REGIONAL INSTITUTE FOR POPULATION STUDIES

UNIVERSITY OF GHANA

POPULATION GROWTH DYNAMICS AND IMPLICATIONS FOR PRE-TERTIARY EDUCATION DEVELOPMENT IN GHANA

BY

ENOCK DAVID ABIRAM

10938024

THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF ARTS IN POPULATION STUDIES DEGREE

APRIL 2023

DECLARATION

I, Enock David Abiram, do hereby declare that except for ideas and references to other people's work which have been duly cited, this dissertation is the result of my own original research done under the supervision of my academic supervisor, Prof. Stephen Owusu Kwankye. This work has neither in part nor whole been presented for any award.

.....

Enock David Abiram

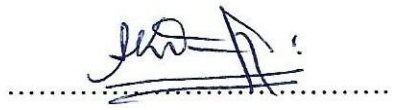
(Student)

24TH AUGUST 2023

Date

ACCEPTANCE

This dissertation has been accepted by the Regional Institute for Population Studies (RIPS), College of Humanities at the University of Ghana, Legon, in partial fulfillment of the requirement for the degree of Master of Arts (MA) in Population Studies.



24TH AUGUST 2023

Prof. Stephen Owusu Kwankye

(Supervisor)

Date

DEDICATION

I dedicate this research work to myself.

ACKNOWLEDGEMENT

I express my profound appreciation to my supervisor, Prof. Stephen Owusu Kwankye, for the patience and effort devoted to the supervision of this work.

I would also express my sincerest appreciation to my mother, Madam Rosina Afaribea for her support and encouragement through this academic journey.

Finally, my heartfelt gratitude goes to my colleagues, Alfred Aboagye Nyarko and Patrick Addo and other colleagues at RIPS, for their support in diverse ways in the realization of this work. Also, to my Director of Management Information Systems (MIS) at work, Nana Gyan Asiedu.

ABSTRACT

The growing population of Ghana over the past five decades has contributed to the rising inequality in access to quality education by increasing the number of school-going age children for basic and secondary education relative to the adequacy in physical infrastructure and trained teaching personnel in Ghana. Previous research works reviewed have primarily focused on the inadequacies in infrastructure, teachers, and budgeted expenditure for the education sector in Ghana, with limited consideration on the demographic variables of the size, growth, age-sex structure and spatial distribution of the population. These have likely implications for planning the education sector and in ensuring equitable access to quality education.

The population dynamics and structure of Ghana were described using data from the 1984, 2000, 2010 and 2021 Population and Housing Censuses. These statistics were used to explore the relationship between the increasing school-age population and the corresponding need for sufficient classrooms and trained teachers for basic and secondary education. Based on an analysis of relevant data from the Ministry of Education for the academic years 2017/2018 to 2019/2020, the study discovered that there were inadequacies in the number of classrooms and trained teachers available to serve the school-going age children across the different levels of basic and secondary education.

The study employed the cohort method of population projection to estimate the number of children in the age range of 0-17 years, who would be enrolled in basic and secondary education between the years 2021-2031. According to the findings, the school-age population for basic and secondary education is expected to rise gradually over the ten-year period.

If demographic variables are not considered in the formulation of policies and planning of the education sector in Ghana, the increasingly high population is likely to lead to an increase in the trained teaching personnel and physical infrastructure deficits. Hence, the Government of Ghana and the Ministry of Education should focus on forestalling the increasing growth of the population and its effects on meeting the recommended infrastructure and services standards in the education sector.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

CHAPTER ONE

INTRODUCTION

1.1 Study Background

Since 1950, the world's population has experienced an unprecedented growth as evidenced in the record of more than threefold increase in size, which was projected to reach 8 billion in November 2022 (Wilmoth et al., 2022). It has also been projected that the world's population can grow to 8.5 billion and 9.7 billion by 2030 and 2050 respectively (United Nations Department for Economic and Social Affairs, Population Division, 2022). However, there are substantial variations in the future trends of population growth across global regions and countries, with sub-Saharan African countries projected to have most of the increase, citing countries including Nigeria, Egypt, Ethiopia, Tanzania and Democratic Republic of the Congo (Gu et al., 2021).

The record of high population growth as envisaged and experienced in most sub-Saharan African countries due to Africa's pronatalist orientation, has the likelihood of impacting human welfare and determining the direction of development efforts. Also, the implications of such high population growth have been underscored as being correlated to the citizenry's standard of living, health, education, provision of basic services, among others (United Nations Development Programme, 2019). High population in some parts of the world such as China, South Korea and Japan have reaped positive dividend from their demographic characteristics of having large supply of labour force through comprehensive strategies put in place for their economic growth (Phang & Mason, 2008). High population growth rate could lead to dire consequences in all spheres of development in a country if population variables are not integrated in the development plans, and this is quite visible in most countries around the world, including most sub-Saharan countries like

Nigeria and the Democratic Republic of Congo and parts of including Bangladesh and Pakistan (United Nations Department for Economic and Social Affairs, Population Division, 2022).

Ghana's population has been growing over the past five decades where with a population of 8.6 million people recorded in 1970, it increased to 12.3 million in 1984. The growth rate of the population for this period was 3.0 percent. Also, the population of Ghana increased to 18.9 million in 2000 with an intercensal population growth rate of 2.7 percent while the population reached 24.6 million in 2010 giving an intercensal growth rate of 2.5 percent (Ghana Statistical Service, 2021). The 2021 Population and Housing Census put Ghana's total population at 30.8 million with a reported total fertility rate (TFR) of 3.1 and an annual projected addition of 700,000 by end of 2022 (Ghana Statistical Service, 2021; United Nations Population Fund, 2022). Such fertility rate (TFR: 3.1) is significantly responsible for rapid population growth which gives rise to large number of young people and less skilled workforce, thereby possibly constraining the ability of government to provide quality education and healthcare services and resources, and employment opportunities because of the overwhelming numbers (Andoh & Mensah, 2022).

In response to the population growth trends and dynamics, Ghana became the first sub-Saharan African country to sign to the United Nations (UN) World Leaders Declaration on Population in 1967. This was ratified in cognizance of the fact that socio-economic development gains made, and prospects could be hampered if unsustainable population growth remains unattended to (National Population Council, 2018) and that deciding the number and spacing of children was a fundamental human right and that family planning was the surest way in granting human dignity (Ashford, 2020). It was also in an era where human population growth had become a problem worldwide and therefore the need by states to formulate adequate national policies in managing the problem (Ashford, 2020). Again, the ratification of the UN Declaration on Population was

followed by the adoption of an "explicit and comprehensive" population policy in 1969 with the aim of promoting socio-economic development. Also, this action was taken because the government saw the investment in the development of the human capital as the most precious resource for national development, hence, the need to protect and enhance their welfare (Kwankye & Cofie, 2015).

It has been established through research study that education constitutes one of the biggest investments that can be pursued by societies and individuals given their enormous socio-economic benefits (Diagne, 2006). Given this, the Government of Ghana has been noted for being proactive from the time it became a republic in acknowledging the immense benefits that would accrue to the population from the investment in education (Abukari et al., 2015). Consequently, several education policies and programmatic interventions have been rolled out to address the challenges in the education sector with the country's population growth in mind. Some of these policies include Free Compulsory Universal Basic Education (1995), Capitation Grant (2005), School Feeding Programme (2005), Free Senior High School (2017), among others. Such policies are particularly meant to address inequalities in the provision of education (Abukari et al., 2015).

Yet, the education sector is still grappling with several challenges. The challenges constraining progress include but are not limited to unequal access to education, fragmented and overloaded curriculum, and high teacher to pupil ratio, and inadequate educational facilities (schools) (Armah, 2017). These challenges which inundate the education sector amidst the country's growing population, calls for the carrying out of a systematic analysis to ascertain whether the myriad of programmatic interventions rolled out in the education sector reflect the nation's current population growth and its spatial distribution and into the future.

1.2 Statement of the Problem

The debate on the relationship between population and development has been lingering on for quite a long time. There have been several propositions debating the discourse going back into history, with contrasting views since the time of Plato and Aristotle (Wako, 2012). Further on, the Malthusian perspective of the debate propounded by Robert Thomas Malthus argues that high and uncontrolled population growth have dire consequences on the development drive of a people or country. Paul Ehrlich and the proponents of the Neo- Malthusian Theory share very similar sentiments with the Malthusian theory about the effect rapid population growth has on development as well as the associated effects it has on land degradation, changing global climate and using up of finite supply of fresh water (Weeks, 2020). This assertion is a rebuttal to the proposition held by the Boserup theorists also described as the "boomsters".

Consequently, Ester Boserup and the Boserup theorists are of the view that high population growth and its corresponding number of people sparks ingenuity, thus stimulating development (Weeks, 2020). The "boomsters" as theorists of the Boserup school of thought as they are so called, are of the opinion that humans can be innovative and can adapt, especially in moments of challenges; spurring inventions and progress (Du Guerny, 1995). The economist Julian Simon also added to this perspective of the debate by claiming as resources are economically indefinite, humans will continuously innovate to deal with population growth and develop new resources; thus, population growth stimulates development rather than slowing it down (Weeks, 2020).

The Marxist's view on the relationship between population and development, however, is that high population growth becomes a problem when other sectors of a country are in disarray and poorly managed and that problems emanating from high population growth rates will not exist when other problems and sectors of a nation are socially organized and efficiently manned. These perspectives

do point out the inherent consequences rapid population growth can have on the development of a country; it can be beneficial if managed well and dire if adequate plans to harness such rapid growth in population fail.

The United Nations Development Programme (UNDP) (2019) report, "Population Growth: Implications for Human Development" revealed the massive challenges the population and growth rate of Pakistan have had on the health, education and employment sectors of the economy. The rapid population growth inhibited Pakistan's government's effort to provide the needs of the people. A fortune of investment was required to meet the demands of the education sector as the human resource capacity is valued as a transformative tool for reviving and improving other sectors of the economy.

Ghana has made some significant strides in improving and sustaining a well-educated people since becoming a republic with promulgation of policies by successive governments specifically in the education sector. Education is one important indicator of human development and a drive to sustainable development and so the need to initiate effective policies and see through their implementation. According to Addo (2019), education is deemed as a pivotal force for building human capital thereby reducing poverty, inequality and social mobility. In 1996, the Ghanaian Government initiated the Free Compulsory Universal Basic Education (FCUBE) as enshrined in Article 39 (2) of the 1992 Constitution which gave the right to every Ghanaian child of school-going age to receive nine years of free schooling and were prepared well enough to further education and skill training. The Capitation Grant Scheme was introduced in the 2004/2005 academic year to help ensure the attainment of the Millennium Development Goal of primary education for all school going aged persons by providing funds to take care of school levies including those for school repairs, cultural and sports activities, etc. (Apratwum & Armah-Attoh,

2010). A recent policy initiative in the education sector is the Free Senior High School Policy introduced in August 2017 in Ghana. This policy complements efforts in the achievement of the Sustainable Development (SDG) Goal 4, Target 4.1, which states that "By 2030, all boys and girls complete free primary and secondary education leading to relevant and effective learning outcomes" (Lee et al., 2016) as well as fulfilling the constitutional mandate of the 1992 Constitution of Ghana. This policy is to remove obstacles through the absorption of school fees, expansion of physical school infrastructure to improve school enrolment and improving the quality of teaching and learning through teacher rationalization and deployment (Addo, 2019). According to the Ghana Statistical Service (2021), data from the 2021 Population and Housing Census revealed that about 1.2 million children of school-going age are not in school; approximately nine percent of children aged 4 -17 years. This staggering number of children fall in the pre-tertiary schooling category of Ghana's education sector.

Furthermore, according to the Ghana Education Sector Analysis Report (2018), in as much as there are efforts in the provision and expansion in school infrastructure for basic schools and for that matter basic education, the provisions have not matched the population growth rate of school-going age children. For instance, in 2016, the pupil-classroom ratio (PCR) stood for public basic schools at 55:1 for Kindergarten, 38:1 for Primary and 35:1 for Junior High School (JHS). More so, the substantial progress made in the rate of increase in access to secondary education experienced between 2011/2012 and 2015/2016 academic years, dipped from the start of the 2016/2017 academic year. The Free Senior High School Policy initiated by the Ghana Government in 2017 as well as that of the Technical and Vocational Education Training as part of the policy which was rolled out the in 2020. The introduction of the Free Senior High School Policy has resulted in some gains in educational enrolment up the tertiary level. Notwithstanding this

contribution, the policy has contributed to escalating the infrastructural, logistic and personnel constraints of pre-tertiary education in Ghana. A research study into the policy acknowledged the challenges confronted in the areas of inadequate teachers, infrastructure and timely funding. The delays in funding were reported in the study and recommended for wider funding mechanism by expanding the tax net to support the locally raised oil fund that funds the policy (Kyei-Nuamah and Larbi, 2022). More so, according to the study by Duah et al. (2023) assessing the Fee Senior High School Policy, though it acknowledged an impressive, steady improvement in enrolment, it revealed that schools experienced classroom and dining hall congestion, inadequate teaching and learning materials, inadequate hostel infrastructure and high student-teacher ratio. Though there have been considerable efforts in these areas of Ghana's pre-tertiary education, there are indeed quite inadequacies and inequalities in the provision of these physical infrastructure and trained teachers in meeting the growing demand of children of school going age at the basic and secondary levels of education in Ghana.

In all these, however, there have been very few comprehensive national level assessments made, considering Ghana's population growth trends currently and projections into the future, in tandem with the provision and expansion of physical infrastructure and trained teaching personnel for pre-tertiary schooling and implications thereof, therefore there is need for such a study.

1.3 Research Questions

This study seeks to provide answers to the following research questions:

i. What changes have occurred in Ghana's population and spatial distribution of the population between 1984 and 2021?

ii. To what extent does the availability of adequate physical infrastructure (classrooms) and personnel (trained teachers) reflect Ghana's population under 17 years?

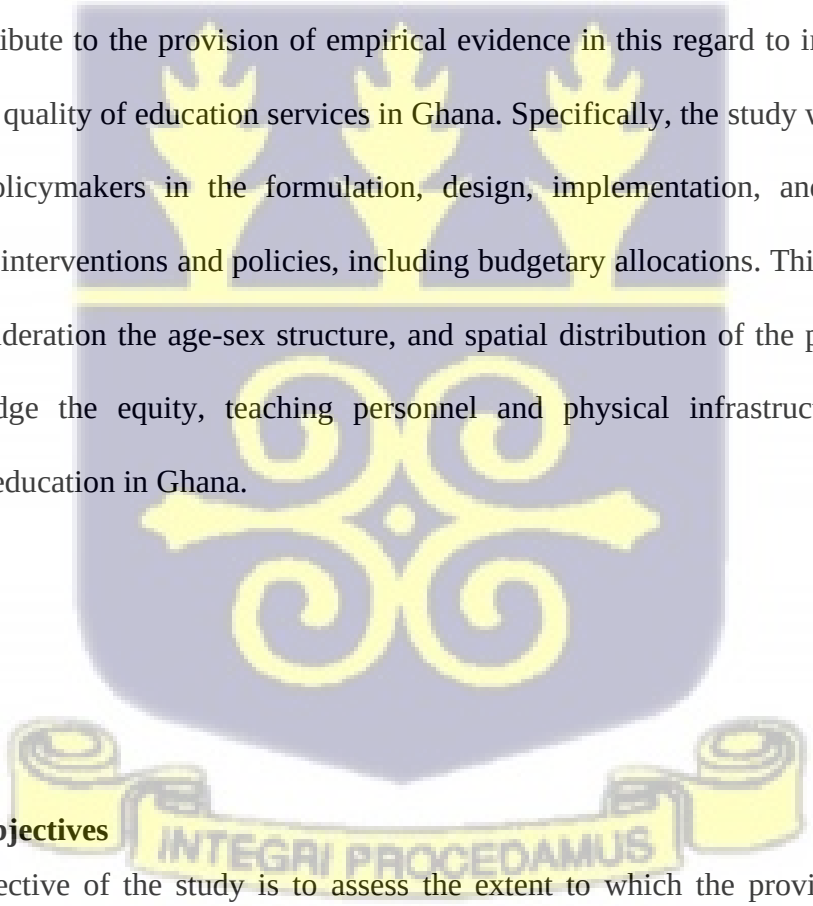
iii. What are the implications of Ghana's future population growth trends on the delivery of quality pre-tertiary education service?

1.4 Rationale of the Study

It has been established that the examination of population dynamics and its relationship with socio-economic factors offer policymakers and planners with plausible insights for significant and effective planning in population and development issues (UNDP, 2019). Therefore, understanding Ghana's population growth trends as well as anticipating demographic changes and their impact on education services provision is indispensably crucial for national development planning and the attainment of the Sustainable Development Goal 4 (quality education). According to the United Nations Development Program (UNDP) (2019), education is one of the three human development indexes. This is closely associated with the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) action in education which values education as a basic human right and a global public good with the power to transform individual lives, communities and the planet for the better. At the national level in Ghana, education is also a fundamental human right upheld by the 1992 Constitution of the Republic of Ghana. Ghana's Education Strategic Plan (2018) sought

to raise learning outcomes and standards in all educational institutions, and at all levels of education including basic and secondary/TVET, and to ensure that no child is left out. Again, the Education Sector Analysis (2018) focused on demographic and socio-economic contextual information as well as in-depth assessment of the various sub-sectors of education in Ghana. All these were geared towards curbing the challenges which include financing, infrastructure and teacher deficits facing the pre-tertiary education sector over the period.

Since not much has been done in an up-to-date assessment of the human resource and facility needs in the education sector relative to Ghana's human population numbers at present and into the future through the deployment of demographic projection and estimation techniques, this study will immensely contribute to the provision of empirical evidence in this regard to improve upon the accessibility and quality of education services in Ghana. Specifically, the study will better inform planners and policymakers in the formulation, design, implementation, and assessment of education sector interventions and policies, including budgetary allocations. This can be done by taking into consideration the age-sex structure, and spatial distribution of the population which would help bridge the equity, teaching personnel and physical infrastructure gap in the development of education in Ghana.



1.5 Research Objectives

The general objective of the study is to assess the extent to which the provision of teaching personnel and physical infrastructure in the education sector mirrors Ghana's population growth dynamics.

The specific objectives are to:

i. examine the changes that have occurred in Ghana's population and spatial distribution of the population between 1984 and 2021
ii. assess the relationship between the availability of education facilities (classrooms) and personnel (trained teachers) and Ghana's population under 17 years
iii. examine the implication of Ghana's future population growth trends on pre-tertiary education sub-sector
iv. make recommendations to improve Ghana's pre-tertiary education sub-sector, specifically in the provision of adequate classrooms and trained teachers into the future

1.6 Organization of the Study

The study is organized into five chapters. The first chapter is the introductory section which presents the background of the study, statement of the problem, research questions, rationale and research objectives of the study. The second chapter presents a review of the relevant literature, theoretical and conceptual frameworks underpinning the study.

The third chapter presents the methodology which involves a discussion of the various methods and data processing and analytical techniques employed in the study. The fourth chapter presents the analysis, results, and discussion whilst the fifth chapter presents a summary, conclusion, and recommendations of the study.

CHAPTER TWO

Literature Review

2.1 Introduction

The effects of rapid population growth on economic development have assumed considerable attention in many developing countries around the world, especially in sub-Saharan Africa. As such, it is prudent to properly situate, conceptualize and analyze the implications of rapid population growth on all sectors of economic development to put in place stop-gaps in terms of policy direction to forestall its dire consequences. This chapter focuses on examining some empirical studies and literature on Ghana's population growth trends and national population policies, assessing the interrelationships between population growth and education, its development, and implications. Again, the chapter presents the theoretical framework underpinning the study as well as the conceptual framework.

2.2 Trends in Ghana's population

Ghana's population has seen an increase from a size of just over two million in 1921 to more than 30 million in 2021 (Ghana Statistical Service, 2021). The increase in the country's population can be partly attributed to a decline in births together with mortality but the decline in mortality is faster than births. The faster decline in mortality in the population is because of improvement in healthcare, education, and general wellbeing. There have been six censuses after independence and the reported population from those censuses are 6.7 million in 1960, 8.6 million in 1970, 12.3 million in 1984, 18.9 million in 2000, 24.6 million in 2010 and 30.8 million in 2021. These numbers give an indication of Ghana's growing population from 1960 to 2021, with 2021 population being five times that of 1960 (Ghana Statistical Service (GSS), 2021).

