and external methods. Notably, the Lewbel method permits a combination of these

instruments. Prior studies, including those by Churchill and Marisetty (2020), Koomson, Abdul-Mumuni, and Abbam (2021), and Koomson and Danquah (2021), have delved into these techniques.

Table 7 presents the Lewbel 2SLS method. It reports findings from the regression that used both internal and external instruments. From Table 7, it is observed that nucleation has positive and significant effects on three child learning outcomes, which is consistent with the TSLS estimation results on nucleation, and child learning outcomes. Thus, a point increase in nucleation, results in an increase of overall learning outcome by approximately 0.406. Also, a point increase in nucleation results in an increase of 3 out of the five child's learning outcomes of children's ability to do math calculation, reading in (English/French), and writing in (English/French) by approximately 0.092, 0.123, and 0.106 respectively. The Lewbel 2SLS results also show consistency with the other covariates of the child characteristics and socioeconomic background results of the baseline estimation results (2SLS).

Overall, findings from the Lewbel 2SLS estimates are consistent with those from the baseline and the externally instrumented results in Table 3 and 4 respectively. A critical look at the results shows that the coefficients of the Lewbel 2SLS estimates in Table 7 are much closer to, but a bit higher than those of the OLS/LPM. The Lewbel 2SLS estimates that combine internal and externally generated instruments are also slightly higher than those that use only instruments, which is in consonance with most studies that have employed this technique (Churchill and Marisetty 2020; Koomson, Abdul-Mumuni, and Abbam 2021; Koomson and Danquah 2021).

Table 8:

Heterogeneity analysis

Table 8: Child Learning outcomes by child sex, location, and type of school

	Female	Male	Urban	Rural	Private	Public
Variables	Overall learning Outcome	Overall learning outcome	Overall learning outcome	Overall learning Outcome	Overall learning outcome	Overall learning Outcome
Nucleation	0.964	1.931**	2.239***	0.428	2.658**	0.364
	(0.715)	(0.814)	(0.817)	(0.740)	(1.111)	(0.600)
Female child	No	No	0.039	0.035	0.007	0.030
			(0.060)	(0.045)	(0.066)	(0.042)
Child age	0.521**	-0.067	0.117	0.264	-0.417	0.187
	(0.260)	(0.230)	(0.313)	(0.207)	(0.311)	(0.205)
Child age_sq	-0.019**	0.003	-0.004	-0.009	0.013	-0.005
	(0.009)	(0.008)	(0.011)	(0.007)	(0.011)	(0.007)
Age start school	0.122***	0.179***	0.141***	0.162***	0.241***	0.104***
	(0.045)	(0.037)	(0.051)	(0.036)	(0.057)	(0.033)
Age start school_sq	-0.012***	-0.016***	-0.018***	-0.014***	-0.017***	-0.012***
	(0.004)	(0.003)	(0.006)	(0.003)	(0.006)	(0.003)
Public school	0.561***	0.692***	0.232***	0.897***	No	No
	(0.063)	(0.062)	(0.071)	(0.059)		
Grade completed by the child						
Lower Primary	-1.405***	-1.633***	-1.415***	-1.508***	-1.235***	-1.696***
	(0.155)	(0.126)	(0.181)	(0.122)	(0.177)	(0.123)
Upper Primary	-0.422***	-0.575***	-0.553***	-0.455***	-0.449**	-0.629***
	(0.145)	(0.120)	(0.154)	(0.121)	(0.181)	(0.111)
JHS	0.586***	0.472***	0.298**	0.654***	0.970***	0.220**
	(0.141)	(0.116)	(0.139)	(0.119)	(0.187)	(0.105)
SHS and above	0.757***	0.569***	0.306*	1.189***	1.353***	0.299**
	(0.186)	(0.165)	(0.174)	(0.179)	(0.273)	(0.128)
NHIS subscription	0.148*	0.384***	0.315***	0.283***	0.282***	0.144**
	(0.078)	(0.077)	(0.091)	(0.068)	(0.106)	(0.062)
Child father work						
Agric	0.017	0.307**	0.129	0.086	0.287	0.092
	(0.117)	(0.129)	(0.166)	(0.108)	(0.185)	(0.093)
Not agric	0.245***	0.398***	0.246**	0.405***	0.361**	0.258***
	(0.092)	(0.090)	(0.113)	(0.082)	(0.150)	(0.070)
Child disbi1ity	-1.538***	-1.114***	-1.277**	-1.337***	-0.908***	-1.187***
	(0.406)	(0.362)	(0.515)	(0.352)	(0.346)	(0.378)
Hours in class	0.004***	0.002**	0.002**	0.002***	0.010***	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Hours on homework	0.051**	0.065***	0.024	0.077***	0.105***	0.026**
	(0.022)	(0.016)	(0.017)	(0.020)	(0.033)	(0.011)

