PROJECTION OF EDUCATIONAL RESOURCE REQUIREMENT FOR PROVISION OF QUALITY EDUCATION IN PRIMARY AND SECONDARY SCHOOLS IN SIAYA COUNTY, KENYA BY 2030

BY

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DECLARATION

This is my original work and has not been presented for any degree or diploma in this or any other college or university.

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DEDICATION

This thesis is dedicated to my mum Mrs. Fridah Khabele Nyongesa, my late Dad Mr. Patrick Nyongesa Munyasia and my husband Fredrick Shitubi for the firm academic foundation they laid in me.

ABSTRACT

Projection of educational resources such as teachers and physical infrastructure is the first step towards effective allocation of the scarce resources that are vital in provision of quality education. Siaya County recorded the third lowest achievement levels in Mathematics nationally with a mean of 431.8. Siaya was also rated the third most dropped county nationally in Kiswahili from 529.6 in 2016 to 429 in the National Assessment System for Monitoring Learner Achievement (NASMLA) at Class 3 level of Primary School Education in Kenya that was done in 2018. The poor performance in numeracy and literacy skills by class three pupils of Siaya County has raised a major concern over the quality of education in the county. A preliminary survey conducted in the county in 2018 established that most primary and secondary schools had overcrowded classrooms, inadequate desks and sanitation facilities. There was therefore need for projection of educational resources in primary and secondary schools in Siaya County that would enhance the provision of quality education envisaged in Kenya Vision 2030. The purpose of this study was to project educational resource requirement for provision of quality education in primary and secondary schools in Siaya County by 2030. The specific objectives of the study were to project: school age population and enrolment, teacher requirement, physical infrastructure requirement and average school size for provision of quality education in primary and secondary schools in Siaya County by 2030. This study was based on system theory and a conceptual framework showing the relationship between the independent variable; educational resources; and the dependent variable quality education. Trend analysis and descriptive survey designs were used in the study. Study population comprised of all school age population (6-17 years) who were 272,226 in 2009 and 339,251 in 2019. Sample for this study was selected through saturated sampling technique. Purposive sampling was used to select one TSC County Human Resource officer and one County Quality Assurance and Standards Officer. Secondary data was collected through Data Analysis Proformas and primary data through Key Informant Interview (KII) Guides. The content, construct and face validity of the research instruments were established through scrutiny by research experts from the Department of Educational Management and Foundations. Reliability of Data Analysis Proformas was established through test retest method where correlation coefficients of 0.99, 0.98 and 0.91 for KNBS, MOE and TSC Data Analysis Proformas were established respectively at $\alpha=0.01$. Compound Rate of Growth and Enrolment Ratio Methods were used to project school age population and school enrolment respectively. Pupil-Teacher Ratio method and method based on number of pupils per class and hours taught by teacher were used to project teacher requirement in primary and secondary schools respectively. Projections of physical infrastructure and average school size were based on the government recommended ratios. The findings of this study indicated that an increase in primary and secondary school age population consequently lead to an increase in enrolment at primary and secondary levels of education. The study also established that an increase in enrolment leads to an increase of teacher requirement, physical infrastructure and average school size by the same margin. The study concluded that there will be shortage of teachers and physical infrastructure due to the projected increase in enrolment especially at junior and senior secondary levels by 2030 and this would hamper provision of quality education. The study therefore recommended that to enhance provision of quality education in primary and secondary schools in the county, more Constituency Development Funds to be allocated to secondary schools to expand the physical infrastructure, primary school teachers with bachelor's degrees in education to be deployed to teach in secondary schools as TSC rolls out a plan to employ more teachers to teach in secondary schools in Siaya County and upgrading of some primary schools to accommodate the anticipated increased enrolment in junior and senior secondary schools by 2030. Findings of this study would inform policy makers including TSC and Ministry of Education to come up with proactive policy reforms that would enhance provision of quality education amidst the on-going education reforms in Kenya.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBE	:	Curriculum Base Establishment
EPDC	:	Education Policy Data Centre
FDSE	:	Free Day Secondary Education
FPE	:	Free Primary Education
GoK	:	Government of Kenya
HIV	:	Human Immunodeficiency Virus
IMF	:	International Monetary Funds
KENPHIA	:	Kenya Population-based HIV Impact Assessment
KNBS	:	Kenya National Bureau of Statistics
KPHC	:	Kenya Population and Housing Census
MDG	:	Millennium Development Goals
MoE	:	Ministry of Education
NCPD	:	National Council for Population and Development
NPHC	:	National Population and Housing Census
OECD	:	Organization for Economic Co-operation and Development
PTR	:	Pupil Teacher Ratio
RoK	:	Republic of Kenya
SDG	:	Sustainable Development Goal
SID	:	Society for International Development
T S C	:	Teacher Service Commission
AIDS	:	Acquired Immunodeficiency Syndrome
EFA	:	Education for All
ILO	:	International Labour Organization
UNESCO	:	United Nations Educational Scientific and Cultural Organization