Ghana's population more than tripled over a 50-year period between 1960 and 2010 and with intercensal increases of 27.2 percent between 1960 and 1970, 43.7 percent between 1970 and 1984, 53.8 percent between 1984 and 2000 and 30.4 percent between 2000 and 2010 (GSS, 2012). The average annual growth rate however was 2.4 percent between 1960 and 1970, 2.6 percent between 1970 and 1984, 2.7 percent between 1984 and 2000 as well as between 2000 and 2010 and 2.1 percent between 2010 and 2021, which recorded the lowest since independence. According to the regional distribution of the population, Ashanti Region has had the highest population in all censuses followed by Eastern in 1960, 1970, 1984 and 2010 with the 2021 Population and Housing Census (PHC) being an exception. The Greater Accra Region recorded the highest population of 5,455,692, surpassing that of the Ashanti Region which recorded 5,440,463 with a lower intercensal growth rate of one percent while Greater Accra grew by 2.9 percent between 2010 and 2021 (GSS, 2021). The Upper East and West regions have had the lowest proportions of Ghana's population in all censes between 1960 and 2010 recording 4.2 percent and 6.9 percent in 1960 and 2.8 percent and 4.2 percent in 2010 respectively (GSS, 2012). However, with the re-organization of Ghana's administrative regions from 10 to 16 in 2019, the Ahafo and Oti regions assumed the lowest proportions during the 2021 PHC recording 1.5 percent and 2.1 percent respectively.

2.3 Urbanisation

The country in the last two censuses have recorded higher urban population than rural population. In 2010, 50.9 percent of the country's population was urban. In 2021, Ghana recorded a higher urban population of 17,472,530 representing 56.7 percent of the total population (Ghana Statistical Service, 2021). The trend of higher urban populations is in line with the UN projections that the developing world will house more growing population in its urban areas (UN HABITAT, 2022).

Ghana now has higher proportions of urban population than was from 1960 and 2000 where in 1960, the proportion of urban population constituted 23.1 percent, 28.9 percent in 1970, 32.0 percent in 1984 and 43.8 percent in 2000 (GSS, 2012). The classification of a locality into urban and rural is based on the size of the population, with localities having population of 5,000 or more classified as urban while others with less than 5,000 are classified as rural (UN HABITAT, 2022). This shows that urbanisation has been quite rapid in the country.

2.4 Age and sex structure

Ghana has had a youthful age structure with a broad base consisting of large numbers of children and young adults and a small number of elderly persons at the apex of a population pyramid, though the structure of the population has undergone changes over the years. For instance, the proportion aged less than 15 years was 44.5 percent in 1960, increased to 46.9 percent in 1970 and declined to 41.3 percent and further declined to 38.3 percent in 2010 (GSS, 2012).

The proportion of males in the age group 0-14 years has been recorded to be higher for males than females between 1960 and 2010. The rest of the age groups did not realize a similar consistent pattern in the proportions of females and males as for instance the 15-24 age group recorded more females than males in 1960, 1970 and 1984 but changed in 2000 and 2010. Interestingly, for the population aged 65 years and above, there were higher proportions of males than females in 1960, 1970 and 2000 with the expected pattern of more females than males in this age group occurring in the 2010 PHC.

The 2021 PHC saw a transition of Ghana's population age structure from one with large proportions being children (0–14 years) to one dominated by young people (15-35 years) with the

proportion of children declining from 41.3 percent in 2000 to 35.3 percent in 2021 while that of young adults increasing from 34.6 percent in 2000 to 38.2 percent in 2021 (GSS, 2021). This inherent age structure is a recipe for momentum in the population resulting in the realization of increased population over a longer period with relatively large number of young women in their reproductive ages.

2.5 Population Policies in Ghana

The human resource base is most valuable in influencing the development of a country and so it is the utmost responsibility of the government to provide policies and programmes targeted at improving the quality of life of the population. In response to the population growth trends and dynamics, Ghana became the first sub-Saharan African country to sign to the United Nations (UN) World Leaders Declaration on Population in 1967 and followed by the adoption of an "explicit and comprehensive" population policy in 1969 with the aim of promoting socio-economic development (Kwankye & Cofie, 2015). There was a revision in the National Population Policy in 1994 with the objectives to include ensuring that population issues are integrated in all aspects of development planning, programmes to alleviate poverty both in rural and urban areas, provide the population with the necessary information and education on the value of a small family size and ensure accessibility to family planning means and services for all sexually active persons to regulate their fertility and contraceptives made affordable (Government of Ghana, 1994). The National Population Policy saw a revision in 2014, targeting to reduce the population growth rate of 2.5 percent to 2.0 percent by 2024 and to 1.5 percent by 2034 as well as reducing the total fertility rate from the Ghana Demographic and Health Survey estimate of 4.2 from 2014 to 3.5 by 2024 and 3.0 by 2034 (National Population Council, 2018).

2.6 Accessing the interrelationships between population growth and education development

There is a vast body of literature that speaks to the relationship between education facilities, personnel, and population growth dynamics. According to a study by Hanushek (2011), increasing population can lead to broadening the school going age population, hence influencing the student to teacher ratio. Hanushek (2011) noted that rapid population growth can put pressure on education systems, leading to overcrowded classrooms and increased demand for trained teachers. This can reduce the quality of education and make it more difficult for students to learn if the classrooms are very inadequate, which can subsequently have negative impacts on economic growth and development as skills development would be stifled. More so, there would be increased expenditure in supporting the training of more teachers in meeting the growing school going age population. In a research study by Birdsall (1977), she indicated that despite population growth could be a great potential contributor to economic growth, improving the skill of the labor force could demand major financial investment such as development of proper structures, planning and skill training of the people as there are in developed nations.

The rural population trends in America in the 1990's, affected school facility needs and means to meet them in rural America (Dewees & Earthman, 2000). The study stated that in 1996, 52 percent of rural schools had at least one inadequate school building feature. In Ghana the introduction of the Capitation Grant scheme increased enrolment levels. The number of years for basic education which was increased from nine to eleven years has huge financial and capacity implications, teacher and classroom requirements and teaching and learning materials (Akyeampong et al., 2007). The study noted that adequate teacher supply and improved school infrastructure facilities are key in the development of education in Ghana. It further referred to the 2006 Education Sector Performance report which points out many classrooms being overcrowded and the lack of teaching

and learning materials as well as teachers to match the increasing pupil population at the basic education level.

Iddrisu (2016), states that the Free Compulsory Universal Basic Education (FCUBE) contributed to an increase in enrolment of pupils in basic schools in Ghana. He suggested that for facilities at the various basic schools should be improved and more classrooms made available to curb the overcrowding challenges encountered. The introduction of the Free Senior High School policy in 2017 has seen year-on-year increase in student enrolment at the Secondary school level. Notwithstanding, the policy has been faced with some challenges including inadequate teachers, infrastructure and timely funding (Kyei-Nuamah & Larbi, 2022). According to Amedorme & Fiagbe (2013), there are pertinent challenges experienced at the Technical and Vocational Education and Training (TVET) level in Ghana. TVET faced problems including limited number of technical institutions, lack of facilities and materials for training students and inadequate technical teachers.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2016 reported the importance of education for sustainable development and argues that education is essential for achieving the Sustainable Development Goals (SDGs). In the report "Education for people and planet: Creating sustainable futures for all," UNESCO emphasizes the importance of high-quality education facilities and trained teachers in ensuring that all children have access to education. The report noted that many children around the world do not have access to quality education facilities, such as safe and well-equipped classrooms, libraries, and laboratories. Additionally, many teachers around the world lack the training and support they need to provide high-quality education to their students (UNESCO, 2016). The unavailability of schools and trained teachers can contribute to school dropout rates. In areas where there are few schools or

lack of trained teachers, children may have limited access to education. This can lead to overcrowded classrooms, poor quality education, and low educational attainment. Children who struggle in school because of overwhelming class sizes may become frustrated and drop out, contributing to higher dropout rates.

Dropout students are at a higher risk of early pregnancy and parenthood, which is a contributory setback to higher education development (Birchall, 2018). A slowly increasing population gives room to adequate development in the education sector of a country, as effective planning on the back of a more stable population growth of school going age, supports the training of teachers and less burden on the expenditure of the state are realized (World Bank Group, 2018). Also, the report emphasized the importance of equity and inclusion in education, as marginalized and disadvantaged communities are often the most likely to be excluded from education. This can contribute to higher levels of poverty and unemployment, and lower levels of human development.

Access to quality education can help to increase productivity, improve health outcomes, and promote social and political stability in the long term. This can lead to higher levels of economic growth, which can in turn influence population dynamics through changes in migration patterns, fertility rates, and demographic shifts (World Bank Group, 2018).

Grant (2017) highlights the importance of education in promoting economic development and reducing poverty in sub-Saharan Africa. Grant argued that investments in school infrastructure and teacher training can lead to improved learning outcomes and greater social and economic benefits. In turn, these benefits can lead to improved health outcomes, reduced mortality rates, and increased opportunities for migration. Grant in her article posited that increased access to education,

particularly for girls, can lead to a reduction in fertility rates. This is because education can provide individuals with the knowledge and resources needed to make informed decisions about their reproductive health and can also create economic opportunities that incentivize smaller family sizes (Grant, 2017).

Armah (2017) reiterates the massive role quality education has in stimulating highly skilled and well-informed citizens. Ghana over the years has seen considerable policy reforms in its educational sector all in a bid in meeting contemporary standards. Ghana has had major changes in the pre-tertiary level of education and invested enormously in realizing desired development. However, the sector is still plagued with many challenges. Armah (2017), in his paper states the inequality in access to educational infrastructure between urban and rural provisions and consequent deprivation of many children of school going age to education and lifelong learning.

He further pointed out the progressively worsening pupil per teacher ratio which hindered academic performance at assessment examinations that ensured transition from basic to secondary education and into the tertiary level.

Furthermore, in the research study "A Study into the Extent of Deprivation in Basic Schools in Deprived Areas and Its Impact on Learning Outcomes" by the Africa Education Watch (2021) conducted in two districts of Ghana; Zabzugu District in the Northern Region and Nkwanta South District in the Oti Region revealed the challenges at the basic education level. The study revealed physical infrastructure issues causing 40 percent of the schools (55 public Primary and 17 JHS) to adopt the multi-grade systems of teaching, where two classes were merged in one room with one teacher. Some classes took place under sheds and trees and this situation impacted negatively on contact hours as well as being disincentive to teachers and learners. The inadequacy of furniture

to accommodate learners was also prevalent in most schools in Nkwanta South District where at the basic education level only 35 percent of learners had access to seating place with an average of three and four learners sharing a dual desk meant for two. More so, the remaining learners without access to school desk resorted to the use of improvised stool, stones, sat on the floor or stood to learn. One of the biggest challenges confronting schools in deprived communities in Ghana according to the study was the inadequate number of trained teachers. Teachers were either not posted to these areas, refused postings on the part of recruited teachers or sought transfers after spending a year or two due to low motivation. The study again found that Zabzugu, which had fifty-five (55) Primary schools with 11,829 students had only 261 teachers while Adenta Municipality which had only eighteen (18) Primary schools with 9,100 students boasted of 363 teachers.

According to the Education Sector Performance Report (2019), transitioning from Primary school to JHS remained a major national issue with only 79 percent making it to JHS 1 in deprived communities in the 2018/2019 academic year. The main contributory factor for the low transition from Primary to JHS was the lack of Junior High School (JHS) in many Primary schools, causing students to walk long distances to access the nearest JHS or dropped out. In the study by Africa Education Watch (2021), Zabzugu District for instance, had 17 JHS serving 55 Primary schools, meaning Primary school graduates from 70 percent of the public schools in the district had no JHS in their communities and this situation was no different in the Nkwanta South District where some 33 percent of Primary schools in the district did not have a JHS. This deprived many students from transitioning to JHS and continuing their education after Primary school. Some students had to walk about 10 kilometres (km) to school at the JHS level, spending on average three to four hours daily, thus, out of frustration many students drop out, especially the girls. Distance to access

essential services is negatively correlated with population wellbeing and so proximity to schools is linked to higher student retention and attendance, especially for girls (Ghana Statistical Service, 2021). According to the 2021 Population and Housing Census, districts in the Bono East region on the average had about 34 percent of residential structures away from primary education facility, followed by the districts in the Savannah Region having approximately 33 percent of residential structures were away from primary education facilities and in Ashanti Region, about 32 percent of residential structures from primary education facilities. Districts in the Greater Accra and Central regions were the two regions having the least percentages of residential structures from primary education facilities; less than three percent, an indication of having residential strictures not more than 3km from primary education facilities as recommended in ensuring high school attendance and retention.

Another interesting revelation from the study findings of the Africa Education Watch (2021) indicated challenges with textbooks availability in all schools in the two districts. As a result of the lack of textbooks in Primary schools, teachers adopted the practice of writing lessons on the chalkboard for learners to copy into their books and this practice affected both learners and teachers as it slowed the pace of teaching and learning; many learners made spelling mistakes while copying from the board.

2.6.1 Relationship Between Population Growth and Education not Unidirectional

It must be noted that population growth does not always have a unidirectional impact on education growth. According to Hanushek (2011), the quality of teachers is the most important factor affecting student outcomes, and that improving teacher quality can have a significant impact on economic growth and development. In his study "The Economic Value of Higher Teacher

Quality," Hanushek (2011) argues that teacher quality is a critical factor that can affect both population dynamics and economic growth. The study utilized data from several nationally representative datasets in the United States to show that there is a strong positive correlation between teacher quality and economic growth. Hanushek (2011) points out that well trained teachers are more effective at helping students learn, which can lead to increased educational attainment and better job prospects for students. This can lead to higher incomes, lower unemployment rates, and reduced poverty, all of which can impact population growth and development. Additionally, higher educational attainment is associated with lower fertility rates, which can help to slow population growth. Therefore, Hanushek (2011) argued that improving teacher quality and adequate numbers are essential for promoting effective teaching and learning outcomes, ensuring an improved human resource capacity of the country. He suggested that policies aimed at improving teacher quality, such as increasing teacher training and support, can have significant positive impacts on educational outcomes, population dynamics, and economic development.

According to the World Bank Group (2018), the importance of investing in the training of teachers and educational facilities is to improve learning outcomes, which can lead to higher levels of educational attainment and better job prospects for students. This can contribute to reduced poverty, lower unemployment rates, and in effect an improved human resource base. Barakat and Hossain (2019) provide insights examining how improvements in education, particularly in terms of increasing the number of trained teachers, can impact demographic transition in the region. The study used data from the Demographic and Health Survey (DHS) conducted in 35 sub-Saharan African countries between 2010 and 2016. The sample included women aged 15-49, and the study employed logistic regression analysis to examine the relationship between education and

demographic transition. Education, particularly the number of years of schooling, has a significant impact on demographic transition in sub-Saharan Africa (Barakat & Hossain 2019). The study found that women with more years of schooling are more likely to have fewer children and delay the age at which they have their first child. Barakat and Hossain (2019) noted that the number of untrained teachers in sub-Saharan Africa is significantly higher than the number of trained teachers, and this can impact the quality of education and, in turn, demographic transition.

2.7 Examining the Implications of Ghana's Population Growth Trends on the Education Sector

The interrelation that exists between population and development has long been debated (Schneider et al., 2011). The world conferences on population which took place in the 18th, 19th and 20th centuries centred around population and development (Finkle et al., 1975). After World War II, increasing population growth was driven by the gap between declining mortality and continuing high fertility. Many developing countries experienced increasing growth in population. Concerns on rapid population growth called for many conferences on population growth and development. The first and second conferences on population convened in Rome, Italy (1954) and Belgrade, Serbia (1964) focused on the link between population and development (McIntosh & Finkle, 1995).

The Third World Population Conference was held in Bucharest, 1974, and the discussion centred on the relationship between population issues and development (Finkle et al., 1975). The

conference reckoned an interrelationship between population growth and development and recommended the need to develop human resources especially women (Finkle et al., 1975). There, developed countries argued population growth as harmful to development, and developing countries argued that population challenges were a product of underdevelopment and not the cause. In a turnaround in 1984, Mexico hosted the second largest conference on population. The aim was to discuss issues regarding overpopulation. Diverse views were expressed at the conference. Many developing countries now saw population growth as a threat to economic growth and called for population control programmes and policies, with support from some developed countries like Sweden and United Kingdom. The United States of America expressed their disagreement and distanced themselves from supporting any population control programmes. In Cairo 1994, the outcome of the International Conference on Population and Development (ICPD) called for the protection of girls and women's rights as keys to economic development.

The influence of population and development has received renewed attention in recent times. In many developing countries where its population can be deemed as having a young population age structure, research shows it can take advantage of its population age-structure and capitalize on to achieve better value in terms of increased productivity rates and economic growth (Easterlin, 1967). This could be done through educating, empowering, good governance, family planning, economic reforms to achieve demographic dividend (Bloom et al., 2003).

The world's population in 2020 was about 7.753 billion. Now, it was projected to reach 8 billion on 15 November 2022 (ESCAP, 2020) and could grow further to around 8.5 billion in 2030, 9.7 billion in 2050, and 10.4 billion in 2100 (United Nations Department of Economic and Social Affairs, Population Division, 2022). More than half of the projected increase in global population up to 2050 will be concentrated in just eight countries: the Democratic Republic of the Congo,

Egypt, Ethiopia, India, Nigeria, Pakistan, the Philippines, and the United Republic of Tanzania (Gu. et al., 2021). The population of Ghana is rapidly increasing despite a lower growth rate observed in its recent population and housing census conducted in 2021.

Ghana has one of the fast-growing populations in sub-Saharan Africa, with a population growth rate of approximately 2.1 percent per year (Ghana Statistical Service, 2021). Though the growth rate of the population declined, the population momentum inherent in such a young population structure has significant implications for the country's education system (Mberu & Ezeh, 2017). According to the World Bank (2021), Ghana's population is projected to reach 40 million by 2030, a significant increase from the current population of approximately 31 million. This growth has a likelihood to place significant pressure on the country's education system, which is already facing some challenges to cope with existing demands (Boadu, 1994). In particular, the increase in population is likely to exacerbate existing challenges such as inadequate infrastructure, overcrowded classrooms, and a shortage of qualified teachers.

According to a research study by Boadu (1994), population growth and education are closely linked in Ghana, as they are in many other countries. Rapid population growth can put pressure on educational systems and infrastructure, as more children need to be accommodated and educated (Boadu, 1994). At the same time, education is a critical factor in controlling population growth, as people who are educated tend to have fewer children (Cohen, 2013) and to delay childbearing (Mills et al, 2011). there is the need to consider the integration of population of school-going age, school infrastructure (classrooms, dormitories, libraries, number of teachers at different levels). So, the rate of growth of population does have a correlation with planning the education sector. According to Birdsall (1977), rapid population growth has a direct effect on expenditures on education. Her study as well stated that high population growth almost guaranteed increasing

children entering the school system and other related issues of rising wages of teachers. The study also found that, increasing rate of school-going aged children showed to be the single most important factor in increasing educational expenditures. Furthermore, in a cross-sectional research study by Sciiultz (1988) with data from 89 countries, stated that rapid population growth has depressed levels of expenditures for every child of school age at the Primary and Secondary school levels. Hence, in Africa where the share of school-aged children continues to increase, average classroom sizes may continue to increase as their population grow at faster rates compared to developed countries. In the study "Analyzing Public Sector Education Facilities: A Step Towards Accessible Basic Education Institutions in Destitute Subregions", the rate at which a population grows is an imperative factor to be considered while analyzing education sector's shortage and provision of facilities. The study recounted the challenges Pakistan faced in providing for basic education services with their population growing at alarming rate (Talpur et al., 2014).

Ghana has made significant progress in expanding access to education in recent years, with a focus on achieving universal primary education and increasing enrolment rates at the secondary level. However, despite these efforts, many challenges remain in ensuring that all children and young people have access to quality education.