Table 8 Continued:

Grade completed by mother						
Lower Primary	-0.232	0.438*	0.552	-0.208	0.187	0.146
	(0.382)	(0.243)	(0.337)	(0.280)	(0.421)	(0.239)
Upper Primary	0.361*	0.366*	0.552***	0.175	0.840***	0.119
	(0.196)	(0.202)	(0.198)	(0.197)	(0.287)	(0.155)
JHS	0.313*	0.231	0.609***	-0.058	0.609**	0.074
	(0.170)	(0.172)	(0.185)	(0.165)	(0.258)	(0.132)
SHS and above	0.502**	0.683***	0.659***	0.680**	1.007***	0.320*
	(0.242)	(0.202)	(0.208)	(0.298)	(0.335)	(0.168)
Head age	-0.001	-0.003*	-0.009***	0.001	-0.006**	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)
Head employed	-0.140*	-0.217***	-0.129	-0.161***	-0.268**	-0.065
	(0.081)	(0.081)	(0.128)	(0.062)	(0.106)	(0.066)
Insurance cover	-0.096	-0.117*	0.017	-0.197***	-0.201**	-0.078
	(0.062)	(0.066)	(0.068)	(0.059)	(0.084)	(0.051)
Log household exp	0.109**	0.186***	0.188***	0.113***	0.227***	0.088**
	(0.044)	(0.043)	(0.053)	(0.038)	(0.058)	(0.036)
Rural location	-0.408***	-0.397***	No	No	-0.487***	-0.258***
	(0.065)	(0.068)			(0.094)	(0.052)
Ecological zone						
Forest zone	0.042	-0.032	-0.027	0.081	0.030	0.093*
	(0.068)	(0.069)	(0.071)	(0.067)	(0.093)	(0.056)
Northern zone	-1.021***	-0.874***	-0.704***	-0.957***	-0.813***	-0.867***
	(0.097)	(0.087)	(0.109)	(0.083)	(0.123)	(0.072)
Constant	-1.773	0.932	0.340	-0.922	2.702	1.414
	(2.130)	(1.794)	(2.576)	(1.662)	(2.558)	(1.665)
Observations	3,039	3,199	2,076	4,162	1,932	4,306
R-squared	0.411	0.401	0.193	0.420	0.506	0.397

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Author's,

We further explore heterogeneity analysis to foster an understanding of how differently the relationship between nucleation, child sex, location of the child, and the type of school on the direction of the effects of family nucleation in this study. This is reported in Table 8.

It is clear from Table 8 that nucleation has a positive and significant effect on male children's overall learning outcomes, urban children's overall learning outcomes, and private overall learning outcomes. A point increase in nucleation results in an increase in male children's overall learning outcome, urban children's learning outcome, and private overall learning outcome by approximately 193.1, 223.9, and 265.8 percentage points respectively. However, nucleation has a positive but not significant effect on female children's overall learning outcomes, rural overall learning outcomes, and public overall learning outcomes. This finding is consistent with Xin Ma *et al* (2015), who found that parental involvement in early childhood education and early elementary education positively correlates with academic achievement, with family involvement being more important than school and community partnerships. Also, this finding is consistent with Fantuzzo *et al* (2004), found that home-based family involvement is the strongest predictor of positive child outcomes in early childhood education, including motivation, attention, task persistence, receptive vocabulary skills, and low conduct problems.

Conclusion

The chapter discussed the empirical findings of the study. The chapter provided insights into descriptive and quantitative analyses. It highlighted on bivariate analysis, OLS/LPM results, TSLS results, potential channel through which the family influences child's learning outcomes, robustness checks and finally on heterogeneity analysis. The next chapter deals with summary, conclusion and recommendations.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The chapter commences with a summary section that succinctly outlines the research problem, objectives, methodology, and study results. Following this, the conclusion emphasizes the overall findings of the study. Additionally, the chapter offers recommendations and outlines the path for future research.