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CHAPTER ONE
INTRODUCTION

1.1 Background to the study

The notion of education quality is often difficult to define. However, there are some basic features which are considered key to educational outcomes (UNESCO, 2012). These include the quality of the teaching workforce, the availability of adequate educational resources, a supportive learning environment and suitable access to basic services in instructional settings like sanitation, clean water and electricity. All of these are important for the promotion of learning and educational performance.

Education resources include the teachers in the school, human beings in the community, real objects, specimen or models, chalk and display boards, school buildings and layout, the community at large and other fundamental materials like pencils, pens, exercise books etc which the learners are expected to have at any point in time to facilitate learning (NOUN, 2009). Education resources are no doubt important in the development of a conducive teaching-learning environment. The use of these resources could give more valuable and powerful direction to the teacher than any personal efforts without the materials. Adequacy of education resources in a learning institution enhances provision of quality education. According to Barrett, Treves, Shmis, Ambasz, Ustinova (2019), key inputs to the education system, such as curricula, teachers, and education infrastructure, help to improve the quality of education.

During the United Nations Sustainable Development Summit in 2015, member states formally adopted the 2030 Agenda for sustainable development in New York. The agenda contains 17 goals including a new global education goal Sustainable Development Goal 4 (SDG 4). The SDG 4 stipulates that all member states to ensure inclusive and equitable quality education and

promote lifelong learning opportunities for all. This goal has seven targets (4.1-4.7) and three means of implementation. The SDG 4 Target 4a addresses the need for adequate physical infrastructure and safe, inclusive environments that nurture learning for all regardless of background or disability status, SDG 4 Target 4b addresses issues on scholarships and SDG 4 Target 4c addresses the need to substantially increase the supply of qualified teachers by 2030 (Global Education Monitoring Report Team, 2020). Provision of inclusive, equitable and quality education is therefore dependant on availability of educational resources such as teachers and physical infrastructure.

Several studies have been undertaken to establish the relationship between educational resources and provision of quality education. A review of the most recent literature indicates that investments to improve school infrastructure has effects on education quality at least in the following three dimensions. First, school infrastructure improves attendance and completion of academic circles. Findings of a study by Branham (2004) on the Effects of inadequate school building infrastructure on student attendance found out that the quality of school infrastructure has a significant effect on school attendance and drop-out rates. Students are less likely to attend schools in need of structural repair, schools that use temporary structures, and schools that have understaffed janitorial services.

Secondly, school infrastructure leads to teacher motivation. Evidence in Bangladesh, Ecuador, India, Indonesia Peru and Uganda indicates that teachers in schools with good infrastructure have on average, 10 percent less absenteeism than teachers with deficient infrastructure (Lee, Goodman, Dandapani and Kehahio, 2015). Thirdly, school infrastructure improves learning results. Studies carried out in the United States such as the one conducted by 21st Century school fund in 2010 found positive results which are statistically significant between school

infrastructure and standardized tests to measure learning processes in many parts of the country. Hanushek (1995) as cited by Rivera (2016) found out that the results of 34 studies with production functions in developing countries that analyzed the relationship between school facilities and learning mostly found a positive effect. Velez, Schiefelbein and Valenzuela (1993) also cited by Rivera (2016) indicate positive results between infrastructure quality and learning based on a review of close to 70 models of functions of production carried out during 20 years in Latin America.

Empiric evidence indicates that there is a direct relationship between school infrastructure and educational performance in that investments in educational infrastructure contribute to improve the quality of education and the economic performance of countries (Rivera, 2016). Lekjep, Dantong, and Inusa (2013) while studying the effects of physical infrastructure on student's performance indicated that physical infrastructure significantly impacts students' performance along with being responsible for the quality of graduates present in the market.

However, despite the numerous findings of studies that have found strong positive relationship between physical infrastructure and quality education, Global Education Monitoring Report for the year 2017/2018 on Sustainable Goal 4 Target 4a indicates that access to basic sanitation facilities was below 50% in 24 of 137 countries including 17 in sub-Saharan Africa (UNESCO, 2020). According to GEM report, the 2013 Third Regional Comparative and Explanatory Study in Latin America showed that more than four-fifths of the richest grade 3 students attended schools with adequate water and sanitation facilities while only one third of the poorest students did. This report concludes that infrastructure shortages often hinder learning in countries at all income levels, particularly in disadvantaged schools.