One key challenge is the sheer number of children who need to be educated, given Ghana's rapidly growing population. This means that the number of school-age children is increasing rapidly, and the demand for educational services is growing accordingly. Another challenge facing Ghana's education system is the lack of access to education for many children, particularly those from low-income families.

According to the Ghana Statistical Service (2021), there were a little over 1.2 million school-aged children not enrolled in school, with girls and children from rural areas being particularly disadvantaged. Out of this number, 942,427 children have never attended school. Again, 287,228 children of pre-primary school age were not attending school. The Savannah Region (43.2%) had the highest percent of children 4 to 17 years who have never attended school followed by the North East (31.6%), Northern (30.2%), and Oti (20.8%) regions. In these four regions, the percent of children who have never attended school is more than twice the national average. As the population grows, the number of children who do not have access to education is likely to increase, unless significant efforts are made to address this issue. While progress has been made in expanding access to education, there are still significant disparities in educational outcomes across regions, socioeconomic groups, and gender. Many children in Ghana do not receive the quality of education they need to succeed in life, and this can have significant long-term consequences for their social and economic well-being.

Rapid population growth is putting significant pressure on Ghana's educational system. According to the Ministry of Education (2012), the number of children enrolled in Primary school in Ghana increased from around 4.4 million in 2000 to 6.1 million in 2010, a growth rate of around 3.2 percent per annum. This rapid growth in enrolments has put pressure on schools, teachers, and resources, and has made it challenging to provide quality education to all children.

Educational quality in Ghana is highly uneven. Ghana has made significant progress in expanding access to education in terms of expenditure, but there are still significant disparities in educational outcomes across regions and socioeconomic groups (UNESCO, 2019). For example, the report found that only 37 percent of children from the poorest households in Ghana completed Primary school, compared to 89 percent of children from the wealthiest households.

Education is an important factor in controlling population growth. Studies have consistently shown that people who are educated tend to have fewer children and to delay childbearing (Murray, 2015). In Ghana, educational interventions have been shown to have a significant impact on fertility rates. For example, a study found that the higher the education level of women the lower the fertility (Angko et al., 2022)

Education can also have positive economic and social impacts (Ministry of Education, 2015). Education is a key driver of economic growth and development, and it can also improve health outcomes, reduce poverty, and promote gender equality. In Ghana, educational interventions have been shown to have positive impacts on a range of outcomes, including health, income, and social mobility (Addo, 2019).

There are significant challenges to improving educational outcomes in Ghana. These challenges include inadequate funding for education, insufficient trained teachers, and a lack of access to quality educational resources. Addressing these challenges will require sustained investment and policy reforms, as well as a focus on equity and inclusion in education.

In conclusion, Ghana's population growth trends have significant implications for the country's education system. While there are significant challenges presented by a rapidly expanding population, there are also opportunities for the education sector to grow and develop. To ensure that these opportunities are maximized, it is important that policymakers, educators, and other stakeholders work together to address the challenges posed by population growth and to develop strategies for improving access to education and expanding the education system with adequate and equitable distribution of physical infrastructure and trained teaching personnel.

A review of the relevant literature revealed that the consideration of integrating demographic variables; population growth, size, age-sex composition and spatial distribution in the education sector planning and education development in Ghana, is lacking. Comprehensive national level assessments considering Ghana's population growth and impact on education services have been few and far between. The growth in population is likely to create shortfalls in educational personnel and infrastructure that should engage the attention of government and the Ministry of Education on the recommended standards. This study therefore seeks to fill this gap in literature by assessing the extent to which the provision of teaching personnel and physical infrastructure in the education sector mirrors Ghana's population growth dynamics.

2.8 Theoretical Framework

The theory underpinning this study is the Malthusian Theory propounded by Robert Thomas Malthus. The tenet of the theory is that the earth's population would greatly exceed the world's food supply. In essence, when rapid population growth goes on unattended to, the means of survival by humans become limited and scarce and would result in undesirable consequences to the human population (Weeks, 2020). This theory is associated with the neo-Malthusian Theory that states that increasing population exerts pressure on limited resources.

These theories depict the consequences rapid population growth has on limited resources (natural, human and physical), reduces private and public capital formation and diverts additions to capital resources to maintain the stock of capital (Easterlin, 1967).

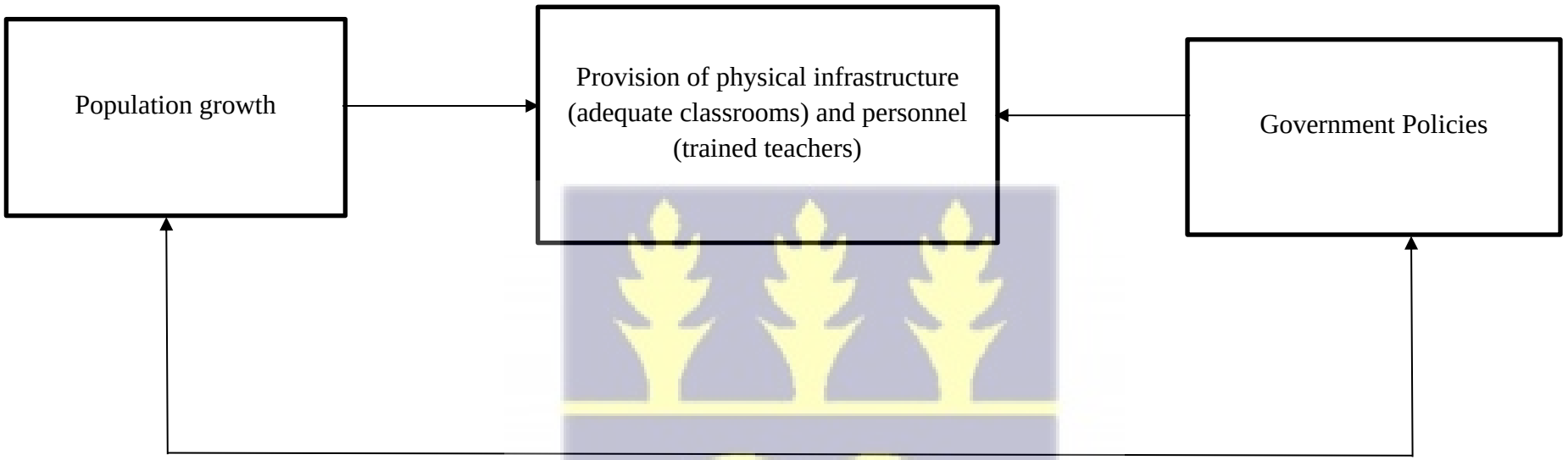
Ghana's high population growth, as evident in most sub-Saharan African countries, is trapped in the Malthusian concept. The high population numbers are likely to impact on the limited social services and economic resources. Empirical evidence has shown that consequences of high population growth on limited resources as characterized by pressure on social amenities including lack and inadequate education infrastructure and services. The education sector is not an exception to the impact high population size has on other sectors of the economy of a country where the population outstrips the available resources and demand; physical infrastructure and human resource. Therefore, as the population of school going age increases, there would be pressure on the existing infrastructure and services. There would be the need to expand the available educational infrastructure and services which would limit the unpleasant consequences in the future. This would ensure quality education services and development of the education sector.

2.9 Conceptual Framework

Figure 2.1 illustrates the implication rapid population growth has on the adequate provision of physical infrastructure and teaching personnel in the delivery of quality education. The interrelationship between population growth and government policies in ensuring a steadier growth of the population in ensuring the state adequately plan for the provision of adequate classrooms and trained teachers in tandem with children of school going age. The rapid rate of population growth, informs decisions by the state in putting in place interventions of controlling the birth rates, thus, ensuring a steady population especially that of school going age and less burden on the expenditure for the provision of these key variables in promoting robust development in the education sector.

Population growth means an increase in demand for physical infrastructure of educational facilities. Also, the proportion of school-going age children will increase because of the young age structure of the population and that will inform the kind the government policies to be formulated and implemented in arresting the high population growth and the policies to be formulated for other sectors of the economy.

Figure 2.1: Relation between population growth dynamics and implications for pre-tertiary education development



Source: Author's Construct (February 2023)

CHAPTER THREE

METHODOLOGY

3.1 Scope of the Study

This study is limited to pre-tertiary education, focusing on basic and secondary education in Ghana. Pre-tertiary education was chosen because, it forms the very bedrock upon which the human development professed by education lies and more so the larger number of the population of school going age falling within the basic and secondary education deserve better development.

The study looked at the trends in school enrolment, pupil-teacher ratio, number of trained teachers and adequate classrooms from 2017/2018 to 2019/2020 academic years.

Projections of the population spanning a period of 10 years, from 2021 to 2031 was made in giving predictive approximations of the population of Ghana and population of school going-aged children within the projection horizon. The year 2021 formed the base year for the projection because it was the year when the most recent Population and Housing Census was conducted, and the 10-year projection period was ideal as changes in the dynamics of population are likely not to change much and to remain relatively constant.

3.2 Sources of Data and Limitation

The main sources of data for this study were the 1984, 2000, 2010 and 2021 Ghana Population and Housing Censuses, providing the population of Ghana within each period required for assessment and highlighting the changes occurring within the intercensal periods in terms of growth rate and spatial distribution. The population from the 2021 Population and Housing Census was the principal dataset used in the projection of the population of children of school-going ages i.e., ages

0-17 years from Pre-school to Secondary school and Technical and Vocational Education and Training (TVET).

Secondary data from the Education Management and Information Systems (EMIS), Ministry of Education provided statistics on the number of adequate classrooms, trend in enrolment, number of trained teachers, pupil-trained teacher ratio and pupil-classroom ratio from 2017/2018 to 2019/2020 academic years in Ghana.

The dataset for the population of Ghana from 1984 to 2021,were from censuses conducted in Ghana and from the Ghana Statistical Service, thus its creditability is no doubt. More so the data from 2021 Population and Housing Census was evaluated for its accuracy age reporting and the outcome stated that it was of very accurate and appropriate to use for analyses. Again, the data for the education statistics were from Education Management Information System (EMIS) of Ghana's Ministry of Education and so very reliable and accurate source of data for the study.

A limitation of the study was that the study population ranged from ages 0-17 years and so projections were made in single ages for the total population (0-80+ years). The school age population for basic and secondary education was then extracted from the total population. However, there are possible cases of early entry or late entry and/or class repetitions of pupils at each level of the basic and secondary education which cannot be accounted for in the projected school age population of each year of the projection horizon.

3.3 Method of Data Analysis

The study used descriptive analysis to report changes that have occurred in Ghana's population over the past three decades (1984-2021), from which approximate predictions of the population

going into the future were made from 2021 to 2031 using the cohort component method of population projection and its implications thereof for education development, specifically in the provision of adequate number of classrooms and trained teachers corresponding with the estimated population over the projection horizon of the study, in Ghana. This method of projection follows each age group cohort throughout their lifetime subjected to their exposure to fertility, mortality and migration. Starting with a base population by age and sex, the population at each specific age group is exposed to the probability of dying as determined by projected mortality levels and patterns by age and sex. The estimated mortalities are then deducted from the surviving population. More so, fertility rates are estimated and applied to the female population of reproductive ages (15 -49 years) to project the number of births year-on-year. The net-migration data (accurate and updated) if available are incorporated in the method of projection as well. The spectrum computer software package; Version 6.19 was used in projecting the population over the 10-year period taking into consideration assumptions of total fertility rate (TFR), the age distribution of fertility, life expectancy at birth by sex for the launch year, the most appropriate model life table and the magnitude of international migration. But for the unavailability of accurate and up-to date data on migration in Ghana, migration was not used in the projection of the population. The UN Joint Score data evaluation technique was used in validating the quality and accuracy of the census data based on age and sex reporting, from Ghana's 2021 Population and Housing Census.

The enrolment ratio method was used for projecting that of school enrolment while the pupil-teacher and classroom-pupil ratios were used for the teacher and classroom requirements going into the future. The projection of school enrolment was made based on the projected total number of children of school going age classified as the standard of the Ghana Education Service (GES) to be enrolled in a specific level of basic secondary education for each year of the projection

horizon for ages 0-17 years. Furthermore, the projection for classroom and trained teachers required were computed by dividing the total number of projected populations of school going aged children for each year of the projection period by the standard class-size for each specific level of basic and secondary education. The standard class-size for Creche/Nursery, Kindergarten and Secondary school and TVET is 30 students while for Primary and Junior High School levels is 35 students. Enrolment assumptions were made for each level of basic education and Secondary/ TVET education, under 75, 85 and 100 percent enrolment rate assumptions.

Also, the study made use of tables, percentages, rates, and ratios in measuring indices and displaying results such as total population size and spatial distribution, school enrolment, gross enrolment rates, pupil-teacher, and pupil-classroom ratios.

Additionally, situational analysis over three academic years: 2017/2018, 2018/2019 and 2019/2020 was made as well as projecting future requirements for classrooms and trained teachers for the various levels of basic and secondary education.

CHAPTER FOUR

ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents analysis and results of data on Population and Housing Censuses conducted in Ghana from 1984 to 2021 as well as statistics on school enrolment, classrooms, and trained teachers for basic and secondary education, interpreted in descriptive form. Discussion of the findings in relation to Ghana's population and implications on the physical infrastructure and teaching personnel for basic and secondary education.

4.2 Ghana's Population Dynamics

4.2.1 Trends in Ghana's Population

Table 4.1 reveals that the intercensal annual growth rate for 1984-2000 was highest for Greater Accra Region followed by the Western and Ashanti regions while the Eastern and Upper East regions saw the lowest over the same period. Greater Accra again recorded joint highest intercensal annual growth rate for 2000-2010 together with the Central Region, followed by the Northern Region. It is evident that Ghana's population has been growing and this is also reflective for all the regions from 1984 through to 2010.

Table 4.1: Trends in Ghana's Population Growth Rate, 1984-2010

Region	Population			Rate of Growth Per Annum (%)	
	1984	2000	2010	1984 – 2000	2000 - 2010
All Regions	12,296,081	18,912,079	24,658,823	2.7	2.7
Ashanti	2,090,100	3,612,950	4,780,380	3.5	2.8
Brong Ahafo	1,206,608	1,815,408	2,310,983	2.6	2.4
Central	1,142,335	1,593,823	2,201,863	2.1	3.3
Eastern	1,680,890	2,106,696	2,633,154	1.4	2.3
Greater Accra	1,431,100	2,905,726	4,010,054	4.5	3.3
Northern	1,164,583	1,820,806	2,479,461	2.8	3.1
Upper East	772,743	920,089	1,046,545	1.1	1.3
Upper West	483,008	576,583	702,110	1.7	2.0
Volta	1,211,907	1,635,421	2,118,252	1.9	2.6
Western	1,157,807	1,924,577	2,376,021	3.5	2.1

Source: Ghana Statistical Service, 2000 and 2010 Population and Housing Censuses

The Greater Accra, Ashanti and Northern regions saw consistent increases in their respective shares of the total population for the period 1984-2010 while the Eastern, Brong Ahafo, Upper East and Upper West regions witnessed declines. The Greater Accra Region more than doubled its population and nearly tripled in the 2000 and 2010 population censuses while the Ashanti Region remained the most populous region from 1984 to 2010 (see Table 4.2)

Table 4.2: Proportional Share of Ghana's Population by Region, 1984 – 2010

Region	Population			Regional Share		
	1984	2000	2010	1984	2000	2010
All Regions	12,296,081	18,912,079	24,658,823	100.0%	100.0%	100.0 (%)
Ashanti	2,090,100	3,612,950	4,780,380	17.1	19.1	19.4
Brong Ahafo	1,206,608	1,815,408	2,310,983	9.7	9.6	9.4
Central	1,142,335	1,593,823	2,201,863	9.4	8.4	8.9
Eastern	1,680,890	2,106,696	2,633,154	13.8	11.1	10.7
Greater Accra	1,431,100	2,905,726	4,010,054	11.6	15.4	16.3
Northern	1,164,583	1,820,806	2,479,461	9.5	9.6	10.1
Upper East	772,743	920,089	1,046,545	6.3	4.9	4.2
Upper West	483,008	576,583	702,110	3.6	3.0	2.8
Volta	1,211,907	1,635,421	2,118,252	9.8	8.6	8.6
Western	1,157,807	1,924,577	2,376,021	9.2	10.2	9.6

Source: Ghana Statistical Service, 2000 and 2010 Population and Housing Censuses

In 2018 there was a referendum conducted by Ghana's Electoral Commission in 47 districts cutting across four existing regions, for regional re-organisation and creation of additional six administrative regions backed by a legal framework from Article (5) of the 1992 Constitution of the Republic of Ghana. According to the results declared by the Electoral Commission of Ghana, all proposed regions were approved with 'yes' votes ranging between 99 percent and 99.7 percent in all regions involved; Western, Northern, Volta and Brong Ahafo regions and turnouts ranging from 80 percent to 90 percent. The Northern Region was split into three; Savannah, North East and Northern regions, the Brong Ahafo Region having Bono, Bono East and Ahafo regions while

over to the west, the Western Region split into Western and Western North regions while Volta Region split into Volta and Oti regions.

In the 2021 Population and Housing Census (PHC), as Ghana's first fully digital census, updated Ghana's demographic, social and economic data. The 2021 PHC was carried out in 16 administrative regions, in sharp contrast to prior censuses conducted in 1984, 2000 and 2010, when the country had 10 administrative regions.

The 2021 PHC was based on electronic processes from Computer Assisted Personal Interviewing (CAPI), geo-data to harness full census coverage and ensured receipt of data in near real time and release of results, as well as ensuring a robust monitoring system.

Ghana's population age structure is transitioning from one dominated by children (0-14 years) to one dominated by young people (15-35 years). The proportion of children declined from 41.3 percent in 2000 to 35.3 percent in 2021, while that of young people increased from 34.6 percent in 2000 to 38.2 percent in 2021. The proportion of children (0 – 14 years) was 45 percent, 15 – 64 years constituted 51.0 percent and 5.3 percent 65 years and over in 1984 (Ghana Statistical Service, 2005). By 2021, urban population recorded 56.7 percent while rural population constituted 43.3 percent of Ghana's total population, with Greater Accra Region witnessing the most share of transition to urban areas in Ghana (Ghana Statistical Service, 2021).

Furthermore, Table 4.3 indicate Ghana's growth rate witnessed a positive decline and cited as the lowest since independence (Ghana Statistical Service, 2021). Four regions, Greater Accra (17.7%), Ashanti (17.6%), Eastern (9.5%) and Central (9.3%) constituted more half (54%) of the total population. The annual growth rate also varied across the regions with the Northern Region having the highest of 3.7 percent with the Eastern Region realizing the lowest growth rate of 1.0 percent.