Summary of Findings

Over the years, there have been rapid changes in the traditional family system, which necessitate the transition into nuclear family system in Ghana due to modernization, urbanization and industrialization. And in this transition, the welfare, growth, and economic success of children are quite paramount. It is also a fact that the family is a key stakeholder as far as the learning and schooling outcomes of children is concerned. Furthermore, in the evolving dynamic educational landscape, there is the need to investigate the effect of family nucleation on child learning outcomes.

In relation to the study's objectives and insights derived from the literature review, the research employed both OLS/LPM (Ordinary Least Squares/Linear Probability Model) and TSLS (Two-Stage Least Squares) estimation techniques. Specifically, the linear probability model was utilized to assess the linearity effect, which was one of the study's objectives. These estimation methods were chosen due to their inherent advantages, including providing insights into relationship directions, enabling effective decision-making by policymakers. The study incorporated variables such as family

nucleation and child learning outcomes (including reading in English and French, writing in English and French, math calculations, reading in Ghanaian language, and writing in Ghanaian language) sourced from the Ghana Living Standard Survey database (GLSS).

The study first explored to understand the relationship between family nucleation and child learning outcomes in Ghana using data from the Ghana Living Standard Survey (GLSS), collected in 2017. The contraceptive use by parents was used as an instrument to solve the possible problem of endogeneity. Differences in child learning status were observed between children of different sexes in the nuclear family structure. Overall, children residing in nuclear family structures were found to be at a significant advantage for almost all child learning outcome measures. This may be due to the availability of all resources in double portions. After the estimation of the main models, the results from the estimation indicated that family nucleation affects children's learning outcomes positively and significantly. The results also indicated that child characteristics and socioeconomic factors affect child learning outcomes either positively or negatively as well. The findings of the study to a large extent confirmed the household's expenditure on education as a potential channel through which family or household can influence child learning in the country.

Aside from family nucleation, the results show that a child's sex, NHIS subscription, mother's education, place of residence, nature of father's employment, child disability, type of school, grade completed by the child, grade completed by mother, employment status, age start school, hours in class, and hours on homework are significant determinants of child learning

outcome. Their effects are however distinct across the various genders of children in the nuclear family structure.

Parents in this family structure, pool financial resources and are in the long run able to cater for the education and well-being needs of their children. Also, parents in the nuclear family structure due to cooperation and division of labor, exhibit good parenting skills. Here, parents can share their time and care with their children which will most likely improve the learning outcomes of their children.

Conclusion

In general, we can conclude that the type of household composition (nuclear family) a child belongs to can forecast the probability of a child experiencing improvement in his/her learning outcomes such as the ability to do math calculations, read in English/French, write in English/French, read in (GH), and write in (GH). Thus, family structure and education care policies should focus more on single families. Family nucleation as seen later on in Table 5, works through a pathway thus total household expenditure and its components such as economic resources of the household, child NHIS subscription, hours to/from school, school uniform provision, dependency level, exercise books, and other school supplies that affect child education.

The key finding indicates that the transition from extended family structures to nuclear family arrangements in Ghana has a positive impact on children's learning and educational outcomes. These effects vary based on gender and rural-urban distinctions. Specifically, Family nucleation has a positive influence on two out of five learning outcomes for girls. Family nucleation significantly affects four out of five learning outcomes for boys.

Additionally, family nucleation appears to reduce learning poverty more significantly for urban children than for their rural counterparts.

Policy Implications and Recommendations

The study identifies some general issues which may benefit the drafting of policy measures and implications. Some areas may be already under active consideration in which case this study may contribute to current discussions. The study conducted emphasizes the possible advantages of developing parenting programs in Ghana specifically targeted at; supporting parents to manage the education outcomes of their children. GES, through this initiative, can introduce support groups where parents can be provided with some guidance and counselling on issue-specific solutions to their children educational outcomes.

Secondly, improving access to various sources of information and education pertinent to good parenting skills and methods required to improve child education (learning) and the general well-being of children. Ministry of Gender, Children and Social Protection (MGCS) can organize workshops and training programs for mothers yearly, to educate them on child education issues and their solutions as well as to keep them informed especially mothers in rural areas, on better parenting skills which may be family structure-specific, and other initiatives, tailored towards better learning and wellbeing for children.

Similarly, the Ministry of Gender, Children and Social Protection should expand its social protection network by enrolling more children from poverty-endemic households into the NHIA membership so that such children can get medical coverage to ensure good health and better learning outcomes.

Also, child education experts can design and develop a website where information is readily available and easily accessible. Also, developing workable and different sources of support for children experiencing child disability challenges through raising awareness of the role family structure plays via school and educational approaches.