The global targets set by the Education for All goals and the United Nation's Millennium Development Goals have led to increased students' enrolment over the past decade. In South Asia, almost 30 million new students have entered the education system since 1999, and in sub-Saharan Africa, more than 20 million new students enrolled in the same period (The William and Hewlett Foundation's Global Development Program, 2008). While such rapid growth is laudable and unprecedented, this massive expansion of schooling has significantly strained existing education systems. Teacher and facility shortages are acute; student/staff ratios are high in sub-Saharan Africa (47:1) and South Asia (35:1), as compared with developed countries (17:1).

In order to reach a target pupil-teacher ratio of 30:1 and Net Enrolment Rate of 100%, the number of teachers needed in Latin America, the Caribbean, Sub-Saharan Africa, Middle East, North Africa, South Asia, East Asia, the Pacific, Central Asia and Eastern Europe would be about 4 million (UNESCO, 2013). According to a report by Hewlett Foundation's Global Development Program (2008), quality is suffering: millions of pupils are entering the doors of school for the first time, but too few are learning.

Education falls under the social pillar of the Kenya's Vision 2030. Under education and training, Kenya intends to provide a globally competitive and quality education, training and research by 2030. The education sector is meant to provide the skills that will be required to steer Kenyans to the economic and social goals of Vision 2030. However, introduction of Free Primary Education (FPE) in 2003 and Free Day Secondary Education (FDSE) in 2008 resulted in increased pupils' enrolment without commensurate increase in either infrastructure or personnel (GOK, 2007). Enrolment in Primary school in Kenya increased from 9,352,800 in 2010 to 10,524,500 in 2018 while secondary school enrolment increased from 1,653, 384 in 2010 to 2,942,700 in 2018 (Statistical Abstract, 2019). This has led to overstretched facilities, overcrowding in schools,

inefficient teacher utilisation and high teacher to pupil ratios all of which have affected the quality of education at primary and secondary levels (GOK, 2007).

A survey undertaken by Institute of Economic Affair Kenya and Action Aid International, Kenya county based civil society organizations in their paper entitled: Enhancing accountability in the provision of free primary education in Baringo, Busia, Kajiado, Kilifi, Mombasa, Taita Taveta and Nairobi counties (2016) established that lack of trained teachers, inadequate learning materials especially text books, inadequate furniture, inadequate classroom facilities, inadequate number of teachers and lack of teachers for certain subjects were among challenges highlighted by the consumers of free primary education services in the target counties.

National Needs Assessment study was also carried out by Kenya Institute of Curriculum Development (2016) which established that the current scenario in Kenya paints a picture of scarcity of educational resources. The poor physical infrastructure in most learning institutions, inadequate schools and inadequate teaching staff have immensely contributed to poor delivery of 8-4-4 system of education and access to quality education. The 8-4-4 curriculum was implemented for three decades. It experiences challenges ranging from insufficient infrastructures and resources, inadequately trained teachers, a large number of learners in the classrooms, unskillful graduates, and increased dropouts. The 8-4-4 philosophy was an education for self- reliance but seemingly it never accomplished its mandate (Cheptoo and Ramdas (2020).

The National Educational Needs Assessment report in 2009 therefore proposed the adoption of a Competency-Based Curriculum (CBC). The major reason was to align the education sector with the Kenya constitution 2010, East Africa community harmonization treaty agreement, and vision 2030 goals. The noble decision brought the adoption of CBC in a phased manner in grades I-VI.

Competency Based Curriculum was piloted in 2017 and thereafter implemented in lower primary grades. However, this type of curriculum generally requires small classes for teachers to give personal attention to each learner. With the increased enrolment to meet the 100 percent transition, the classrooms are overflowing with large numbers of pupils. Sossion (2017) and Ondimu (2018) as cited by Cheptoo and Ramdas (2020) have argued that there has also been an acute shortage of teachers, with some schools, having only a few teachers posing a major challenge in the successful implementation of the new curriculum.

Introduction of the competency based curriculum under the 2-6-6-3 system of education in Kenya is therefore likely to exacerbate the teacher shortage and inadequacy of physical infrastructure if immediate action is not taken to mitigate the educational resource shortages currently facing the education system in the country. Altinyelken, (2015) points out the fact that curriculum development is a complex and slow process; there are no quick-fixes. It needs to be accompanied by re-alignments in all aspects of instructional infrastructure and it is critical to provide sufficient resources to do the implementation properly.