Table 4.3: Ghana's Population Growth Rate and Distribution by Region, 2021

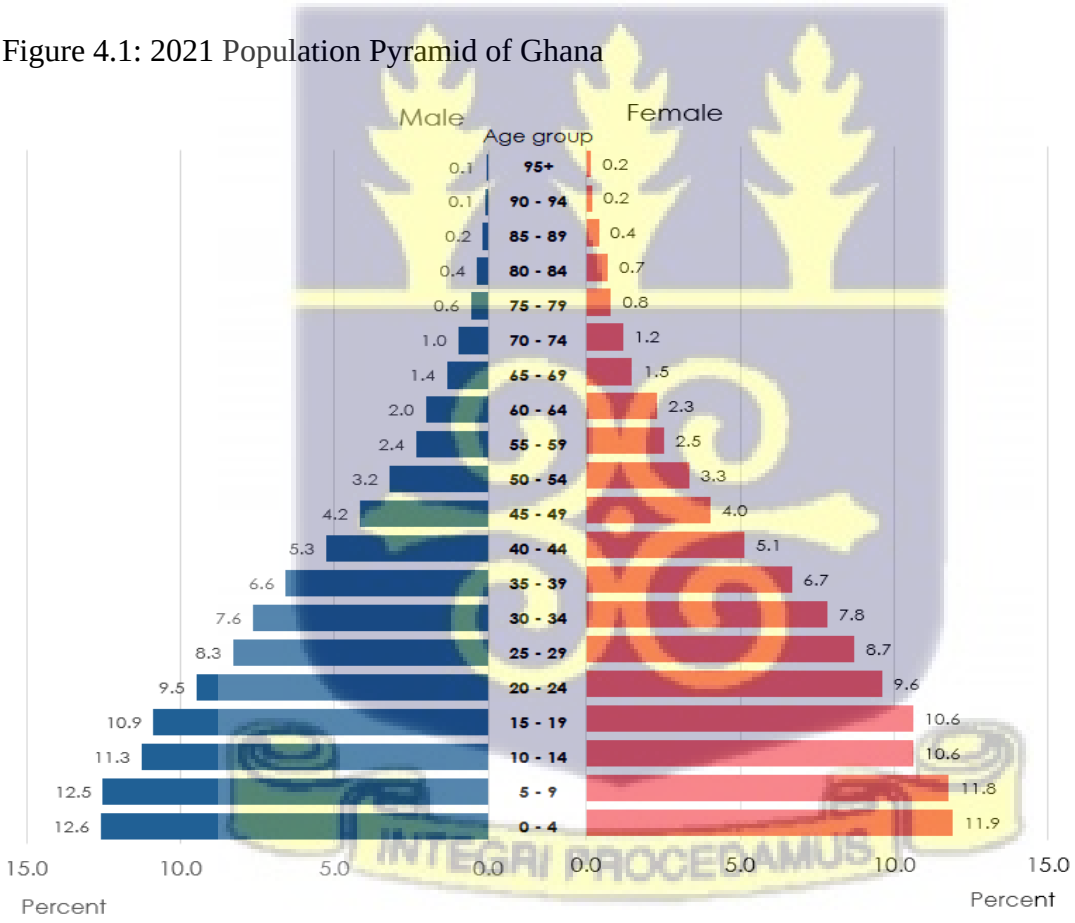
Region	Population 2021	Rate of Growth Per Annum (%) 2010 - 2021	Regional Share 100.0 (%)
All Regions	30,832,019	2.1	
Ahafo	564,668	1.4	1.8
Ashanti	5,440,463	1.2	17.6
Bono	1,208,649	2.5	3.9
Bono East	1,203,400	2.7	3.9
Central	2,859,821	2.4	9.3
Eastern	2,925,653	1.0	9.5
Greater Accra	5,455,692	2.9	17.7
North East	658,946	3.2	2.2
Northern	2,310,939	3.7	7.5
Oti	747,248	1.5	2.4
Savannah	653,266	3.1	2.1
Upper East	1,301,226	2.0	4.2
Upper West	901,502	2.3	2.9
Volta	1,659,040	1.1	5.4
Western	2,060,585	2.0	6.7
Western North	880,921	2.0	2.9

Source: Ghana Statistical Service, 2021 Population and Housing Census

4.3 Age-Sex structure of Ghana's Population

Age and sex are two important characteristics of a population in demographic analyses. Age is the most critical variable and seems to have an association with fertility, mortality and migration. Mortality rates vary across a wide range of different ages with childbearing limited lifespan of a woman and migration generally in adult ages. These demographic processes are better understood when observed with the sex component too. The sex composition is highly recognized into classifying everyone in the population as being biologically male or female and this generally helps differentiations in demographic events. Figure 4.1 is a graphical representation of the age-sex composition of Ghana's population.

Figure 4.1: 2021 Population Pyramid of Ghana



Source: Ghana Statistical Service, 2021 Population and Housing Census

4.4 Evaluation of Population Census Data

4.4.1 Introduction

Demographic events such as births, deaths and migration are very critical in describing the composition and size of the population of a defined territory and data on these events can be captured through a robust civil registration system, sample surveys and population censuses (Lundquist et al., 2015).

High quality data on demographic events helps in describing the characteristics of the population in terms of growth, age-sex structure, and distribution, etc. and effective monitoring of the components of population change. Updated records of these demographic events go a long way in ensuring effective planning processes and yielding effective results.

The Population Census has been the primary source of collecting demographic, social and economic data at specific times and according to the United Nations censuses should be conducted at regular intervals, at least every ten years as there would have not been vast changes in the demographic events of an area. The data gathered from censuses also provide a basis for the estimation of future population growth, size, structure, and spatial distribution. Again, census data are important for planning for socio-economic development in the area of education, health, housing, etc.

However, there are some inherent challenges with population censuses at various stages of enumeration and processing and the two most critical are errors of coverage and content (Shryock et al., 1975). These errors are common in most countries and not peculiar to Africa, Ghana or the developing world and this stems from the fact that these data are collected by human beings and from human beings. Coverage errors include enumerators not counting every person and even counting some people more than once. Some groups of persons such as the homeless may be

overlooked and so not counted during the enumeration of persons. Some peculiar groups may as well not participate in the census or have them counted and such groups could include some religious sects and anti-political groups. The other error, which is the content error, tends to have errors in the characteristics of the persons counted resulting in information misreporting or failure to report accurately by both the enumerator and respondent. Therefore, population census data are not all perfect, rather have some challenges hindering on the quality and so the need to validate its quality before using them for analyses.

One way of validating census data is by evaluating the data in estimating for the accuracy and quality to know the extent of error and how they affect the results and conclusions to be drawn from the analysis of the data and if errors are established, inform the need to smoothen the data by adjustment to remove the errors entirely or reduce them for use. This therefore calls for an evaluation of Ghana's 2021 Population Census which is the prime census upon which most indications on the composition would dwell on as well as for projecting the population over the next ten years.

The UN Joint Score (UNJS) method was employed in the evaluation of the age data. In instances where single age data are grouped into five-year age-groups, there are possibilities of shifting of one age group into another, usually from the previous age group or the next age group and this could vary between males and females. The issue of age misreporting cannot also be ruled out in age accuracy of census data. The UN Joint Score therefore is a combined indicator of the overall differentials in the age misreporting of males and females and that of the five-year age-group displacements. Age Ratio Scores calculated separately for males and females and that of Sex Ratio Score are computed in deriving the UN Joint Score. An index score of 17.065, below 20 from the 2021 PHC means the data is of high accuracy and useful in making analyses (see Appendix A).

4.5 Analysis of Ghana's Educational Development

4.5.1 Introduction

According to the United Nations Development Program (UNDP) (2019), education is one of the three human development indexes. It is also a fundamental human right upheld by the 1992 Constitution of the Republic of Ghana. It is therefore mandated by successive governments in making education accessible. It is from this backdrop that this study assesses the development in education sector of Ghana, specifically for this study encompassing basic and secondary education and with narrowed interest in infrastructure and personnel. Infrastructure in this study will zero in on adequate classrooms and that of personnel will be the number of trained teachers in the sector.

4.5.2 Basic Education

Basic education in Ghana covers from Creche/ Nursery, Kindergarten, Primary school to the Junior High School level. Enrolment for the various levels of basic education in Table 4.4 comprises of enrolments both public and private schools in Ghana. Table 4.5 also reports on the estimated school age population at each level of basic education during the three academic periods provided by the Ghana Statistical Service to the Ministry of Education. As a matter of national policy in Ghana's education, there are age categorization for each level of basic education. Ideally, the age range to be in Creche/Nursey is ages 0–3 years, Kindergarten 4-5 years, Primary school 6–11 years while JHS, 12–14 years. Creche/Nursery enrolment was 479,619 for the 2017/2018 academic year when the estimated projected 2010 census population of school going age for Creche/Nursery (0–3 years) for the period was 3,359,162 provided by the Ghana Statistical Service (Ministry of Education, 2018). There was an increase in the enrolment for the 2018/2019 academic to 506,166 with an estimated population of 3,406,185 but saw a decline in enrolment to 380,501 during the 2019/2020 academic year while estimated population of Creche/Nursery going age stood at

3,414,935. The trend in Kindergarten enrolment saw 1,778,021 pupils when the estimated population for 4 - 5-year ages was 1,581,200 during the 2017/2018 academic year. Enrolment went up to 1,832,693 during the 2018/ 2019 academic year with an estimated population of Kindergarten going age of 1,609,130 for the same period. For the 2019/2020 academic year there were1,867,939 pupils with an estimated Kindergarten going aged children recorded as 1,682,098.

More so, Primary school and Junior High School (JHS) enrolments for the 2017/2018 were 3,699,575 and 1,645,764 respectively and estimated school going aged children at those levels estimated at 4,144,762 and 1,912,381 respectively. A total of 4,511,268 and 4,584,381 were respectively the enrolment figures for the 2018/2019 and 2019/2020 academic years for Primary school while 1,787,002 and 1,651,901 pupils enrolled at JHS for the 2018/2019 and 2019/2020 academic years respectively.

Table 4.4: School Enrolment at the Basic Education Level in Ghana, 2017/2018 – 2019/2020

Basic Education Levels	**2017/ 2018 Academic Year Enrolment**		**2018/ 2019 Academic Year Enrolment**		**2019/ 2020 Academic Year Enrolment**	
	Male	Female	Male	Female	Male	Female
Creche/Nursery	242,214	237,405	255,869	250,297	267,044	113,457
	Total: **479,619**		Total: **506,166**		Total: **380,501**	
Kindergarten	899,932	878,089	928,597	904,096	945,479	922,450
	Total:**1,778,021**		Total: **1,832,693**		Total: **1,867,929**	
Primary School	1,875,067	1,824,508	2,286,640	2,224,628	2,319,908	2,264,473
	Total: **3,699,575**		Total: **4,511,268**		Total: **4,584,381**	
Junior High School (JHS)	836,642	809,122	955,965	831,037	781,634	870,267
	Total: **1,645,764**		Total: **1,787,002**		Total: **1,651,901**	

Source: Education Management Information System, Ministry of Education

Table 4.5: Population of School Going Age at Each Level of Basic Education in Ghana, 2017/2018 – 2019/2020 Academic Years

2017/ 2018 Academic Year							
Pop. 0 – 3 years for creche/nursery		Pop. 4 – 5 years for kindergarten		Pop. 6 – 11 years for Primary		Pop. 12 – 14 years for JHS	
Male	Female	Male	Female	Male	Female	Male	Female
1,698,308	1,660,854	798,511	782,689	2,105,323	2,039,439	970,714	941,667
Total: **3,359,162**		Total: **1,581,200**		Total: **4,144,762**		Total: **1,912,381**	
2018/ 2019 Academic Year							
Pop. 0 – 3 years for creche/nursery		Pop. 4 – 5 years for kindergarten		Pop. 6 – 11 years for Primary		Pop. 12 – 14 years for JHS	
Male	Female	Male	Female	Male	Female	Male	Female
1,722,420	1,683,765	812,781	796,349	2,172,602	2,112,862	989,787	941,667
Total: **3,406,185**		Total: **1,609,130**		Total: **4,285,464**		Total: **1,945,752**	
2019/ 2020 Academic Year							
Pop. 0 – 3 years for creche/nursery		Pop. 4 – 5 years for kindergarten		Pop. 6 – 11 years for Primary		Pop. 12 – 14 years for JHS	
Male	Female	Male	Female	Male	Female	Male	Female
1,750,558	1,664,377	862,784	819,314	2,387,127	2,277,024	1,071,269	2,058,854
Total: **3,414,935**		Total: **1,682,098**		Total: **4,664,151**		Total: **3,130,123**	

Source: Education Management Information System, Ministry of Education

Furthermore Tables 4.6 and 4.7 highlight the available number of adequate classrooms as well as that of trained teachers at each level of basic education for the three academic periods. The number of adequate classrooms serving basic education totaled 250,963 for the 2017/2018 academic year. The number increased to 265,370 in the 2018/2019 academic year and further increased to 277,140 in the 2019/2020 academic year. The JHS level had the higher share of the classrooms over the three academic years while the Creche/Nursery level had the least share.

Table 4.6: Adequate Classrooms Available for Basic Education During the 2017/2018 to 2019/2020 Academic Years

Basic Education Level	2017/2018 Academic Year	2018/2019 Academic Year	2019/2020 Academic Year
Creche/Nursery	15,708	17,188	19,978
Kindergarten	41,483	44,890	47,113
Primary	139,543	146,563	150,127
JHS	54,229	56,729	59,922
Total	**250,963**	**265,370**	**277,140**

Source: Education Management Information System, Ministry of Education

There were 222,829 trained teachers handling the levels of basic education during the 2017/2018 academic year. For the 2018/2019 academic year, the numbers decreased to 141,971 and saw a remarkable increase to 401,496 trained teachers the following academic year. Again, Creche/Nursery had the least number of trained teachers while JHS recorded the highest. Table 4.7 shows the number of trained teachers available in handling various levels of basic education for each of the three academic years.

Table 4.7: Number of Trained Teachers for Basic Education for 2017/2018 – 2019/2020 Academic Years

Basic Education Level	2017/2018 Academic Year	2018/2019 Academic Year	2019/2020 Academic Year
Creche/Nursery	1,656	1,982	2,429
Kindergarten	33,671	36,269	44,068
Primary	97,545	103,720	125,031
JHS	89,957	95,040	114,984
Total	**222,829**	**141,971**	**401,496**

Source: Education Management Information System, Ministry of Education

It was also observed that some academic periods had lesser number of pupils enrolling at each level of basic education while some periods also saw more students enrolled compared with the estimated national population for that level. This therefore calls for an analysis on the enrolment rate in capturing the challenges and bottlenecks facing basic school enrolment in Ghana such as low enrolment rate and over enrolment vis-à-vis available infrastructure to serve the numbers, over the three academic periods. The total enrolment recorded at each specific level encapsulated ages other than the actual ages for each level of basic education as a principle of national education policy, expressed as a percentage of the estimated population in the official age group corresponding to the specific level of education and this is known as Gross Enrolment Rate (GER) (see Appendix B).

The GER for Creche/Nursery recorded low percentages with 14.3 percent, 14.9 percent, and 11.1 percent over the three academic periods respectively. That for Junior High School had recorded rates of 48.2 percent, 91.8 percent, and 52.8 percent over the same academic periods while Primary school had higher GER recording 112.4 percent, 113.9 and 111.0 percent respectively for the three academic periods. It is worthy of note that gross enrolment rate can exceed 100% because of early or late entries and/or repetitions of pupils at each level of basic education as realized from the computations done in Table 4.8. Table 4.8 gives details of the Gross Enrolment Rates at each level over the academic periods.

Table 4.8: Gross Enrolment Rate (GER) for Basic Education Levels for 2017/2018-2019/2020

Basic Education Levels	2017/2018 Academic Year			2018/2019 Academic Year			2019/2020 Academic Year		
	Total Enrolment	Population at level (0 – 3, 4 – 5, 6 -11 & 12 -14 years)	**GER (%)**	Total Enrolment	Population at level (0 – 3, 4 – 5, 6 -11 & 12 -14 years)	**GER (%)**	Total Enrolment	Population at level (0 – 3, 4 – 5, 6 -11 & 12 -14 years)	**GER (%)**
Creche/ Nursery	479,619	3,359,162	**14.3**	506,166	3,406,185	**14.9**	380,501	3,414,935	**11.1**
KG	1,778,021	1,581,200	**112.4**	1,832,693	1,609,130	**113.9**	1,867,929	1,682,098	**111.0**
Primary	3,699,575	4,144,762	**89.3**	4,511,268	4,285,464	**105.3**	4,584,381	4,664,151	**98.3**
JHS	1,645,764	3,414,935	**48.2**	1,787,002	1,945,752	**91.8**	1,651,901	3,130,123	**52.8**

Source: Computed with figures from tables 4.4 and 4.5

Consequently Table 4.9 details the number of classrooms and trained teachers corresponding to enrolment numbers at each level of basic education for the 2017/2018 to 2019/2020 academic years. Ghana's national policy on education in meeting international standards, has ideal standard class sizes at each level of basic education. Creche/Nursery and Kindergarten levels require every classroom to hold 30 pupils, Primary level has a capacity of 35 pupils per class and the same at the JHS level. This also goes in tandem with pupil per (trained) teacher (PTTR), stating a pupil per

(trained) teacher as 30:1, 35:1 and 35:1 for Creche/Nursery/Kindergarten, Primary and JHS levels respectively. These standards create the conducive and enabling environment for both pupils and teachers in churning out effective learning outcomes. It also determines the level of individual attention needed in class and this is key in building better relationship between pupils and teachers (see Appendix C).

The pupil-classroom ratio statistics for the three academic periods looked to conform to the standards and even better at the Creche/Nursery, Primary and JHS levels but a disproportion at the Kindergarten level over the same period. However, the indications for pupil-trained teachers (PTTR) revealed wide deficits especially at the Creche/Nursery levels over the three academic years where the PTTR was 290:1, 255:1 and 157:1 respectively over the three academic years. The narrative seemed much better at the JHS level where PTTR was 18:1, 19:1 and 14:1 over the same periods. The Kindergarten and Primary school levels had moderate overloads witnessing PTTR of 53:1 and 38:1 for the 2017/2018 academic year. These disparities put much pressure on the available trained teachers in handling large class sizes invariably and this does not auger well for effective service delivery.

Generally, there were shortfalls in the number classrooms and trained teachers at the various levels of basic education in Ghana analysing the available numbers of the three academic years to meet the recommended standards.

Table 4.9: Pupil-Classroom Ratio (PCR) and Pupil-Trained Teacher Ratio (PTTR) for Basic Education, 2017/2018 – 2019/2020 Academic Years

2017/ 2018 Academic Year												
Creche/nursery			Kindergarten			Primary			JHS			
Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	
479,619	15,708	1,656	1,778,021	41,483	33,671	3,699,575	139,543	97,545	1,645,764	54,229	89,957	
PCR: 31:1	**PTTR: 290:1**		**PCR: 43:1**	**PTTR: 53:1**		**PCR: 27:1**	**PTTR: 38:1**		**PCR: 30:1**	**PTTR: 18:1**		
2018/ 2019 Academic Year												
Creche/nursery			Kindergarten			Primary			JHS			
Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	
506,166	17,188	1,982	1,832,693	44,890	36,269	4,511,268	146,563	103,720	1,787,002	56,729	95,040	
PCR: 29:1	**PTTR: 255:1**		**PCR: 41:1**	**PTTR: 51:1**		**PCR: 31:1**	**PTTR: 43:1**		**PCR: 32:1**	**PTTR: 19:1**		
2019/ 2020 Academic Year												
Creche/nursery			Kindergarten			Primary			JHS			
Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	Pupils Enrolled	Classrooms	Trained Teachers	
380,501	19,978	2,429	1,867,929	47,133	44,068	4,584,381	150,127	125,031	1,651,901	59,922	114,984	
PCR: 19:1	**PTTR: 157:1**		**PCR: 40:1**	**PTTR: 42:1**		**PCR: 31:1**	**PTTR: 37:1**		**PCR: 28:1**	**PTTR: 14:1**		

Source: Computed with figures from tables 4.4, 4.6 & 4.7

4.5.3 Secondary Education

Secondary education occupies an advanced level after basic education acquisition which provides further learning and educational activities on primary education and preparing for both the labour market and transition into advanced learning at the tertiary level of education.

According to the Pre-tertiary Education Act, 2020, secondary education has been made progressively, free by the Government of Ghana for public schools. It is progressively free, because Secondary school education was made free beginning of the 2017/2018 academic year while that of Technical and Vocational Education and Training (TVET) was made free from the 2022/2023 academic year. It is therefore important to state that the scope for secondary education in this study comprises Secondary schooling and TVET. Trends in student total and gross enrolments, pupil-classroom ratio (PCR) and pupil-trained teacher (PTTR) are analysed for the 2017/2018 – 2019/2020 academic years.

4.5.3.1 Trends in student total and gross enrolment at the Secondary Education level for 2017/2018 – 2019/2020 academic years

Table 4.10 presents information on total and gross enrolments for secondary education. Gross enrolment rate is preferred to net enrolment rate (NER) - which measures the total enrolment of children of official school going age who are enrolled in school to the corresponding official school age- just as used in the analysis of basic education because it provides the actual enrolment rate and its corresponding effect on class size and trained teacher requirement. It is envisaged to have year-on-year increases in total enrolment following the Free Senior High School and TVET Policy implementation for secondary education over the three academic periods. The official age group

for secondary education as a matter of policy direction is 15-17 years. Total enrolment recorded for the 2017/2018 academic year was 1,103,005 with a gross enrolment rate (GER) of 55.9 percent from an estimated population in the age group 15-17 years of 1,811, 345. Subsequently, 1,155,841 were enrolled in the 2018/2019 academic year out of a population in the age category of secondary education of 1,846,084, thus a GER of 62.6 percent while 1,249,449 pupils enrolled in the 2019/2020 academic year with a GER of 63.2 percent. It is worth also mentioning that the data for those of private Secondary schools in Ghana was included to give a holistic account at the secondary education level in Ghana. It can be noted that GER increased year-on-year over the three academic years.