Last but not least, structures and measures can be put in place to co-opt women into the labour force market to reduce the financial burden of men in various households and improve a child's chances of good learning status. These measures if put into place will be of benefit to the country and move it a step closer to achieving the Sustainable Development Goal 4 of quality and accessible education for all citizens irrespective of age and race.

Direction for Future Research

The study settled for the use of a simple composition of family structure (nuclear) based on the Ghanaian context rather than the complex composition (single, cohabiting, extended, and step-biological parent) that has been used in most studies conducted in the U.S and U.K. This is particularly due to unavailable data on these complex family structure forms. The use of the complex composition would have thrown the study from a broader perspective and would have captured a lot more children than originally sampled. Also, the study would have been able to figure out how these new family structure types may also influence the education of children in such households. Other types of family structure forms keep springing up, with available data, this study can be conducted using new family structure variables and other measures of child education outcomes and this could be the subject of further empirical investigation in the Ghanaian context.

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APPENDICES

A: First stage (TSLS)

nucleation1	Coefficient	std. err.	t	P>t
Contraceptive use	0.111	0.013	8.420	0.00
Female child	-0.003	0.006	-0.510	0.611
Child age	-0.087	0.027	-3.220	0.001
Child age_sq	0.003	0.001	2.800	0.005
Age start school	0.006	0.005	1.240	0.213
Age start school_sq	-0.001	0.000	-1.470	0.142
Public school	-0.019	0.007	-2.620	0.009
Grade completed by child				
Lower primary	-0.040	0.017	-2.390	0.017
Upper primary	-0.028	0.016	-1.670	0.095
JHS	-0.015	0.017	-0.920	0.357
SHS and above	0.016	0.023	0.690	0.493
NHIS subscription	0.035	0.008	4.670	0.000
Child father work				
Agric	-0.131	0.007	-18.070	0.000
Not agric	-0.058	0.009	-6.230	0.000
Child disability	0.018	0.046	0.390	0.699
Hours in class	0.000	0.000	2.970	0.003
Hours on homework	0.002	0.002	0.880	0.377
Grade completed by mother				
Lower primary	-0.166	0.023	-7.110	0.000
Upper primary	-0.180	0.015	-11.800	0.000
JHS	-0.169	0.012	-13.890	0.000
SHS and above	-0.162	0.023	-6.930	0.000
Head age	0.001	0.000	6.590	0.000
Head employed	0.087	0.006	14.200	0.000
Insurance cover	-0.004	0.008	-0.480	0.628
Log household exp	-0.027	0.004	-6.400	0.000
Rural location	-0.043	0.007	-5.890	0.000
Ecological zone				
Forest zone	-0.028	0.008	-3.420	0.001
Northern zone	-0.077	0.009	-8.380	0.000
Constant	1.270	0.194	6.530	0

Source (Author's construct, 2023).

B: Post estimation tests

B: Tests of endogeneity			
H0: Variables are exogenous			
Robust score chi2(1)	=	8.13964	(p=0.0043)
Robust regression F(1,6172)	=	8.216	(p=0.0042)

Source (Author's construct, 2023)

C: Tests of identification	
Under identification test (Kleibergen-Paap rk LM statistic):	65.715
Chi-square P-value:	0.000
Weak identification test (Cragg-Donald Wald F statistic):	114.474
(Kleibergen-Paap rk Wald F statistic):	70.965
Stock-Yogo weak ID test critical values:	
10% maximal IV size	16.380
15% maximal IV size	8.960
20% maximal IV size	6.660
25% maximal IV size	5.530

Source: Stock-Yogo (2005). Reproduced by permission.
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.

C: Pairwise correlations of key variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Overall learn outcome	1.000							
(2) Maths calculations	0.758	1.000						
	(0.000)							
(3) Read in Eng/Fren	0.855	0.727	1.000					
	(0.000)	(0.000)						
(4) Write in Eng/Fren	0.857	0.703	0.902	1.000				
	(0.000)	(0.000)	(0.000)					
(5) Read in Ghanaian lang	0.809	0.380	0.465	0.473	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)				
(6) Write in Ghanaian lang	0.794	0.358	0.439	0.458	0.900	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
(7) Nucleation	0.082	0.063	0.057	0.060	0.077	0.078	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
(8) Contraceptive use	0.022	0.039	0.021	0.020	0.011	0.005	0.172	1.000
	(0.078)	(0.002)	(0.096)	(0.124)	(0.382)	(0.710)	(0.000)	