A review of studies carried out in countries that have adopted the Competency Based Approach indicate that shortage of teachers and inadequacy of educational resources, which are key in puts in provision of quality education, have hindered smooth implementation of competency based curriculum. Esongo (2017) who studied the implementation of competency-based teaching approaches in Cameroon, indicate that the failure is linked to under-resourcing. Nsengimana, Ozawa and Chikamori's (2014) study on the level of implementation of the outcomes-based education in the lower secondary science curriculum in Rwanda found out that the weak implementation of competency based approaches was caused by lack of appropriate resources.

Pedzisai, Tsvere and Nkhonde (2014) did a survey of a 2006 secondary school curriculum reform in Zimbabwe – which adopted a two-pathway system to offer a skills pathway to include both business/commercial subject combination and a second subject combination around technical/vocational subjects and found out that the weak uptake of the technical/vocational curriculum pathway was due to inadequate materials and finance resources and lack of skilled teachers. Kakupa (2017) also studied the feasibility of implementing a German style multiple pathways within the Zambian secondary school curriculum and found, again, that it was unlikely to work because of resource constraints.

Dalberg's 2014 paper identifies some familiar challenges with this curriculum innovation – challenges that the Botswana example tried to avoid. These were lack of teachers and lack of resources. Schools had limited infrastructure and resources to teach these applied subjects. In Tanzania's schools, challenges hampering the implementation of competency-based teaching and learning are: overcrowded classrooms, poor infrastructure and inadequate teaching and learning facilities (Iyabo, (2014), Okoye and Udoudo (2015) and Adeyonu and Carim-Sanni (2015).

Cunningham (2018) points out the fact that competence/outcomes-based reforms (with more focus on learner-centred teaching) requires increased teacher capacities as well as institutional capacities, yet reforms seldom integrate any planning or budgeting towards increasing these capacities. Competency based curriculum being rolled out in Kenya brings on board more subjects than what was being taught in 8-4-4 curriculum. In lower primary education, nine subjects will be taught as compared to six subjects in 8-4-4 curriculum. In upper primary education, 12 subjects will be taught compared to six in the 8-4-4 curriculum. In lower secondary education, learners will be required to take the 12 core subjects provided with an opportunity to choose a minimum of one and a maximum of two subjects according to personality, abilities,

interests and career choices. In the 8-4-4 curriculum, students in form one and two are expected to take a maximum of 12 subjects (Republic of Kenya, 2017).

The increased number of teaching subjects calls for increase in number of teachers. The pupil Teacher Ratio (PTR) in primary and secondary schools in Kenya is already high due to increased pupil enrolment. A high teacher pupil-ratio suggests that each teacher has to be responsible for a large number of pupils. In other words, the higher the pupil/teacher ratio, the lower the relative access of pupils to teachers. It is generally assumed that a low pupil-teacher ratio signifies smaller classes, which enables the teacher to pay more attention to individual students, which may in the long run result in a better performance of the pupils (UNESCO, 2009). Table 1.1 shows PTR in countries that have successfully adopted CBC in comparison to PTR in Kenya.

Table Error! No text of specified style in document.**.1 Pupil Teacher Ratio in countries with Competency Based Curriculum**

SN	County	PTR in Primary	PTR in Secondary
1	Canada	17:1	19:1
2	China	17:1	13:1
3	England	15:1	19:1
4	Finland	13:1	13:1
5	Ghana	27:1	16:1
6	Malasya	12:1	12:1
7	Singapore	15:1	12:1
8	South Africa	30:1	27:1
9	South Korea	16:1	14:1
10	**Kenya**	**42:1**	**41:1**

Source: UNESCO institute for Statistics (2018) World Bank Data

Most of the countries where Competency Based Curriculum has succeeded have low pupil teacher ratios. Finland, the country with the best education system in the world, has a pupil teacher ratio of 13:1 in both primary and secondary schools (Sirkku, Jarko and Tommie, 2009). South Africa and Ghana from Africa have pupil teacher ratio of 30:1 and 27:1 at primary and a PTR of 27:1 and 16:1 at secondary respectively. Kenya, on the contrary, has the highest PTR of 42:1 at primary and 41:1 at secondary (UNESCO Institute of Statistics, 2018).