Consequently, Table 4.11 indicate that the total enrolment levels, realized increased numbers over the three academic years as more pupils had entry opportunities transitioning from the basic to the secondary education level. The 2018/2019 total pupil enrolment increased by 14.1 percent over the 2017/2018 academic year enrolment and a further 8.1 percent increase in the subsequent academic year's (2019/2020) total enrolment. This trend in enrolment is very encouraging, giving equal opportunities for children of school going age attain secondary education as Ghana strides in her effort of meeting the Sustainable Development Goal 4 (Quality Education) targets. Additionally, the illiteracy levels of the country are reduced, and the human resource capacity equipped with relevant skills in ensuring development of the country. The total and gross enrolments as well as the percentage changes in enrolment levels are presented in Tables 4.10 and 4.11.

Table 4.10: Total Student and Gross Enrolments for Secondary Education, 2017/2018 – 2019/2020 Academic Years

2017/2018 Academic Year			2018/2019 Academic Year			2019/2020 Academic Year		
Total Enrolment	Population at level (15 – 17 years)	**GER (%)**	Total Enrolment	Population at level (15 - 17 years)	**GER (%)**	Total Enrolment	Population at level (15 -17 years)	**GER (%)**
1,013,005	1,811,345	**55.9**	1,155,841	1,846,084	**62.6**	1,249,449	1,977,831	**63.2**

Source: Computed from the Education Management Information System, Ministry of Education

Table 4.11: Total Student Enrolment Percentage Change for Secondary Education from 2017/2018 -2019/2020 Academic Years

2017/2018 Total Enrolment	2018/ 2019 Total Enrolment	Percentage Change (%)	2018/2019 Enrolment	2019/2020 Enrolment	Percentage Change (%)
1,013,005	1,155,841	14.1	1,155,841	1,249,449	8.1

Source: Computed from the Education Management Information System, Ministry of Education

Again**,** adequate physical infrastructure and requisite personnel are paramount in ensuring better learning outcomes in the education sector. Table 4.12 displays information on the number of classrooms and trained teachers as well as pupil-classroom and pupil-trained teacher ratios in Secondary and TVET institutions in Ghana for the 2017/2018 through to the 2019/2020 academic years. The standard class size is 30 for secondary education in Ghana. In effect a teacher has an ideal class of 30 as an enabling number to impart knowledge and have the needed time to deal with each student and address their problems in class, thereby avoiding work overload. The pupil-classroom ratio seems to have more pupils clustered in a class, beyond the ideal standard of 30 and this could be realized for each academic year. The pupil per classroom were 45:1, 51:1 and 49:1 for the three academic years respectively. Though the pupil-trained teacher ratios conformed with the ideal, the situation was quite different from the actuals because, the effects of having more pupils in the classrooms had a toll on the actual numbers a teacher had to handle and therefore the need to reduce the classroom deficits to ensure standard class sizes for teachers in their service delivery. Apparently, there are deficits in education services in available classrooms at the Secondary/TVET level over the three academic periods.

Table 4.12: Pupil-Classroom Ratio (PCR) and Pupil-Trained Teacher Ratio (PTTR) for Senior High Schools and TVET, 2017/2018 – 2019/2020 Academic Years

2017/ 2018 Academic Year			2018/ 2019 Academic Year			2018/ 2019 Academic Year		
Total Enrolment	Classrooms	Trained Teachers	Total Enrolment	Classrooms	Trained Teachers	Total Enrolment	Classrooms	Trained Teachers
1,013,005	22,338	41,323	1,155,841	22,779	50,415	1,249,449	25,383	53379
PCR: 45:1		**PTTR: 25:1**	**PCR: 51:1**		**PTTR: 23: 1**	**PCR: 49:1**		**PTTR: 23:1**

Source: Computed from the Education Management Information System, Ministry of Education

4.6 Future Population and its Implications for Education

4.6.1 Introduction

Ghana's future population growth and its implications for Ghana's education development are examined from 2021 to 2031. The cohort component method was used in the projection of the population. This enables the total population of children of school going age for basic and secondary education 0-17 years to be estimated for each year of the projection, thereby estimating the classroom and trained teachers required in meeting standards at each level of Ghana's pre-tertiary education levels.

4.6.2 Population projection

Bremner (2014) defines population projection as representing the future size of a population and the age and sex distribution if the assumptions used hold true. They are therefore conditional estimates of future population based on assumptions made for the components of population change; fertility, mortality and migration. If births, deaths and migration rates are assumed to follow certain patterns, an approximation of the future population size can be made.

Population projections are very important in promoting development and invariably planning for the education sector. Depending on how rapid or slowly the population grows, it gives an indication of the need for more investment in the sector in its management or prompting against impeding implications. The future population size helps build a comprehensive plan to achieve specific goals in public policy, which are related to accelerating social and economic development (Shryock et al., 1975).

The base year for the projection is 2021 and projections are made over a ten-year period from 2021 to 2031. This forms the basis for estimating the classroom and trained teacher requirements of the

population of school going age for basic and secondary education for each year of the projection period. As stated earlier, population projections are made based on assumptions on fertility, mortality and migration and these assumptions are discussed subsequently.

4.6.2.1 Fertility Assumptions

Fertility level is an important component of population growth. The higher the fertility rate the higher the population grows, and vice versa. Total fertility rate (TFR) is the average number of children that would be born to a woman if she were to experience the current pattern of age specific fertility rates (ASFR) throughout her reproductive life (15-49 years). Data on TFRs from Ghana's Demographic and Health Survey (GDHS) from 1988 to 2014 revealed 6.4 births per woman in 1988, 5.2 in 1993, 4.4 in 1998, 4.4 in 2003, 4.0 in 2008 and 4.2 in 2014 (GDHS, 2014). The reported TFR from the 2021 Population and Housing Census was 3.1. The trend has seen decline in the number of births per woman over the years with few intermittent upward surges in the rate.

High, medium and low projection variants are considered for the approximation of age and sex of the population over the projection horizon. Though the TFR was 3.1 for the 2021 PHC, censuses by their very focus do not give accurate results on TFR (GSS, 2005; 2012). Therefore, the policy target of reducing TFR 4.2 (GDHS estimate) to 3.5 by 2024 was used and held constant for the high, medium and low variants for the base year 2021 for the projection of the population.

Again, a medium population projection variant was assumed based on a relatively reducing TFR rates over the projection horizon compared with TFR assumption under the high population variant assumption. Formal education which is the process of giving and receiving standardized systematic instruction from a recognized and accredited institution to individuals for knowledge acquisition and skill development (Ghana Statistical Service, 2021) had more females going to school between 2010 and 2021. There were approximately 10.1 million female population, 6 years and older

having ever attended school over the previous 2010 PHC census figure of approximately 8.1 million, and this would have positive correlation with rising age at first marriage and first birth. This is assumed to steadily reduce the total fertility rate by 0.2 of the 3.5 TFR and suggests that fertility levels would not remain high indefinitely, thus an assumed TFR of 3.3 under the medium variant.

Under the low variant, TFR is likely to reduce further by 0.3, recording TFR of 3.0 assumed for the low variant projection of the population. This TFR corroborates the national policy target of reaching TFR of 3.0 by 2034 (National Population Council, 2018). Table 4.13 presents the assumed TFR under high, medium and low variants of projections.

Table 4.13: Fertility Assumptions for the Three Variants of Population Projection, 2021-2031

Year	High Variant	Medium Variant	Low Variant
2021	3.50	3.50	3.50
2022	3.50	3.48	3.45
2023	3.50	3.46	3.40
2024	3.50	3.44	3.35
2025	3.50	3.42	3.30
2026	3.50	3.40	3.25
2027	3.50	3.38	3.20
2028	3.50	3.36	3.15
2029	3.50	3.34	3.10
2030	3.50	3.32	3.05
2031	3.50	3.30	3.00

Source: Computed from Spectrum Computer Package (Version 6.19)

4.6.2.2 Mortality Assumptions

Individual lifestyles, socio-economic factors, environmental and health system factors combine in determining the health and survival of individuals. Life expectancy is usually a measure of

mortality and predicts the average age at death a cohort of new births is expected to live before their death. Mortality levels are expected to decline with improvements in the health systems, environmental exposure to infectious, chemical, physical agents, etc., socio-economic factors such as wealth and employment. Infant mortality rate (IMR) is also one key determinant of how many new birth cohorts will survive beyond one year which serves as a measure of life expectancy of a population. According to the 2020 and 2021 World Population Data Sheets, IMR was 37 deaths per 1,000 live births for Ghana. Furthermore, the 2020 and 2021 World Population Data Sheets estimated life expectancy at birth for Ghana to be 64 and 69 years respectively. Male life expectancy at birth was 63 years and 67 years while female life expectancy at birth estimated at 65 and 70 years according to the 2020 and 2021 World Population Data Sheets. The General Pattern of the United Nations (New) Model Life Tables for developing countries had Ghana's life expectancy at birth for males as 63.8 years and 66.2 years for females in 2021 and these vary for each year of the projection period, 2021 and 2031 following an interpolation of the initial life expectancies of both sexes computed using the spectrum computer software package for the population projections. The life expectancy for males and females estimated were used utilized under all three population projection variants, thus, one mortality pattern assumed (see Table 4.14).

Table 4.14: Life Expectancy at Birth Underlying Mortality Assumptions, 2021-2031

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Male	63.8	64.0	64.1	64.3	64.5	64.7	64.9	65.1	65.3	65.4	65.6
Female	66.2	66.4	66.6	66.8	67.0	67.3	67.5	67.7	68.0	68.2	68.4

Source: General Pattern, United Nations (New) Model Life Tables for Developing Countries

4.6.2.3 Migration Assumptions

Migration is assumed to be zero throughout the projection period. The challenges in having regular and up to date statistics on migration in Ghana made it difficult to factor in the projection of the population over the ten-year period. The migration assumption simply indicate that migration does not play any significant role in the population projection results and so was not factored in the projection. This is normal with projections of this nature.

4.7 Projected Population

Based on the assumptions of fertility, mortality and migration made for the three population projection variants, Table 4.15 displays the total projected population from 2021 to 2031 using the cohort component method of projection.

Because of the assumptions made, the total population of Ghana under the high variant will reach 34,292,864 by the year 2026 and 38,192,484 by 2031. More so, the total population of Ghana under the medium variant is estimated to be 34,213,336 by 2026 and 37,884,138 by 2031 while under the low variant, the population was estimated to be 34,094,044 and 37,421,628 in 2031.

Table 4.15: Projected Population of Ghana Under the High, Medium and Low Variant Assumptions, 2021-2031

Year	Population (High Variant)	Population (Medium Variant)	Population (Low Variant)
2021	30,832,019	30,832,019	30,832,019
2022	31,481,802	31,476,744	31,469,158
2023	32,154,248	32,138,890	32,115,852
2024	32,848,288	32,817,194	32,770,552
2025	33,562,556	33,510,112	33,431,448
2026	34,292,864	34,213,336	34,094,044
2027	35,038,856	34,926,324	34,757,520
2028	35,802,520	35,650,804	35,423,224
2029	36,584,580	36,387,232	36,091,208
2030	37,383,160	37,133,580	36,759,216
2031	38,192,484	37,884,144	37,421,628

Source: Computed from Spectrum Computer Package (Version 6.19)

The age group distributions of the population under the high and low variants are shown in Appendices D and E. However, the age-sex population of Ghana under the medium variant were used for further analysis relevant to the study (see Appendices F and G). The medium variant projection showed that Ghana's population will increase by approximately seven million during the decade 2021-2031. The estimated population served as basis for projecting for school going age for basic and secondary education; the ages 0 to 17 years. The total projected population for each year was made in single years (0-80+ years) and so the projected school aged population for the basic and secondary education (0-17 years) were extracted from the total projected population for each year of the projection period. This made it easier to categorize the age ranges for the various levels of basic and secondary education; 0-3 years, 4-5 years, 6-11 years, 12-14 years, and 15-17 years. Table 4.16 presents the projected school age population for basic and secondary education under the medium variant projection.

Table 4.16: Projected Population of School Going Age for Basic and Secondary Education, 2021 – 2031 (Medium Variant)

Year / Age Groups (Years)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0-3	2,988,913	3,086,160	3,210,809	3,384,945	3,572,563	3,622,360	3,667,698	3,711,382	3,755,833	3,802,354	3,845,832
4-5	1,560,998	1,552,768	1,524,034	1,473,808	1,436,045	1,581,871	1,743,422	1,771,567	1,797,492	1,819,619	1,839,515
6-11	4,351,578	4,460,793	4,512,293	4,573,457	4,575,696	4,538,770	4,485,676	4,573,841	4,669,762	4,793,736	4,943,532
12-14	1,988,964	2,013,110	2,074,919	2,076,017	2,161,368	2,185,561	2,249,109	2,273,077	2,300,724	2,298,807	2,277,793
15-17	2,009,893	1,985,802	1,973,398	1,980,367	2,004,561	2,066,340	2,067,667	2,152,895	2,177,235	2,240,734	2,264,801
Total	**12,900,346**	**13,098,633**	**13,295,453**	**13,488,594**	**13,750,233**	**13,994,902**	**14,213,572**	**14,482,762**	**14,701,046**	**14,955,250**	**15,171,473**

Source: Computed from Spectrum Computer Package (Version 6.19)

As shown in Table 4.16, the total estimated population of school going age (0-17 years) for basic and secondary education in Ghana under the medium variant would range between 12,900,346 (constituting about 41.8 percent of the 2021 population of 30,832,019) and 15,171,473 by 2031 (which would constitute 40 percent of the estimated total population of the country of 37,884,144). Thus, the population of school going age for basic and Secondary school is estimated to increase by 14.9 percent at the end of the projection period of the launch population figure.

School enrolment largely depends on the school going age population. The projected school going age population in Table 4.16, generally shows an increase year-on-year in the projected school going age population over the ten-year period. This trend gives an indication of the need to plan for similar patterns in enrolment at each level of basic and secondary education in Ghana. As mandated by the Government of Ghana to achieve universal, free and compulsory education for her citizens, it is incumbent on the state to plan effectively and efficiently in achieving the set targets as a matter of policy (Pre-tertiary Education Act, 2020). These populated age groups for each basic and secondary education level serves as an in-depth database guiding plans of actions in estimating enrolments for each year, from 2021 to 2031. These would inform the provision of adequate physical infrastructure, that is, classrooms in accommodating the pupils as well as the number of trained teachers required, in meeting the growing demand and ensuring effective teaching and learning without having large class-sizes and disproportionate pupil to trained teacher ratios.

Appendices H, I, J, K and L presents projected Creche/Nursery, Kindergarten, Primary, JHS and SHS/TEVT school age populations from the medium variant under three plausible percentage enrolment assumptions. The net enrolment rate from the Ministry of Education's Education Management Information System (EMIS) report indicates an average net enrolment rate for basic

school ranging between 62.4 percent and 89.3 percent from 2017/2018 to 2019/2020 academic years while a range of 48.3 percent and 62.6 percent for the same period for Secondary school/ TVET.

Considering these enrolment rates, school enrolment for each level of basic and secondary education was projected under 75 percent, 85 percent and 100 percent assumptions from 2021 to 2031 and these are also highlighted in Appendices H, I, J, K and L.

4.8 Projected Basic School enrolments, 2021-2031

From Appendix H, the school enrolment for Creche/Nursery would reach 2,716,770, 3,079,006 and 3,622,360 under the 75 percent, 85 percent, and 100 percent enrolment assumptions by 2026. This would be an increase in enrolment from the 2021 estimated enrolments of 2,241,685, 2,540,576 and 2,988,913 respectively under the same enrolment assumptions. More so, the enrolment would reach an estimated 2,884,374, 2,540,576 and 3,845,832 respectively under the three enrolment assumptions by 2031.

Furthermore, Appendix I gives details of Kindergarten estimated student enrolments of 1,186403, 1,344590 and 1,581,871 by 2026 and a further increase to 1,379,636, 1,563,588 and 1,839,515 by 2031 under the three enrolment assumptions.

An initial estimated Primary school enrolment of 3,263,684, 3,698,841 and 4,351,578 in 2021 would reach approximately 3,707,649, 4,064,049 and 4,943,532 by 2031 under the 75 percent, 85 percent and 100 percent enrolment assumptions respectively (see Appendix J)

The JHS consequently would reach 1,639,170, 1,857,726 and 2,185,560 mid-way in the projection period while recording estimated figures of 1,708,346, 1,936,125 and 2,277,794 in 2031 also under the three respective enrolment assumptions indicated in Appendix K.

4.8.1 Projected Secondary School/TVET student enrolments, 2021-2031

It is envisaged against the backdrop of Ghana's young aged population structure that the population of school going age would also increase going into the future. Appendix L gives estimated population and corresponding student enrolment for Secondary schools/TVET student enrolment under the 75 percent, 85 percent and 100 percent enrolment assumptions.

Enrolments in 2021 under the three enrolment assumption percentages, enrolments are estimated to be 1,507,420, 1,708,409 and 2,009,893 respectively. Again, in 2026 enrolments are estimated to be 1,549,755, 1,756,389 and 2,066,340 respectively under the same enrolment assumptions while by 2031 reach a further 1,698,601, 1,925,081 and 2,264,801 enrolments under the three enrolment assumptions respectively.

4.9 Projected classrooms and trained teachers required for Basic Education, 2021 – 2031

The relationship between adequate provision and available physical infrastructure, i.e. classrooms for the purposes of this study and increasing school enrolment cannot be overemphasized. This is because the pupil-classroom ratio must meet the required standard of 30:1 (preprimary) and 35:1 (primary and JHS) in facilitating effective teaching and learning. This standard ratio goes in hand with the standard pupil-trained teacher ratio, and this ensures productive service delivery. Additionally, it builds effective relationship between pupils and teachers as well as adding positive dimensions in improving weaknesses in the pupils when noticed by the teachers. It is evident that the creation of an enabling teaching and learning environment is very fundamental in the effort of

transforming and developing the educational sector of the country. Productive service delivery and performance outcomes are realized when these pivotal interventions are made available and timely.

Appendices M, N, O, P, R, S and T present the estimated population for each year of the projection period and including the classrooms and trained teachers required within the same periods and under 75 percent, 85 percent and 100 percent enrolment assumptions for basic education. Creche/Nursery and Kindergarten had a standard class size of 30 pupils per class while Primary and JHS had a standard class size of 35 pupils per class. These resulted in having the estimated number of classrooms and trained teachers to meet the standard class size of the population as 74,723, 84,686 and 99,630 classrooms and trained teachers under the three respective student enrolment assumptions in 2021 and increasing to 90,559, 102,634 and 120,745 by 2026 and subsequently at 96,146, 108,965 and 128,194 by 2031 for Creche/Nursery level of basic education.

Also, the classroom and trained teacher requirements for Kindergarten would be 39,547, 44,820 and 52,729 by 2026 under the three enrolment assumptions and 45,988, 52,120 and 61,317 by the year 2031. Again, for Primary school classroom and trained teacher requirements based on the estimated population of Primary school going age, under the same enrolment assumptions, 97,259, 110,227 and 129,679 would be needed by 2026 and 105,933, 120,057 and 141,244 by 2031.

For the Junior High School level, 46,833, 53,078 and 62,445 classrooms and trained teachers would be required while 48,810, 55,318 and 65,080 classrooms and trained teachers under the same enrolment assumptions by 2031.

4.9.1 Projected classrooms and trained teachers required for Secondary Education, 2021 – 2031

Appendices Q and V also estimated the population 15-17 years for secondary education as well as the classroom and trained teacher requirements based on the 75 percent, 85 percent and 100 percent pupil enrolment assumptions. Classrooms and trained teachers required by 2026 would be 51,659, 58,546 and 68,878 and respectively. By 2031, 56,620, 64,169 and 75,493 would be the estimated classroom and trained teacher requirements.