According to the report by the Taskforce on Enhancing Access, Relevance, Transition, Equity and Quality for Effective Curriculum Reforms Implementation (2020), junior secondary school will be domiciled in secondary education level categorized as sub-county schools. Senior secondary level of education will be domiciled in secondary schools categorized as county, extra-county and national schools. This is informed by the fact that primary schools lack capacity both in human resource and physical infrastructure (especially for teaching science) to facilitate the expected depth engagement with the junior secondary school CBC content. This implies that the 12 year olds (Grade 7) who have been part of the primary school age population will transit to junior secondary school level in the year 2023 as shown in Table 1.2.

Table Error! No text of specified style in document.**.2: Implementation of 2-6-6-3 and phasing out of 8-4-4 system of education by 2030**

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
8-4-4 SYSTEM OF EDUCATION												
Class	8	F.1	F.2	F.3	F.4							
	7	8	F.1	F.2	F.3	F.4						
	6	7	8	F.1	F.2	F.3	F.4					
	5	6	7	8	F.1	F.2	F.3	F.4				
2-6-6-3 SYSTEM OF EDUCATION												
Grade	4	5	6	JS.1	JS. 2	JS.3	SS.1	SS.2	SS.3			
	3	4	5	6	JS.1	JS.2	JS.3	SS.1	SS.2	SS.3		
	2	3	4	5	6	JS.1	JS.2	JS.3	SS.1	SS.2	SS.3	
	1	2	3	4	5	6	JS.1	JS.2	JS.3	SS.1	SS.2	SS.3

Key: F- Form, JS- Junior Secondary, SS- Senior Secondary

In the year 2023, the first grade 7 under the 2-6-6-3 system of education will join junior secondary school. At the same time, secondary schools will still be admitting form one students under the 8-4-4 system of education. This implies that each sub-county secondary school will have to create one more classroom to accommodate the first years in junior secondary school. The demand for more educational resources in these schools will persist up to the year 2025 as

sub-county secondary schools will be accommodating students under 2-6-6-3 system of education and students under the 8-4-4 system of education.

Implementation of the 2-6-6-3 system of education will see schooling years at primary school level in Kenya reduce from 8 years to 6 years. The primary school age population will therefore change from 6-13 years to 6-11 years. Schooling years at secondary school level, on the other hand, will increase from 4 years to 6 years with 3 years at junior secondary level and 3 years at senior secondary level. The secondary school age population for junior secondary level will therefore comprise of 12-14 years old and senior secondary level will have 15-17 years school age population. These reforms have implications on teacher requirement and physical infrastructure in both primary and secondary schools and if not well planned for, they may affect provision of quality education. Studies by Makunja (2016), Lyong'o, Too and Kipngetich (2017) and Muneja (2015) established that overcrowded classrooms, high PTR and heavy work load for teachers have hampered effective implementation of competence based curriculum in Tanzania.

Sustainable Development Goal (SDG) 4 target aims at ensuring that all children complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes by 2030. In Kenya, the corresponding indicator for monitoring this target is the proportion of children and young people who in Grades 2 and 3 at the end of primary education; and at the end of lower secondary education, achieve at least a minimum proficiency level in Reading and Mathematics (ROK, 2019). Since 2018, Kenya National Examination Council has conducted Early Grade Mathematics Assessment (EGMA), Midline and End line for Grade 2; National Assessment System for Monitoring Learner Achievement (NASMLA) for Grade 3; NASMLA for Class 7 and Monitoring Learner Achievement (MLA) for Form 2. This is achieved through a descriptive survey design where data is collected from 250 to 325 randomly sampled

schools with a representative sample of 25 pupils. Besides administering achievement tests, MLA studies also administer background questionnaires to head teachers, teachers and pupils. These tools provide information on educational inputs such as textbook: pupil ratio and availability of key teaching and learning resources.

The National Assessment System for Monitoring Learner Achievement (NASMLA) was conducted for Class 3 in 2016 and 2018. The benchmark of achievement in numeracy and literacy was set at 50% score, at each competency level (ROK, 2019). According to the performance report generated by Kenya National Examination Council on achievement of numeracy and literacy competencies by counties, Siaya County was rated amongst counties with the lowest levels of achievement in Mathematics, English and Kiswahili as indicated in Table 1.3.