4.10 Discussion

Ghana's population growth trajectory evidenced in the Population and Housing Censuses have substantially modified the population structure, transitioning from one dominated by children (under 15 years) to one dominated by young people (15-35 years). This finding is similar to the population structure observed in Comoros, Kenya, Rwanda and Equatorial Guinea (Population Reference Bureau, 2022). The population momentum inherent in such a structure can have dire consequences for future population growth and size as well as the effect it has on other sectors of the Ghanaian economy in terms of development. Without substantial increase in economic growth, there would be insufficient fiscal investment required in meeting the cost of providing schools, hospitals, housing, etc. for the increasing population. Consequently, demographic variables including population size, growth, and its components of change (fertility, mortality, and migration), age-sex structure and spatial distribution are key factors of consideration in the realization of ensuring socio-economic development of a country.

Estimating the population of school-going age for Creche/Nursery and Kindergarten provides a useful benchmark for comparing enrolment figures and measuring progress in basic education provision. The findings from this study shows a fluctuation in enrolment for Creche/Nursery and Kindergarten in Ghana's basic education over the three academic years. The study's findings are consistent with Boadu's (1994) assertion that enrolment in basic schools in Ghana does not follow a stable trend. Rather, enrollment tends to fluctuate as policies and programmes in the education sector change too rapidly as a result of change in governance and policy direction. Thus, the fluctuation in enrolment for these levels suggests a need for a more consistent approach in policy implementation of basic education services in Ghana. The increase in enrolment for some years could be due to an increase in the number of children going to school. The cost of education for Creche/Nursery and the proximity of schools at all levels of basic education have been identified as factors that significantly influence the likelihood of pupils dropping out of school. Again, this finding reveals similar to Africa Education Watch's (2021) study in Zabzugu and Nkwanta South Districts at the JHS level of basic education in Ghana.

To achieve the goal of ensuring that the school-age population has access to basic and secondary education, it is necessary to address certain challenges such as a lack of sufficient schools and adequate classrooms, as well as adequate number of trained teachers. The effective implementation of policies aimed at increasing access to quality education and reducing the financial burden on parents by ensuring their children attend school, requires adequate allocation of financial resources. This study found that the number of pupils enrolled at each level in most cases outnumbered the available classrooms and in particular the number of trained teachers handling them. This finding is consistent with the African Education Watch's (2021) study, which found that two classes were merged into one classroom with only one teacher, leading to a negative

impact on the quality of education. The study conducted by the Africa Education Watch (2021) in the Zabzugu District in the Northern Region and Nkwanta South District in the Oti Region also revealed that 40 percent of the schools (55 public Primary and 17 JHS) had to adopt a multi-grade system of teaching due to physical infrastructure issues. The inadequate teacher-pupil ratio may hinder the teacher's ability to identify and address weaknesses in the pupils. This could impede the teacher's efforts in noticing such instances for the desired outcomes for the education sector. Possible reasons for the observed finding may include inadequate funding for education, inadequate planning, and management of resources to meet the growing population.

The study found that the gross enrolment rate for Creche/Nursery was consistently below 15 percent throughout the three academic years. The implication of this finding is that a large proportion of Ghanaian children are missing out on the benefits of early childhood education. Inadequate classrooms and trained teachers could also be other contributing factors to the low gross enrolment rates. Other plausible reasons for the low gross enrolment rate in Creche/Nursery could include lack of awareness about the importance of early childhood education and cultural beliefs that prioritize home care over formal schooling. The lack of access to early childhood education could potentially result in poor academic outcomes in later years and may widen the education gap between children from different socioeconomic backgrounds. Additionally, it may also limit future opportunities for economic and social development in Ghana, as early childhood education has been shown to have long-term positive effects on both cognitive and non-cognitive skills (Ritblatt et al., 2013).

In sharp contrast to the gross enrolment at the Creche/Nursery, the gross enrolment rate at the Kindergarten level was constantly above 100 percent over the three academic year periods. A reason for this outcome may be that students either entered school earlier or later than the expected

age range or are repeating classes at the Kindergarten level of education. A higher enrolment rate can be seen as a positive development in terms of access to education for children. However, it may also place additional pressure on the education system to provide adequate resources and infrastructure to support the increased student population.

The gross enrolment rate for Primary school was consistently above average throughout the three academic years of 2017/2018, 2018/2019, and 2019/2020. However, the GER for Junior High School (JHS) was below average for 2017/2018, above average for 2018/2019, and about average for 2019/2020. The fluctuation in GER for Junior High School (JHS) may have several implications and possible reasons. Firstly, a below-average GER for JHS in the 2017/2018 academic year could mean that fewer children were able to transition from Primary school to JHS due to factors such as lack of access to JHS, inadequate number of schools with JHS classrooms, or poor academic performance. The above-average GER in the 2018/2019 academic year may suggest that measures were taken to address the issues that led to the low GER in the previous academic year. However, the GER returning to about average in the 2019/2020 academic year could indicate that these measures were not sustained, or that new challenges emerged. It is also possible that demographic changes or fluctuations in population size and distribution could have influenced the GER for JHS. Further analysis of the specific factors contributing to the fluctuation in the GER for JHS would be necessary to fully understand its implications and possible reasons.

On the other hand, the gross enrolment rate for Senior High Schools (SHS) and TVET was found to be above average for the three-year period spanning from 2017/2018 to 2019/2020. Nonetheless, the pupil-classroom ratio (PCR) for the duration was realized not to adhere to the recommended standards of 30 pupils per class. Possible factors accounting for the low PCR at the SHS/TVET level could be the inadequacy of classrooms which was evident in the results over the three

academic years. There were more pupils in a class with the least number being 45 in the 2017/2018 academic year. The Free Senior High School policy implemented during the 2017/2018 academic year saw more year-on-year student enrolment against the existing infrastructure before the policy roll out as well as a slow pace of bridging the physical infrastructure gap at the SHS/TVET level.

The population projections for the age groups of school going at different levels of basic and secondary education as well as its corresponding projected classroom and trained teacher requirements constitute a major factor in the educational sector planning for basic and secondary education. This does estimate the extent of fiscal investment needed in meeting the student enrolment as the population grows and therefore the required classrooms and trained teachers as shown by the projections made, now and into the future. These projections do serve as a framework of guiding and influencing policy decisions aimed at directing the needed resources into basic and secondary education in Ghana. The policy of Free Senior High School being fraught with its challenges of adequate physical infrastructure, trained teacher requirement and needed resources would have been minimized if not prevented, by an informed projected number of students to be enrolled and catered for each year of the policy. This would have informed the expenditure required each year, thus, preparing adequately for successive students and even the source of funding needed for the roll out of the policy and its sustainability over the plan period.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study has investigated trends in Ghana's population growth and spatial distribution that have occurred from 1984 to 2021 and its relation to the availability of adequate classrooms and trained teachers. The study examined the implications rapid population growth has on basic and secondary education in Ghana. The general objective of the study was to assess the relationship between Ghana's population growth and the provision of adequate classrooms and trained teachers for basic and secondary education development. The sources of data for the population were from the 1984, 2000, 2010 and 2021 Population and Housing Censuses. The population from the 2021 PHC was used as the base year for projecting for the estimated population into 2031 and from which the school going age population for basic and secondary education were derived.

Data on educational statistics were obtained from the Education Management Information System (EMIS) of the Ministry of Education and these provided statistics on total, net and gross enrolments, number of classrooms, number of trained teachers and computed pupil-trained teacher and pupil-classroom ratios from 2017/2018 to 2019/2020 academic years. Also, the 2014 Demographic and Health Survey report was used in providing the total fertility rate (TFR) trend in Ghana for 1988, 1993, 1998, 2003, 2008 and 2014 as well as the Ghana's National Population Policy (2014 revised edition) TFR targets for 2024 and 2034 in assuming for the TFR during the projection horizon. The data presented in Table 4.15 suggested that the assumed population for Ghana by 2026 would be 34,292,864, 34,213,336 and 34,094,044 under the high, medium and low variant assumptions while 38,192,484, 37,884,144 and 37,421,628 under the same three assumptions of population growth by 2031. These assumptions were made about the components

of population change and upon which the projection of the population was made using the cohort component method because it portrayed a more realistic approach to estimating future rate of growth.

The medium variant of projecting Ghana's population was used in extracting for the ages 0 to 17 years which were estimated to be the school going age population for basic and secondary education in Ghana. The analysis of the educational statistics indicated that as the population grows, the school age population increases thereby resulting in a higher propensity for increased enrolments.

The pupil per trained teacher ratio revealed wide deficits at the various levels of basic education and disproportionate pupil per classroom ratio at the Secondary/TVET level of secondary education in Ghana following the assessment made from statistics for 2017/2018 to 2019/2020 academic years. This implies interventional measures by government in expenditure support for training of more teachers and provision of adequate classrooms in tandem with the population of school going age in ensuring desired outcomes are achieved, as the education sector is developed to meet required standards.

Based on the net enrolment rates, there would be the need for about 120,745 and 128,194 classrooms by 2026 and 2031 respectively for the Creche/Nursey level, 52,729 and 61,317 classrooms for Kindergarten by 2026 and 2031. For Primary school classroom requirement, 129,679 and 141,244 by 2026 and 2031, under 100 percent enrolment assumption while JHS would need 62,445 and 65,080 for the same period and enrolment assumption. For secondary education, 51,659, 58,546 and 68,878 classrooms and teachers would be required by 2026 and by 2031, 56,620, 64,169 and 75,493 would be the estimated classroom and trained teacher requirements.

The disparities in the educational facilities and teaching personnel in relation to the school going age population were realized from the three academic years analyzed and a need to bridge the deficits.

5.2 Conclusion

This study has demonstrated the impact high population growth is likely to have on the development of education in Ghana. The role of education, as an indispensable asset for human resource development, is well documented. Education is also widely acknowledged as a fundamental human right and a measure of development for many countries around the world (UNDP, 2019).

The increasing population of children of pre-tertiary schooling from 2021-2031 in the analyses through projections made of the population of pre-tertiary education, is a clear manifesting of how Ghana's population trend would be should the projection assumptions made hold. The rising enrolment levels, shortfalls in access to education, and inadequacies in available classrooms and trained teachers at specific levels of Ghana's basic and secondary school/TVET in the analyses made for the 2017/2018-2019/2020 academic years shows the deficits being witnessed. These deficits in access, personnel and infrastructure, do have dire consequences for pre-tertiary education sub-sector currently and into the future based on the projected pre-tertiary schooling aged children (0-17 years) for each year of the projection horizon (2021-2031). With these revelations made, it is evident that the growth of Ghana's population has put pressure on the limited physical infrastructure and human resource (trained teachers) demanded in ensuring conducive and quality education for pre-tertiary schooling. This would ensure adequate preparedness and

provision of adequate number of schools, teaching personnel and the physical infrastructure requirements into the future.

As education occupies a transformative position in the economy of the country, politicians and policy makers cannot afford to neglect demographic variables including population growth, size and spatial distribution in planning for the education sector. Consequently, the state should aim at improving economic growth and control the rate of the population increasing to ensure the desired economic growth is attained.

Under these circumstances, it calls for the slow growth of the population through concerted sensitization on planning family size. This would be a contributory factor for increased economic growth for a more stable means of saving and investing adequately into Ghana's education sector.

It is also worthy of note of the possible limitation of the study, and this is realized in the projected population of Ghana's pre-tertiary education children. The study sets the ages 0-17 years as the standard ages for children of school-going age for basic and secondary/TVET education. However, there are possible cases of early entry or late entry and/or class repetitions of pupils at each level of the basic and secondary education which cannot be accounted for in the projected school age population of each year of the projection horizon. Nonetheless, since the population of pre-tertiary schooling level may not be large, its effect on the results may be minimal.

5.3 Recommendations

The rate of growth of the population has adverse implications for Ghana's educational development. The available classrooms and trained teachers require some more fiscal investments in building more classrooms and supporting the training of more teachers in the country. The inequality gap in accessing quality education through the unavailability of schools in closer proximity to residential structures of learners; not more than more than 3km away from an educational facility for basic education, needs to be bridged in ensuring higher attendance, retention, and higher academic performances. The spatial distribution of the population of school going age for basic and secondary education as projected under the medium variant over the projection horizon should serve as a yardstick in estimating the number of pupils for pre-tertiary education each year and so make adequate provision for classrooms, trained teachers and other teaching and learning materials like textbooks needed in making teaching and learning better and achieving desired outcomes.

Furthermore, the Ministry of Education through the Ghana Education Service must rationalize their deployment of trained teachers equitably to every part of Ghana and re-posting trained teachers that are of surplus to manpower requirement to where they are short in supply and based on the number of pupils at each level of basic and secondary education requirement. In doing so meeting the standard pupil-trained teacher ratio stemming from the annual population projections made.

Thus, it is also recommended for the Ministry of Education through Ghana Education Service to develop an effective and equitable system for distributing teaching and learning materials. The transition rate from Primary to JHS would be higher with the availability of schools with JHS classrooms without having students commute longer distances to other communities to access

Junior High School education. This will enhance high school attendance, retention and effective teaching and learning outcomes.

This study provides valuable information on estimated population for secondary education in Ghana towards the continuous implementation of the Free Senior High School and Technical and Vocational Education and Training policies. The inadequacies in the number of teachers, infrastructure and funding should be addressed in sustaining the policy. The tax net should be widened to support the oil fund currently funding the Free Senior High School Policy. This will give the expenditure per student and teachers as well as for other teaching and learning materials like textbooks and furniture. Consequently, assessment of the policy could see revision in the policy for its sustenance and achieving its objective of taking out the element of cost as a barrier to education.

There should be a continuous effort to slow down the birth rate as this would lead to increased saving capacity and to invest in the development of the economy. It is estimated that one percent of growth in population requires about 3-4 percent growth in the economy to maintain present standard of living (Ghana Statistical Service, 2005). When the economic status of the citizens is improved, it will inform their decisions to opt for smaller family sizes. There should also be concerted action in expanding access to family planning services and utilization. There should be efforts made in changing the social and individual behaviour of people in addressing issues surrounding myths and stigma on the side effects of using family planning methods. This would be geared towards improving family planning acceptability rate which goes a long way in preventing unwanted pregnancies. Again, the education on the need to plan family sizes and contraceptive methods available and usage must not be limited to women only but to include men too. This would also impact in a decline of cultural myths around contraceptive utilization.

There should be more private venture investments in the provision of education and improved proportions of physical infrastructure at all levels of basic and secondary education to reduce the burden on government's expenditure in the education sector.

REFERENCES

Abukari, Z., Kuyini, A. B., & Kuyini Mohammed, A. (2015). *Education and health care policies in Ghana: examining the prospects and challenges of recent provisions. Sage Open, 5*(4), 2158244015611454.

Addo, P. K. (2019). Review of Ghana's educational policies and its implication for educational leadership in developing countries. *International Journal of Psychology and Education (IJOPE), 2*.

Africa Education Watch (2021). *A study into the extent of deprivation in basic schools in deprived areas and its impact on learning outcomes*. Africa Education Watch, Accra, Ghana (pp. 5-16)

Akyeampong, K., Djangmah, J., Oduro, A., Seidu, A., & Hunt, F. (2007). Access to basic education in Ghana: The evidence and the issues. *CREATE Country Analytic Review*.

Amedorme, S. K., & Fiagbe, Y. A. (2013). Challenges facing technical and vocational education in Ghana. *Cell*, *233*, 244833980.

Ampratwum, E., & Armah-Attoh, D. (2010). Tracking capitation grant in public primary schools in Ghana. *Ghana Center for Democratic Development. Briefing Paper*, *10*(1), 1-8.

Andoh and Mensah (2022). *Why Ghana needs to reduce population growth rate to a sustainable level.* Press briefing by the Executive Director of National Population Council. Accessed on 8th November, 2022. Retrieved from: https://www.graphic.com.gh/news/general-news/reduce-population-growth-rate-to-a-sustainable-level

Angko, W., Arthur, E., & Yussif, H. M. (2022). Fertility among women in Ghana: Do child mortality and education matter? *Scientific African*, e01142.

Armah, P. H. (2017). Overview And Challenges of Ghana' s Education System: how to fix it. *Reforming Ghana's Educational System Retreat organized by The Institute of Economics Affairs under the Youth Capacity Building Initiative, held at Birdrock Hotel, Animabo.*

Ashford, H. (2020). Population Control, Development, And Ghana's National Family Planning Programme, 1960–1972. *The Historical Journal*, *63*(2), 469-493

Barakat, B., & Hossain, Z. (2019). The relationship between education and demographic transition in Sub-Saharan Africa. *International Journal of Population Studies, 5(2)*, 43-58. https://doi.org/10.18063/IJPS.2019.02.004

Birchall, J. (2018). Early marriage, pregnancy and girl child school dropout.

Birdsall, N. (1977). Analytical approaches to the relationship of population growth and development. *Population and development Review*, 63-102.

Bloom, D., Canning, D., & Sevilla, J. (2003). *The demographic dividend: A new perspective on the economic consequences of population change.* Rand Corporation.

Boadu, A. E. (1994). Rapid Population Growth and Development in Ghana. *Department of Geography and Resource Development, University of Ghana, Accra*. https://doi.org/10.1080/00033799300200371

Bremner, J. (2014). Understanding population projections: assumptions behind the numbers. *Population Reference Bureau*.

Cohen, P. (2013). Let's not panic over women with more education having fewer kids. *The Atlantic.*

Constitution of the Republic of Ghana (1992). art. IV

Constitution of the Republic of Ghana (1992). art. XXXIX, cl. 2

Dewees, S., & Earthman, G. (2000). Trends and Issues Affecting School Facilities in Rural America: Challenges and Opportunities for Action.

Diagne, A. (2006). Investing in people: Education and health. In *African Development Bank Seminar-African Economic Research Consortium, Tunis, Tunisia* (pp. 22-24).

Du Guerny, J. (1995). Population and Development. *Nação e Defesa*.

Duah, R. K., Gyabaah, K. O. Y., Mensah, B., Poku, A. A., & Damte, F. K. (2023). Effects of Increasing Student Enrollment on Teaching and Learning in Senior High Schools in Ghana: The Free Senior High School Policy in Retrospection. *Social Education Research*, 227-239.

Easterlin, R. A. (1967). Effects of population growth on the economic development of developing countries. *The Annals of the American Academy of Political and Social Science, 369(1),* 98-108.

ESCAP, U. (2020). ESCAP population data sheet 2020. Retrieved on 28th March, 2023 from https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=population+data+sheet&btnG=

Finkle, J. L., & Crane, B. B. (1975). The politics of Bucharest: Population, development, and the new international economic order. *Population and Development Review*, 87-114.

Ghana Statistical Service (2005). *2000 Population Data Analysis Report, Vol. 1: Socio-economic and Demographic Trends Analysis* Accra: Ghana Statistical Service

Ghana Statistical Service (2012). *2010 Population and Housing Census: Summary Report of Final Results* Accra: Ghana Statistical Service.

Ghana Statistical Service (2015). Ghana Demographic and Health Survey Summary Report.

Ghana Statistical Service (2021). 2021 *Population and Housing Census: General Reports. Volumes 3A, 3B, 3D & 3H.* Retrieved from: https://census2021.statsghana.gov.gh

Gomda, A., Sulemana, N., & Zakaria, H. (2022). Access to Education for Persons with Disabilities in Ghana: A Review. *Environmental Sciences Proceedings*, 15(1), 50.

Government of Ghana. (1994). National Population Policy (Revised Edition, 1994). National Population Council, Accra, Ghana.

Grant, C. (2017). The contribution of education to economic growth.

Gu, D., Andreev, K., & Dupre, M. E. (2021). Major trends in population growth around the world. *China CDC weekly*, *3*(28), 604

Habitat, U.N. (2022). World Cities Report: Envisaging the Future of Cities.

Hanushek, E. A. (2011). The economic value of higher teacher quality. *Economics of Education Review*, *30*(3), 466–479. https://doi.org/10.1016/j.econedurev.2010.12.006

http://projects.worldbank.org/P165557/?lang=en&tab=documents&subTab=projectDocument

Kwankye, S. O., & Cofie, E. (2015). Ghana's population policy implementation: Past, present and future. *African Population Studies*, *29*(2).