Table Error! No text of specified style in document.**.3: Nyanza Region Class Three achievement in Numeracy and Literacy in 2018 NASMLA**

County	Standardized Mean score Mathematics	Rank (out of 47)	Standardized Mean Score English	Rank (out of 47)	Standardized Mean score Kiswahili	Rank (out of 47)
Nyamira	520.6	14	497.5	22	515.8	18
Homabay	495	21	515.3	14	473.2	32
Kisii	478.8	33	455	40	473	33
Kisumu	464.8	41	484	26	459.6	38
Migori	447.3	43	465.8	35	449.2	41
Siaya	**431.8**	**45**	**458.5**	**39**	**429**	**44**
National	**500**		**498.1**		**499.7**	

Source: Approved Basic Education Statistical Booklet (ROK, 2019)

The national standardized mean score for Mathematics (Numeracy) for Grade 3 pupils in the National Assessment System for Monitoring Learner Achievement (NASMLA) was 500. Only Nyamira County with a standardized mean score of 520.6 managed to score above the national standardized mean score. The lowest achievement levels in Mathematics nationally were reported in Siaya (431.8), Samburu (421.2) and Garissa (398.2). Of these counties, Samburu and

Garissa are categorized as Arid and Semi Arid Lands (ASALs). In English Siaya, Taita Taveta, and Garissa registered significant decline at 98.8 (from 557.3 in 2016 to 458.5 in 2018), 107.5 (from 606.6 in 2016 to 499.2 in 2018), and 153.6 (from 516.8 in 2016 to 363.2 in 2018) mean points respectively. In Kiswahili, Garissa, Embu and Siaya registered significant decline at 76.0 (from 427.8 in 2016 to 351.8 in 2018), 98.4 (from 560.2 in 2016 to 461.8 in 2018), 100.6 (from 529.6 in 2016 to 429.0 in 2018) mean points respectively (Karogo, Matei, Kipchirchir, Mugailwa, Omunyang'oli and Kawira , 2020).

The low achievement in numeracy and literacy in Siaya County is a reflection of the quality of education being offered in the county. One of the key findings of the study was that high pupil teacher ratios and inadequacy of basic facilities like classrooms, toilets and desks are among the factors affecting the achievement of numeracy and literacy amongst class three pupils in Kenya (Karogo et. al, 2020). This concurs with findings of a study by Onyango, Malyo and Ndiku (2019) on capacity expansion of educational resources and students' participation in Siaya County, Kenya which also established that 54.2% schools in Siaya County did not have adequate physical facilities. Findings of a preliminary survey conducted to establish the status of educational resources in primary and secondary schools in Siaya County in 2018 are shown in Table 1.4.

Table Error! No text of specified style in document.**.4 Current status of educational resources in primary and secondary schools in Siaya County**

Primary schools

Sub-county	No of schools	Enrolment			Teachers		Classroom		Boys Toilets		Girls toilets		Desks
		M	**F**	**T**	**TSC**	**BOM**	**P**	**T**	**P**	**T**	**P**	**T**	
Siaya	133	29212	29361	58573	1282	130	1200	0	550	13	492	0	11714
Bondo	128	22480	22392	44872	1089	248	1095	31	495	0	538	0	7736
Gem	119	24250	23689	47162	1127	83	1114	49	592	0	509	2	8733
Rarieda	119	20163	20379	40542	996	74	1019	65	403	48	494	89	6871
Ugenya	86	18049	17929	35978	830	150	751	0	349	9	329	6	8994
Ugunja	71	13147	13428	25359	704	47	641	99	234	44	182	26	6502
County	**656**	**127301**	**127178**	**254476**	**6028**	**732**	**5820**	**244**	**2623**	**114**	**2544**	**123**	**50550**

Secondary schools

Sub-county	No of schools	Enrolment			Teachers		Classrooms		Boys' Toilets		Girls' Toilets		Lockers
		M	**F**	**T**	**TSC**	**BOM**	**P**	**T**	**P**	**T**	**P**	**T**	
Siaya	50	8802	11236	20038	534	340	404	0	300	0	458	0	20000
Bondo	39	9818	8423	18241	512	315	353	4	381	18	336	16	18226
Gem	47	11069	9103	20172	547	332	432	0	329	0	440	0	20161
Rarieda	47	9584	8156	17740	486	199	376	0	274	61	332	5	17719
Ugenya	31	6703	6534	13237	346	217	260	4	237	0	256	0	13230
Ugunja	24	6061	6850	12911	293	198	212	0	210	0	223	0	12899
County	**238**	**52,037**	**50,302**	**102,339**	**2718**	**1601**	**2037**	**8**	**1731**	**79**	**2045**	**21**	**102,235**

Key: *P- Permanent, *T-Temporary

Based on the enrolment in primary and secondary schools in Siaya County, the Pupil Teacher Ratio in primary schools in the county is 44:1 while the Pupil Teacher Ratio in secondary schools in the county is 62:1. The pupil desk ratio in primary schools in the county stood at 5:1

against the recommended ratio of 3:1. In secondary schools, the recommended pupil desk ratio is 1:1. This implies that the number of desks in secondary schools should be equivalent to the enrolment in secondary schools. However, while enrolment in secondary schools in Siaya County was 102,339, the number of lockers/chairs was 102,235. This implies that in some secondary schools, students shared lockers and chairs.