Kyei-Nuamah, David., & Andrews, L. (2022). Free Senior High School Policy in Ghana: Implementation and Outcomes against Policy Purposes. *International Journal of Trend in Scientific Research and Development*, *6*(6), 1207-1222.

Lee, B. X., Kjaerulf, F., Turner, S., Cohen, L., Donnelly, P. D., Muggah, R., ... & Gilligan, J. (2016). Transforming our world: implementing the 2030 agenda through sustainable development goal indicators. *Journal of public health policy*, *37*, 13-31.

Lundquist, J. H., Anderton, D. L., & Yaukey, D. (2015). *Demography: The Study of Human Population (4th Edition)*. Waveland Press, Inc. Illinois, USA.

Mberu, B. U., & Ezeh, A. C. (2017). The Population Factor and Economic Growth and Development in Sub-Saharan African Countries. *African Population Studies*, *31*(2). http://aps.journals.ac.za/pub/article/view/1056/803

McIntosh, C. A., & Finkle, J. L. (1995). The Cairo conference on population and development: A new paradigm? Population and development review, 223 – 260.

Mills, M., Rindfuss R.R., McDonald, P., The Verde, E. & ESHRE Reproduction and Society Task Force (2011). Why do people postpone parenthood? Reasons and social policy incentives. *Human reproduction update, 17 (6),* 848-860.

Ministry of Education. (2012). Education Strategic Plan 2010 to 2020: Volume 1 Policies, Strategies, Delivery, Finance.

Ministry of Education. (2015). Inclusive Education Policy. *Policy Document*, 1-46

Ministry of Education. (2018). *Education Management Information System Report*. Accessed on 10th September 2022. Retrieved from https://africaeducationwatch.org.

Ministry of Education. (2018). *Education Sector Analysis Report.*

Ministry of Education. (2019). *Education Management Information System Report*. Accessed on 10th September 2022. Retrieved from https://africaeducationwatch.org.

Ministry of Education. (2019). *Education Sector Performance Report.*

Ministry of Education. (2020). *Education Management Information System Report*. Accessed on 10th September 2022. Retrieved from https://africaeducationwatch.org.

Murray, S. (2015). How education can moderate population growth. Retrieved from https://www.weforum.org>2015/07.

National Population Council. (2018). *GHANA RAPID 2017 Population and Development Effective Population Management for Better Quality of Life National Population Council*.

Phang, H., & Mason, A. (2008). Demographic dividend and labor force transformations in Asia: The case of the Republic of Korea. *Demographic dividend: Concepts and experiences*, 59-90.

Population Reference Bureau (2020), *2020 World Population Data Sheet* New York, Population Reference Bureau.

Population Reference Bureau (2021), *2021 World Population Data Sheet* New York, Population Reference Bureau.

Population Reference Bureau (2022), *2022 World Population Data Sheet* New York, Population Reference Bureau.

Ritblatt, S. N., Garrity, S., Longstreth, S., Hokoda, A., & Potter, N. (2013). Early care and education matters: A conceptual model for early childhood teacher preparation integrating the key constructs of knowledge, reflection, and practice. *Journal of Early Childhood Teacher Education*, *34*(1), 46-62.

Schneider, U. A., Havlík, P., Schmid, E., Valin, H., Mosnier, A., Obersteiner, M., ... & Fritz, S. (2011). Impacts of population growth, economic development, and technical change on global food production and consumption. *Agricultural Systems*, *104(2)*, 204-215.

Sciiultz, T. P. (1988). Expansion of public school expenditures and enrollments: intercountry evidence on the effects of income, prices, and population growth. *Economics of education review*, *7*(2), 167-183.

Shryock, H. S., Siegel, J. S., & Larmon, E. A. (1975). *The methods and materials of demography* (Vol. 2). US Bureau of the Census.

Talpur, M. A. H., Napiah, M., Chandio, I. A., & Memon, I. A. (2014). Analyzing Public Sector Education Facilities: A Step Further towards Accessible Basic Education Institutions in Destitute Subregions. *International Education Studies*, *7*(4), 110-119.

UNDP, U. (2019). Population Growth: Implications for Human Development. Volume 6, Issue 1.

United Nations Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022: Summary of Results.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2019). Global education monitoring report 2019: Migration, displacement and education: Building bridges, not walls.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2016). Global Education Monitoring Report Summary 2016: Education for People and Planet: Creating Sustainable Futures for All.

United Nations Population Fund (2022). *National Population Council and UNFPA Ghana commence celebration of World Population Day 2022 with Press Briefing.* Accessed on 8th November 2022. Retrieved from: https://ghana.unfpa.org/en/news/national-population-council-and-unfpa-ghana-commence-celebration-world-population-day-2022

Wako, H. (2012). Demographic changes and economic development: Application of the vector error correction model (VECM) to the case of Ethiopia.

Weeks, J. R. (2020). *Population: An introduction to concepts and issues*. Cengage Learning

Wilmoth, M. J., Menozzi, M. C., & Bassarsky, M. L. (2022). Why population growth matters for sustainable development.

World Bank Group. (2017). *World Development Report 2018: Learning to Realize Education's Promise*.

World Bank. (2018). Ghana Accountability for Learning Outcomes Project (P165557)

World Bank. (2021). The World Bank in Ghana: Overview. Accessed on 28th March 2023. Retrieved from https://www.worldbank.org/en/country/ghana/overview.

APPENDICES
APPENDIX A

Age Group	Males	Females	Sex Ratio	Absolute Difference between Successive Sex Ratio	Age Ratio (Males)	Absolute Difference of Age Ratio from 100	Age Ratio (Females)	Absolute Difference of Age Ratio from 100
0 - 4	1,912,807	1,860,916	102.7884655					
5 - 9	1,904,253	1,840,757	103.4494504	0.660984951	105.03	5.03	104.60	4.6
10 - 14	1713157	1,658,563	103.2916446	0.157805782	96.31	3.69	94.8	5.2
15 - 19	1,653,241	1,658,205	99.70064015	3.591004485	104.77	4.77	104.91	4.91
20 - 24	1,442,802	1,502,735	96.0117386	3.688901553	98.98	1.02	99.51	0.49
25 - 29	1,262,118	1,362,184	92.65400269	3.357735907	96.88	3.12	99.91	0.09
30 - 34	1,162,621	1,224,094	94.97808175	2.324079059	102.78	2.78	101.75	1.75
35 - 39	1,000,131	1,043,907	95.80652299	0.828441246	101.82	1.82	102.97	2.97
40 - 44	802,432	803,471	99.87068606	4.064163066	97.99	2.01	96.01	3.99
45 - 49	637,581	629,887	101.2214889	1.350802873	98.71	1.29	95.02	4.98
50 - 54	489,431	522,295	93.70777051	7.513718421	98.32	1.68	101.96	1.96
55 - 59	358,036	394,659	90.72034339	2.987427128	89.51	10.49	89.6	10.4
60 - 64	310,566	358,625	86.59909376	4.121249624	110.22	10.22	114.4	14.4
65 - 69	205,496	232,291	88.46489963	1.865805869				
70+	345,769	538,990	64.1511					
		Total for Sex Ratio (from age groups 5 – 9 to 65 - 69 years)		36.51212	**Totals for absolute differences of Age Ratios**	47.92		55.74
		Average Totals for Sex Ratio Score (for 13 values)		**2.809** (Sex Ratio Score)	**Average Totals for Age Ratio Score**	**3.993** (Male Age Ratio Score)		**4.645** (FARS)
UN Joint Score/ Age Accuracy Index computed 3*(Sex Ratio Score) + Male Age Ratio Score + Female Age Ratio Score (FARS)= **17.065**								

Computing Sex Ratio Score

Sex Ratio = (Male): $\frac{{}_5M_x}{{}_5F_x} * 100$ (Female): $\frac{{}_5F_x}{{}_5M_x} * 100$

where ${}_5M_x$ = Number of males enumerated in a specific age group

${}_5F_x$ = Number of females enumerated in a specific age group

Sex Ratio Score = total of the absolute difference between successive age sex ratios (separately for males and females excluding the first age group, 0 – 4 years and the open-ended age group + 70 years)

Computing Male and Female Age Ratios for 5-year Age groupings

Male Age Ratios: $\frac{P_{(i)}}{0.5\,(P_{(i-5)} + P_{(i+5)})} * 100$ where, P= The population in a specific age group

(i) = a specific age group,

$P_{(i-5)}$ = an age group preceding the specific age group of which the age ratio is being computed

$P_{(i+5)}$ = a succeeding age group

Female Age Ratios: $\frac{P_{(i)}}{0.5\,(P_{(i-5)} + P_{(i+5)})} * 100$

Male/Female Age Ratio Scores = $\frac{\sum|\text{Male/Female}_{(i)}\ \text{Age Ratio}|}{\text{Number of deviations of 13 age groups } (5-9 \text{ to } 65-69 \text{ years})}$

Interpretation of UN Joint Score Indexes

Index score below 20: Date are accurate.

Index score 20 to 40: Data are usable with adjustments.

Index score above 40: Data are highly inaccurate.

APPENDIX B

Computing Gross Enrolment Rate (GER)

$$GER = \frac{\text{Total number of students enrolled in a specific level of basic or secondary education regardless of age}}{\text{Population of the age group which officially corresponds to each specific level of basic or secondary education}} * 100$$

APPENDIX C

Computing Pupil-Classroom Ratio (PCR) / Pupil-Trained Teacher Ratio (PTTR)

$$PCR = \frac{\text{Total number of students enrolled at a given specific level of basic or secondary education regardless of age}}{\text{Number of classrooms}}.$$

$$PTTR = \frac{\text{Total number of students enrolled at a given specific level of basic or secondary education regardless of age}}{\text{Number of full-time trained teachers at that level}}.$$

APPENDIX D

Projected Total Population of Ghana, 2021 – 2031 (High Variant)

Year / Age Groups (years)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0 – 4	3,773,723	3,861,073	3,982,170	4,135,594	4,343,121	4,567,222	4,655,202	4,741,454	4,828,389	4,915,773	5,001,371
5 – 9	3,745,010	3,820,910	3,836,551	3,835,442	3,783,142	3,724,079	3,810,378	3,931,012	4,084,014	4,290,777	4,514,126
10 – 14	3,371,720	3,435,905	3,518,695	3,568,285	3,671,852	3,716,788	3,792,858	3,809,119	3,808,756	3,757,544	3,699,520
15 – 19	3,311,446	3,314,026	3,290,287	3,329,534	3,314,809	3,347,496	3,411,757	3,494,610	3,544,551	3,647,992	3,693,239
20 – 24	2,945,537	3,078,574	3,222,525	3,313,412	3,285,486	3,273,998	3,277,313	3,254,744	3,294,473	3,280,720	3,314,018
25 – 29	2,624,302	2,629,227	2,606,803	2,657,528	2,813,002	2,904,899	3,036,952	3,179,924	3,270,553	3,243,963	3,233,558
30 – 34	2,386,715	2,453,688	2,578,514	2,584,259	2,567,861	2,585,370	2,590,842	2,569,491	2,620,222	2,774,371	2,865,896
35 – 39	2,044,038	2,113,740	2,092,955	2,199,875	2,301,042	2,346,502	2,412,829	2,536,220	2,542,535	2,527,181	2,545,297
40 – 44	1,605,903	1,684,509	1,826,727	1,854,632	1,905,754	2,002,093	2,070,529	2,050,711	2,156,043	2,255,997	2,301,646
45 – 49	1,267,468	1,284,631	1,312,000	1,418,878	1,498,611	1,563,949	1,640,517	1,779,487	1,807,161	1,857,684	1,952,631
50 – 54	1,011,726	1,058,826	1,112,542	1,120,716	1,164,329	1,221,869	1,238,299	1,264,974	1,368,384	1,446,146	1,510,639
55 – 59	752,695	775,958	795,516	845,104	884,420	958,857	1,003,254	1,054,314	1,062,126	1,104,241	1,160,266
60 – 64	669,191	649,565	665,028	677,653	694,259	692,241	713,338	731,661	777,680	815,109	885,377
65 – 69	437,787	476,901	493,382	509,830	548,219	584,356	567,120	580,744	591,366	607,185	607,586
70 -74	334,000	334,447	342,778	344,895	341,236	349,469	381,175	394,448	406,970	438,260	469,632
75 – 79	213,169	207,696	202,874	206,520	212,544	227,588	226,704	231,887	232,562	230,962	240,048
80+	337,589	302,126	274,902	246,131	232,868	226,087	209,790	197,723	188,794	189,255	197,632
Total	**30,832,019**	**31,481,802**	**32,154,248**	**32,848,288**	**33,562,556**	**34,292,864**	**35,038,856**	**35,802,520**	**36,584,580**	**37,383,160**	**38,192,484**

APPENDIX E

Projected Total Population of Ghana, 2021 – 2031 (Low Variant)

Year / Age Groups (years)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0 – 4	3,773,723	3,848,430	3,943,773	4,057,859	4,212,014	4,368,404	4,386,272	4,399,918	4,411,587	4,421,125	4,426783
5 – 9	3,745,010	3,820,910	3,836,550	3,835,442	3,783,142	3,794,079	3,797,971	3,893,253	4,007,447	4,161,481	4,317,861
10 – 14	3,371,720	3,435,905	3,518,695	3,568,285	3,671,852	3,716,788	3,792,859	3,809,119	3,808,756	3,757,544	3,699,520
15 – 19	3,311,446	3,314,026	3,290,287	3,329,534	3,314,809	3,347,496	3,411,757	3,494,610	3,544,551	3,647,992	3,693,240
20 – 24	2,945,537	3,078,574	3,222,525	3,313,412	3,285,486	3,273,998	3,277,313	3,254,744	3,294,473	3,280,720	3,314,017
25 – 29	2,624,302	2,629,227	2,606,803	2,657,528	2,813,002	2,904,899	3,036,952	3,179,924	3,270,553	3,243,962	3,233,558
30 – 34	2,386,715	2,453,688	2,578,514	2,584,259	2,567,861	2,585,370	2,590,842	2,569,491	2,620,222	2,774,371	2,865,896
35 - 39	2,044,038	2,113,740	2,092,955	2,199,875	2,301,042	2,346,502	2,412,829	2,536,220	2,542,534	2,527,180	2,545,297
40 – 44	1,605,903	1,684,509	1,826,727	1,854,632	1,905,754	2,002,093	2,070,529	2,050,711	2,156,044	2,255,997	2,301,646
45 – 49	1,267,468	1,284,631	1,312,000	1,418,878	1,498,611	1,563,948	1,640,517	1,779,487	1,807,161	1,857,683	1,952,631
50 – 54	1,011,726	1,058,826	1,112,542	1,120,716	1,164,329	1,221,870	1,238,299	1,264,974	1,368,384	1,446,146	1,510,639
55 – 59	752,695	775,958	795,516	845,104	884,420	958,857	1,003,254	1,054,314	1,062,126	1,104,241	1,160,266
60 – 64	669,191	649,565	665,028	677,653	694,259	692,241	713,338	731,661	777,680	815,109	885,377
65 – 69	437,787	476,901	493,382	509,830	548,219	584,356	567,120	580,744	591,366	607,185	607,586
70 -74	334,000	334,447	342,778	344,895	341,236	349,469	381,175	394,448	406,970	438,260	469,632
75 – 79	213,169	207,696	202,874	206,520	212,544	227,588	226,704	231,887	232,562	230,962	240,048
80+	337,589	302,126	274,902	246,131	232,868	226,087	209,790	197,723	188,794	189,255	197,632
Total	**30,832,019**	**31,469,158**	**32,115,852**	**32,770,552**	**33,431,448**	**34,094,044**	**34,757,520**	**35,423,224**	**36,091,208**	**36,759,216**	**37,421,628**

APPENDIX F

Projected Male Population of Ghana by Age Groups, 2021 – 2031 (Medium Variant)

Year / Age Groups (years)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0 – 4	1,912,807	1,955,624	2,014,702	2,087,434	2,184,386	2,288,062	2,318,646	2,347,838	2,405,530	2,405,530	2,432,879
5 – 9	1,904,253	1,942,460	1,951,565	1,948,324	1,919,973	1,886,996	1,929,044	1,987,754	2,060,227	2,156,830	2,260,199
10 – 14	1,713,157	1,749,771	1,792,311	1,816,903	1,869,471	1,891,082	1,929,294	1,938,614	1,935,664	1,907,760	1,875,223
15 – 19	1,653,241	1,657,415	1,650,936	1,678,900	1,680,690	1,701,211	1,737,775	1,780,272	1,804,984	1,857,430	1,879,145
20 – 24	1,442,802	1,517,881	1,595,622	1,648,867	1,634,822	1,634,370	1,638,802	1,632,783	1,660,834	1,662,936	1,683,661
25 – 29	1,262,118	1,265,067	1,258,101	1,283,973	1,369,708	1,422,390	1,496,804	1,573,907	1,626,862	1,613,418	1,613,367
30 – 34	1,162,621	1,191,230	1,249,715	1,249,311	1,232,743	1,243,284	1,246,425	1,239,863	1,265,648	1,350,530	1,402,868
35 - 39	1,000,131	1,035,280	1,023,952	1,078,422	1,129,243	1,142,324	1,170,629	1,228,360	1,228,237	1,212,280	1,223,037
40 – 44	802,432	838,866	904,554	908,129	930,047	978,101	1,012,489	1,001,639	1,055,169	1,105,301	1,118,661
45 – 49	637,581	644,202	658,161	714,107	752,736	778,584	813,846	877,761	881,432	903,099	950,397
50 – 54	489,431	515,619	541,411	547,596	572,390	610,834	617,023	630,482	684,291	721,782	747,378
55 – 59	358,036	367,382	377,652	401,904	422,303	459,324	483,738	507,961	513,807	537,554	574,591
60 – 64	310,566	300,941	307,679	315,080	324,037	324,765	333,050	342,531	364,783	383,975	418,438
65 – 69	205,496	223,001	229,513	235,002	251,768	266,656	258,391	264,238	270,450	278,800	280,368
70 -74	149,255	150,489	154,643	156,726	155,520	160,848	174,806	179,922	183,918	197,327	210,002
75 – 79	86,379	85,665	85,399	88,256	92,602	98,985	99,381	102,004	103,114	102,710	107,596
80+	110,134	99,943	92,350	83,418	80,063	78,971	74,949	72,336	70,422	72,156	75,878
Total	**15,200,440**	**15,540,836**	**15,888,266**	**16,242,352**	**16,602,502**	**16,966,787**	**17,335,092**	**17,708,265**	**18,115,372**	**18,469,418**	**18,853,688**

APPENDIX G

Projected Female Population of Ghana by Age Groups, 2021 – 2031 (Medium Variant)

Year / Age Groups (years)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0 – 4	1,860,916	1,900,392	1,952,109	2,017,065	2,106,292	2,199,633	2,228,984	2,257,002	2,284,833	2,312,384	2,338657
5 – 9	1,840,757	1,878,450	1,884,986	1,887,118	1,863,168	1,837,083	1,876,372	1,928,155	1,993,160	2,082,229	2,175,421
10 – 14	1,658,563	1,686,135	1,726,384	1,751,382	1,802,381	1,825,706	1,863,565	1,870,505	1,873,092	1,849,783	1,824,296
15 – 19	1,658,205	1,656,611	1,639,351	1,650,634	1,634,118	1,646,285	1,673,982	1,714,338	1,739,567	1,790,563	1,814,094
20 – 24	1,502,735	1,560,693	1,626,903	1,664,545	1,650,664	1,639,628	1,638,511	1,621,961	1,633,639	1,617,784	1,630,356
25 – 29	1,362,184	1,364,160	1,348,702	1,373,555	1,443,294	1,482,509	1,540,148	1,606,017	1,643,690	1,630,545	1,620,190
30 – 34	1,224,094	1,262,458	1,328,799	1,334,947	1,335,118	1,342,086	1,344,418	1,329,628	1,354,574	1,423,841	1,463,028
35 - 39	1,043,907	1,078,460	1,069,002	1,121,453	1,171,799	1,204,178	1,242,200	1,307,860	1,314,297	1,314,900	1,322,260
40 – 44	803,471	845,643	922,173	946,503	975,707	1,023,992	1,058,040	1,049,072	1,100,875	1,150,696	1,182,985
45 – 49	629,887	640,429	653,839	704,771	745,875	785,364	826,671	901,726	925,729	954,584	1,002,234
50 – 54	522,295	543,207	571,131	573,120	591,939	611,036	621,276	634,492	684,093	724,364	763,261
55 – 59	394,659	408,576	417,864	443,200	462,117	499,533	519,516	546,353	548,319	566,687	585,675
60 – 64	358,625	348,624	357,349	362,573	370,222	367,476	380,288	389,130	412,897	431,134	466,939
65 – 69	232,291	253,900	263,869	274,828	296,451	317,700	308,729	316,506	320,916	328,385	327,218
70 -74	184,745	183,958	188,135	188,169	185,716	188,621	206,369	214,526	223,052	240,933	259,630
75 – 79	126,790	122,031	117,475	118,264	119,942	128,603	127,323	129,883	129,448	128,252	132,452
80+	227,455	202,183	182,552	162,713	152,805	147,116	134,841	125,387	118,372	117,099	121,754
Total	**15,631,579**	**15,935,910**	**16,250,623**	**16,574,840**	**16,907,608**	**17,246,549**	**17,591,233**	**17,942,541**	**18,300,553**	**18,664,163**	**19,030,450**