Most primary and secondary schools had few classrooms resulting to overcrowding. Some schools had put up temporary classrooms to accommodate the excess students. Most schools in the county did not adhere to the toilet recommended ratio of 30:1 for boys and 25:1 for girls. From Table 1.4 above, the pupil toilet ratio in primary schools in Siaya County was 49: 1 for boys and 50:1 for girls. Some primary and secondary schools in the county had put up temporary toilets to serve the increased enrolment. These findings concur with findings of a research by Konyango, Ogeta and Orodho (2018) on influence of resources on students' academic performance in physics at secondary schools in Ugenya sub-county, Siaya County which established that there was acute shortage of appropriate physical facilities and that this had an impact on the students' academic performance.

The main purpose of the National Assessment System for Monitoring Learner Achievement (NASMLA) that was undertaken at Class 3 in 2018 was to assess the quality of education since the implementation of the Basic Education Act (2013) took effect. In particular, the study sought to determine the levels of achievement of Class 3 pupils in Mathematics, English and Kiswahili, as well as the levels of acquisition of life skills. The study also sought to establish the factors that influence pupils' achievement levels (Karogo et.al, 2020)

Findings of this study indicate that Siaya County is amongst the last three counties nationally that have recorded a significant drop in achievement of numeracy and literacy competences in

class 3 as compared to their achievement in these competencies in 2016 when the first National Assessment System for Monitoring Learner Achievement (NASMLA) was conducted. Based on the findings of this study, it is quite evident that inadequacy of educational infrastructure is affecting provision of quality education in Siaya County. This study therefore sought to project educational resource requirement that would enable primary and secondary schools in the county to successfully provide quality education as envisaged in Kenya Vision 2030.

According to Mbiti (2007), educational planning is problem prevention, that is, it minimizes the magnitude of an educational problem likely to be encountered at some point in time. In order for planners and policy makers to allocate efficiently the scarce resources, they need to know the future size and structure of the country's population as well as their characteristics. Projection informs the educational planner of a future pattern and trend of education parameters, especially the resource requirements in the educational system. These include enrollment, staffing, facilities, funding, etc. Projection also acquaints the institutional managers with the number of students and staff that would be expected in the system at a future period, assuming no change occurs in the educational system. All levels of education require timely projection of resources for an effective operation and sustainable development (Agboola and Adeyemi, 2013).

While many studies have been conducted to establish the effect of educational resources (teacher factor, physical infrastructure factor, unit cost of education factor among others) on provision of quality education, there are very few studies carried out to project educational resources required for provision of quality education in the fast changing world. Altinyelken, (2015) points out the fact that curriculum development is a complex and slow process; there are no quick-fixes. It needs to be accompanied by re-alignments in all aspects of instructional infrastructure and it is critical to provide sufficient resources to do the implementation properly. There was therefore

need to project educational resource requirement for provision of quality education in primary and secondary schools in Siaya County by 2030.

Oloo (2017) did a study on projection of optimal allocation of educational resources in primary and secondary schools in Kenya during 2013 to 2030. The objectives of the study were to project enrolments by primary and secondary education for the period 2013 to 2030, estimate the optimal number of classrooms required to accommodate the school enrolment in primary and secondary schools in Kenya and to estimate the free schooling funds required for the enrolment in primary and secondary schools in Kenya for the period 2013 to 2030. Cohort projection model was used to generate desired enrolments.

Projection of enrolment by Oloo (2017) was based on internal efficiency indicators like promotion rates, repetition rates and completion rates. However, in 2013, repetition of classes in Kenya was outlawed by the Ministry of Education through Circular No. MOE/HRS/3/7/4 (World Bank, 2014). This means that transition in primary schools from one class to the other was to be calculated at 100%. The repetition parameter therefore cannot be used in projection of school enrolment. Under the 2-6-6-3 system of education, the number of years in primary schools in Kenya has also been reduced to 6 years from 8 years while the secondary school years have been increased from 4 years to 6 years. A projection of educational resource requirement under the 2-6-6-3 system of education was therefore mandatory to ensure that the quality of education is not compromised even as the country undertakes reforms in the education sector.