APPENDIX H

Projected Creche/Nursery Enrolments, 2021 – 2031 (Medium Variant)

Year	Total Population (0 – 3 years)			75% Enrolment Assumption			85% Enrolment Assumption			100% Enrolment Assumption		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
2021	1,513,722	1,475,191	2,988,913	1,135,292	1,106,393	2,241,685	1,286,664	1,253,912	2,540,576	1,513,722	1,475,191	2,988,913
2022	1,565,966	1,520,194	3,086,160	1,174,475	1,140,145	2,314,620	1,331,071	1,292,165	2,623,236	1,565,966	1,520,194	3,086,160
2023	1,632,095	1,578,714	3,210,809	1,224,071	1,184,036	2,408,107	1,387,281	1,341,907	2,729,188	1,632,095	1,578,714	3,210,809
2024	1,722,937	1,662,008	3,384,945	1,292,203	1,246,506	2,538,709	1,464,496	1,412,707	2,877,203	1,722,937	1,662,008	3,384,945
2025	1,821,839	1,750,724	3,572,563	1,366,379	1,313,043	2,679,422	1,548,563	1,488,115	3,036,678	1,821,839	1,750,724	3,572,563
2026	1,847,253	1,775,107	3,622,360	1,385,440	1,331,330	2,716,770	1,570,165	1,508,841	3,079,006	1,847,253	1,775,107	3,622,360
2027	1,870,390	1,797,308	3,667,698	1,402,793	1,347,981	2,750,774	1,589,832	1,527,712	3,117,544	1,870,390	1,797,308	3,667,698
2028	1,892,684	1,818,698	3,711,382	1,419,513	1,364,024	2,783,537	1,608,781	1,545,893	3,154,674	1,892,684	1,818,698	3,711,382
2029	1,915,368	1,840,466	3,755,834	1,436,526	1,380,350	2,816,876	1,628,063	1,564,396	3,192,459	1,915,368	1,840,466	3,755,834
2030	1,939,101	1,863,252	3,802,353	1,454,326	1,397,439	2,851,765	1,648,236	1,583,764	3,232,000	1,939,101	1,863,252	3,802,353
2031	1,961,278	1,802,914	3,845,832	1,135,292	1,106,393	2,884,374	1,286,664	1,253,912	2,540,576	1,961,278	1,802,914	3,845,832

APPENDIX I

Projected Kindergarten Enrolments, 2021 – 2031 (Medium Variant)

Year	Total Population (4 – 5 years)			75% Enrolment Assumption			85% Enrolment Assumption			100% Enrolment Assumption		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
2021	794,056	766,942	1,560,998	595,542	575207	1,170,749	674,947	651901	1,326,848	794,056	766,942	1,560,998
2022	787,800	764,967	1,552,767	590,850	573725	1,164,575	669,630	650222	1,319,852	787,800	764,967	1,552,767
2023	771,361	752,674	1,524,035	578,521	564506	1,143,026	655,657	639773	1,295,430	771,361	752,674	1,524,035
2024	746,234	727,574	1,473,808	559,676	545681	1,105,357	634,299	618438	1,252,737	746,234	727,574	1,473,808
2025	726,231	709,814	1,436,045	544,673	532361	1,077,034	617,296	603342	1,220,638	726,231	709,814	1,436,045
2026	802,565	779,306	1,581,871	601,923	584480	1,186,403	682,180	662410	1,344,590	802,565	779,306	1,581,871
2027	888,129	855,292	1,743,421	666,097	641469	1,307,566	754,910	726998	1,481,908	888,129	855,292	1,743,421
2028	902,481	869,086	1,771,567	676,861	651814	1,328,675	767,109	738723	1,505,832	902,481	869,086	1,771,567
2029	915,699	881,793	1,797,492	686,774	661345	1,348,119	778,344	749524	1,527,868	915,699	881,793	1,797,492
2030	926,982	892,637	1,819,619	695,237	669477	1,364,714	787,935	758741	1,546,676	926,982	892,637	1,819,619
2031	937,126	902,389	1,839,515	702,845	676792	1,379,636	796,557	767031	1,563,588	937,126	902,389	1,839,515

APPENDIX J

Projected Primary School Enrolments, 2021 – 2031 (Medium Variant)

Year	Total Population (6 – 11 years)			75% Enrolment Assumption			85% Enrolment Assumption			100% Enrolment Assumption		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
2021	2,215,173	2,136,405	4,351,578	1,661,380	1,602,304	3,263,684	1,882,897	1,815,944	3,698,841	2,215,173	2,136,405	4,351,578
2022	2,270,603	2,190,190	4,460,793	1,702,952	1,642,643	3,345,595	1,930,013	1,861,662	3,791,675	2,270,603	2,190,190	4,460,793
2023	2,295,336	2,216,957	4,512,293	1,721,502	1662718	3,384,220	1,951,036	1,884,413	3,835,449	2,295,336	2,216,957	4,512,293
2024	2,324,183	2,249,275	4,573,458	1,743,137	1,686,956	3,430,093	1,975,556	1,911,884	3,887,440	2,324,183	2,249,275	4,573,458
2025	2,326,403	2,249,293	4,575,696	1,744,802	1,686,970	3,431,772	1,977,443	1,911,899	3,889,342	2,326,403	2,249,293	4,575,696
2026	2,305,308	2,233,462	4,538,770	1,728,981	1,675,097	3,404,078	1,959,512	1,898,443	3,857,955	2,305,308	2,233,462	4,538,770
2027	2,275,268	2,210,408	4,485,676	1,706,451	1,657,806	3,364,257	1,933,978	1,878,847	3,812,825	2,275,268	2,210,408	4,485,676
2028	2,320,490	2,208,351	4,528,841	1,740,368	1,656,263	3,396,631	1,972,417	1,877,098	3,849,515	2,320,490	2,208,351	4,528,841
2029	2,369,927	2,299,836	4,669,763	1,777,445	1,724,877	3,502,322	2,014,438	1,954,861	3,969,299	2,369,927	2,299,836	4,669,763
2030	2,435,468	2,358,268	4,793,736	1,826,601	1,768,701	3,595,302	2,070,148	1,897,197	3,967,345	2,435,468	2,358,268	4,793,736
2031	2,514,180	2,429,352	4,943,532	1,885,635	1,822,014	3,707,649	2,137,053	1,926,996	4,064,049	2,514,180	2,429,352	4,943,532

APPENDIX K

Projected Junior High School Enrolments, 2021 – 2031 (Medium Variant)

Year	Total Population (12 – 14 years)			75% Enrolment Assumption			85% Enrolment Assumption			100% Enrolment Assumption		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
2021	1,007,266	981,698	1,988,964	755,450	736,274	1,491,723	856,176	834,443	1,690,619	1,007,266	981,698	1,988,964
2022	1,023,484	989,626	2,013,110	767,613	742,220	1,509,833	869,961	841,182	1,711,144	1,023,484	989,626	2,013,110
2023	1,059,785	1,015,134	2,074,919	794,839	761,351	1,556,189	900,817	862,864	1,763,681	1,059,785	1,015,134	2,074,919
2024	1,059,308	1,016,709	2,076,017	794,481	762,532	1,557,013	900,412	864,203	1,764,614	1,059,308	1,016,709	2,076,017
2025	1,099,357	1,062,012	2,161,369	824,518	796,509	1,621,027	934,453	902,710	1,837,164	1,099,357	1,062,012	2,161,369
2026	1,111,014	1,074,546	2,185,560	833,261	805,910	1,639,170	944,362	913,364	1,857,726	1,111,014	1,074,546	2,185,560
2027	1,143,196	1,105,912	2,249,108	857,397	829,434	1,686,831	971,717	940,025	1,911,742	1,143,196	1,105,912	2,249,108
2028	1,158,551	1,114,525	2,273,076	868,913	835,894	1,704,807	984,768	947,346	1,932,115	1,158,551	1,114,525	2,273,076
2029	1,171,732	1,128,991	2,300,723	878,799	846,743	1,725,542	995,972	959,642	1,955,615	1,171,732	1,128,991	2,300,723
2030	1,168,569	1,130,238	2,298,807	876,427	847,679	1,724,105	993,284	960,702	1,953,986	1,168,569	1,130,238	2,298,807
2031	1,155,717	1,122,077	2,277,794	866,788	841,558	1,708,346	982,359	953,765	1,936,125	1,155,717	1,122,077	2,277,794

APPENDIX L

Projected Senior High School/TVET Enrolments, 2021 – 2031 (Medium Variant)

Year	Total Population (15 – 17 years)			75% Enrolment Assumption			85% Enrolment Assumption			100% Enrolment Assumption		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
2021	1,005,530	1,004,363	2,009,893	754,148	753,272	1,507,420	854,701	853,709	1,708,409	1,005,530	1,004,363	2,009,893
2022	996,339	989,462	1,985,801	747,254	742,097	1,489,351	846,888	841,043	1,687,931	996,339	989,462	1,985,801
2023	995,585	977,814	1,973,399	746,689	733,361	1,480,049	846,247	831,142	1,677,389	995,585	977,814	1,973,399
2024	1,003,062	977,305	1,980,367	752,297	732,979	1,485,275	852,603	830,709	1,683,312	1,003,062	977,305	1,980,367
2025	1,019,269	985,292	2,004,561	764,452	738,969	1,503,421	866,379	837,498	1,703,877	1,019,269	985,292	2,004,561
2026	1,055,512	1,010,828	2,066,340	791,634	758,121	1,549,755	897,185	859,204	1,756,389	1,055,512	1,010,828	2,066,340
2027	1,055,131	1,012,536	2,067,667	791,348	759,402	1,550,750	896,861	860,656	1,757,517	1,055,131	1,012,536	2,067,667
2028	1,095,109	1,057,786	2,152,895	821,332	793,340	1,614,671	930,843	899,118	1,829,961	1,095,109	1,057,786	2,152,895
2029	1,106,823	1,070,412	2,177,235	830,117	802,809	1,632,926	940,800	909,850	1,850,650	1,106,823	1,070,412	2,177,235
2030	1,138,961	1,101,773	2,240,734	854,221	826,330	1,680,551	968,117	936,507	1,904,624	1,138,961	1,101,773	2,240,734
2031	1,154,329	1,110,472	2,264,801	865,747	832,854	1,698,601	981,180	943,901	1,925,081	1,154,329	1,110,472	2,264,801

APPENDIX M

Projected Classrooms Required for Creche/Nursery, 2021- 2031

Year	Total Population under Medium Variant (0 – 3 years)	Required Classrooms under 75% Enrolment Assumption	Required Classrooms under 85% Enrolment Assumption	Required Classrooms under 100% Enrolment Assumption
2021	2,988,913	74,723	84,686	99,630
2022	3,086,160	77,154	87,441	102,872
2023	3,210,809	80,270	90,973	107,027
2024	3,384,945	84,624	95,907	112,832
2025	3,572,563	89,314	101,223	119,085
2026	3,622,360	90,559	102,634	120,745
2027	3,667,698	91,692	103,918	122,257
2028	3,711,382	92,785	105,156	123,713
2029	3,755,834	93,896	106,415	125,194
2030	3,802,353	95,059	107,733	126,745
2031	3,845,832	96,146	108,965	128,194

APPENDIX N

Projected Classrooms Required for Kindergarten, 2021 – 2031

Year	Total Population under Medium Variant (4 – 5 years)	Required Classrooms under 75% Enrolment Assumption	Required Classrooms under 85% Enrolment Assumption	Required Classrooms under 100% Enrolment Assumption
2021	1,560,998	39,025	44,228	52,033
2022	1,552,767	38,819	43,995	51,759
2023	1,524,035	38,101	43,181	50,801
2024	1,473,808	36,845	41,758	49,127
2025	1,436,045	35,901	40,688	47,868
2026	1,581,871	39,547	44,820	52,729
2027	1,743,421	43,586	49,397	58,114
2028	1,771,567	44,289	50,194	59,052
2029	1,797,492	44,937	50,929	59,916
2030	1,819,619	45,490	51,556	60,654
2031	1,839,515	45,988	52,120	61,317

APPENDIX O

Projected Classrooms Required for Primary School, 2021 – 2031

Year	Total Population under Medium Variant (6 – 11 years)	Required Classrooms under 75% Enrolment Assumption	Required Classrooms under 85% Enrolment Assumption	Required Classrooms under 100% Enrolment Assumption
2021	4,351,578	93,248	105,681	124,331
2022	4,460,793	95,588	108,334	127,451
2023	4,512,293	96,692	109,584	128,923
2024	4,573,458	98,003	111,070	130,670
2025	4,575,696	98,051	111,124	130,734
2026	4,538,770	97,259	110,227	129,679
2027	4,485,676	96,122	108,938	128,162
2028	4,528,841	97,047	109,986	129,395
2029	4,669,763	100,066	113,409	133,422
2030	4,793,736	102,723	116,419	136,964
2031	4,943,532	105,933	120,057	141,244

APPENDIX P

Projected Classrooms Required for Junior High School, 2021 – 2031

Year	Total Population under Medium Variant (12 – 14 years)	Required Classrooms under 75% Enrolment Assumption	Required Classrooms under 85% Enrolment Assumption	Required Classrooms under 100% Enrolment Assumption
2021	1,988,964	42,621	48,303	56,828
2022	2,013,110	43,138	48,890	57,517
2023	2,074,919	44,463	50,391	59,283
2024	2,076,017	44,486	50,418	59,315
2025	2,161,369	46,315	52,490	61,753
2026	2,185,560	46,833	53,078	62,445
2027	2,249,108	48,195	54,621	64,260
2028	2,273,076	48,709	55,203	64,945
2029	2,300,723	49,301	55,875	65,735
2030	2,298,807	49,260	55,828	65,680
2031	2,277,794	48,810	55,318	65,080

APPENDIX Q

Projected Classrooms Required for Senior High School/TVET, 2021 – 2031

Year	Total Population under Medium Variant (15 – 17 years)	Required Classrooms under 75% Enrolment Assumption	Required Classrooms under 85% Enrolment Assumption	Required Classrooms under 100% Enrolment Assumption
2021	2,009,893	50,247	56,947	66,996
2022	1,985,801	49,645	56,264	66,193
2023	1,973,399	49,335	55,913	65,780
2024	1,980,367	49,509	56,110	66,012
2025	2,004,561	50,114	56,796	66,819
2026	2,066,340	51,659	58,546	68,878
2027	2,067,667	51,692	58,584	68,922
2028	2,152,895	53,822	60,999	71,763
2029	2,177,235	54,431	61,688	72,575
2030	2,240,734	56,018	63,487	74,691
2031	2,264,801	56,620	64,169	75,493

APPENDIX R

Projected Trained Teachers Required for Creche/Nursery, 2021 – 2031

Year	Total Population under Medium Variant (0 – 3 years)	Required Trained Teachers under 75% Enrolment Assumption	Required Trained Teachers under 85% Enrolment Assumption	Required Trained Teachers under 100% Enrolment Assumption
2021	2,988,913	74,723	84,686	99,630
2022	3,086,160	77,154	87,441	102,872
2023	3,210,809	80,270	90,973	107,027
2024	3,384,945	84,624	95,907	112,832
2025	3,572,563	89,314	101,223	119,085
2026	3,622,360	90,559	102,634	120,745
2027	3,667,698	91,692	103,918	122,257
2028	3,711,382	92,785	105,156	123,713
2029	3,755,834	93,896	106,415	125,194
2030	3,802,353	95,059	107,733	126,745
2031	3,845,832	96,146	108,965	128,194

APPENDIX S

Projected Trained Teachers Required for Kindergarten, 2021 – 2031

Year	Total Population under Medium Variant (4 – 5 years)	Required Trained Teachers under 75% Enrolment Assumption	Required Trained Teachers under 85% Enrolment Assumption	Required Trained Teachers under 100% Enrolment Assumption
2021	1,560,998	39,025	44,228	52,033
2022	1,552,767	38,819	43,995	51,759
2023	1,524,035	38,101	43,181	50,801
2024	1,473,808	36,845	41,758	49,127
2025	1,436,045	35,901	40,688	47,868
2026	1,581,871	39,547	44,820	52,729
2027	1,743,421	43,586	49,397	58,114
2028	1,771,567	44,289	50,194	59,052
2029	1,797,492	44,937	50,929	59,916
2030	1,819,619	45,490	51,556	60,654
2031	1,839,515	45,988	52,120	61,317

APPENDIX T

Projected Trained Teachers Required for Primary School, 2021 – 2031

Year	Total Population under Medium Variant (6 – 11 years)	Required Trained Teachers under 75% Enrolment Assumption	Required Trained Teachers under 85% Enrolment Assumption	Required Trained Teachers under 100% Enrolment Assumption
2021	4,351,578	93,248	105,681	124,331
2022	4,460,793	95,588	108,334	127,451
2023	4,512,293	96,692	109,584	128,923
2024	4,573,458	98,003	111,070	130,670
2025	4,575,696	98,051	111,124	130,734
2026	4,538,770	97,259	110,227	129,679
2027	4,485,676	96,122	108,938	128,162
2028	4,528,841	97,047	109,986	129,395
2029	4,669,763	100,066	113,409	133,422
2030	4,793,736	102,723	116,419	136,964
2031	4,943,532	105,933	120,057	141,244

APPENDIX U

Projected Trained Teachers Required for Junior High School, 2021 – 2031

Year	Total Population under Medium Variant (12 – 14 years)	Required Trained Teachers under 75% Enrolment Assumption	Required Trained Teachers under 85% Enrolment Assumption	Required Trained Teachers under 100% Enrolment Assumption
2021	1,988,964	42,621	48,303	56,828
2022	2,013,110	43,138	48,890	57,517
2023	2,074,919	44,463	50,391	59,283
2024	2,076,017	44,486	50,418	59,315
2025	2,161,369	46,315	52,490	61,753
2026	2,185,560	46,833	53,078	62,445
2027	2,249,108	48,195	54,621	64,260
2028	2,273,076	48,709	55,203	64,945
2029	2,300,723	49,301	55,875	65,735
2030	2,298,807	49,260	55,828	65,680
2031	2,277,794	48,810	55,318	65,080

APPENDIX V

Projected Trained Teachers Required for Senior High School/TVET, 2021 – 2031

Year	Total Population under Medium Variant (15 – 17 years)	Required Trained Teachers under 75% Enrolment Assumption	Required Trained Teachers under 85% Enrolment Assumption	Required Trained Teachers under 100% Enrolment Assumption
2021	2,009,893	50,247	56,947	66,996
2022	1,985,801	49,645	56,264	66,193
2023	1,973,399	49,335	55,913	65,780
2024	1,980,367	49,509	56,110	66,012
2025	2,004,561	50,114	56,796	66,819
2026	2,066,340	51,659	58,546	68,878
2027	2,067,667	51,692	58,584	68,922
2028	2,152,895	53,822	60,999	71,763
2029	2,177,235	54,431	61,688	72,575
2030	2,240,734	56,018	63,487	74,691
2031	2,264,801	56,620	64,169	75,493


INTEGRI PROCEDAMUS