Despite the teacher shortages noted in counties across the country, the 2014 and 2019 Basic educational statistical data booklets indicate that there was no teacher shortage at primary and secondary levels of education in Kenya. The reports indicate that the ratio of government

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employed teachers to enrolled pupils/students was within an acceptable range considering the sector norm. This notwithstanding, there are serious cross county disparities ranging from very high PTR of 101.3 in Turkana to a low of 25.4 in Baringo (MOE, 2017). Projections and analyses of educational data done at the national level do not fully capture the disparities in educational requirements at the lower levels like the counties and sub-counties. This calls for projections to be done at lower levels to establish specific educational needs of every sub-county which are later summed up to get county and national requirements.

In some large countries like Brazil, China, India and Nigeria, fertility levels vary considerably between various parts of the country (May, 2012). Therefore due to regional disparities in socio economic demographic characteristics like birth rates, death rates, enrolment rates, a national projection cannot give specific needs of every county. Since the promulgation of the Kenyan constitution, many government functions were devolved to the county level. The county is therefore the planning unit. The current study sought to project educational resource requirement for provision of quality education in primary and secondary schools in sub-counties within Siaya County which were summed up to establish Siaya County educational resource requirements.

Therefore based on significant drop in achievement in numeracy and literacy assessment at class 3 in 2018 that saw Siaya County ranked as the third last county nationally, findings of the preliminary survey, literature of reviewed studies, the on-going educational reforms and the promulgation of Kenya constitution in 2010 which led to decentralization of teacher management functions by TSC to the county level, there was need to project educational resource requirement for provision of quality education in Siaya County by 2030.

1.2 Statement of the Problem

Siaya County is one of the counties that recorded lowest achievement in numeracy and literacy assessment at class 3 that was conducted by Kenya National Examination Council in 2018 to assess quality of education at lower primary level of education in Kenya. A preliminary survey conducted in Siaya County in 2018 established that most primary and secondary schools had inadequate teachers, overcrowded classrooms, shortage of desks and inadequate sanitation facilities which are vital educational resources for provision of quality education in the county.

The inadequacy of teachers, classrooms, desks and toilets in primary and secondary schools in Siaya County is likely to worsen due to the on-going education reforms in the country. The competence based curriculum being implemented in Kenya is a learner centred curriculum hence requires more teachers and physical facilities to ensure that quality learning takes place.

One of the major reforms in the education sector in Kenya is the introduction of junior secondary education which will be attached to the current secondary education level. Years of schooling in primary schools have been reduced from eight to six years while secondary schooling has been increased from four to six years. The learning areas (subjects) in the 2-6-6-3 system of education are more compared to the subjects under the 8-4-4 system of education. All theses educational reforms have implications on teacher requirement and physical infrastructure in both primary and secondary schools in Siaya County as well as all other basic learning institutions in Kenya.

Since provision of quality education is attributed to adequacy of key educational resources like teachers, classrooms, sanitation facilities and desks, there was need for a projection to be done in Siaya County to project educational resource requirement that will enable Siaya County to effectively implement the 2-6-6-3 system of education and achieve quality primary and secondary education envisaged in Vision 2030.

1.3 Purpose of the Study

The purpose of this study was to project educational resource requirement for provision of quality education in primary and secondary schools in Siaya County by 2030.

1.4 Objectives of the Study

The specific objectives of the study were to:

1. Project school age population and school enrolment for primary and secondary schools in Siaya County by 2030.

2. Determine teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030.

3. Establish the physical infrastructure requirement for provision of quality education in primary and secondary schools in Siaya County by 2030.

4. Determine the average school size for provision of quality education in primary and secondary schools in Siaya County by 2030.

1.5 Research Questions

The following specific research questions guided the study:

1. What is the projected school age population and enrolment in Siaya County by 2030?

2. What is the projected teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030?

3. What is the projected physical infrastructure requirement for provision of quality education in primary and secondary schools in Siaya County by 2030?

4. What is the average school size for provision of quality education in primary and secondary schools in Siaya County by 2030?

1.6 Assumptions of the Study

This study was guided by the following assumptions:

1. The whole school age population (6-17 years old) is enrolled in primary and secondary schools in Siaya County and the number of those leaving the county is equal to those coming into the county.

2. All primary and secondary schools in Siaya County have inadequate educational resources which are vital in provision of quality education.

3. The school age population growth rate, the enrolment rate, Ministry of education recommended standards for physical infrastructure and average school size and Teachers' Service Commission staffing norms will remain constant.

1.7 Significance of the study

Theoretically the study will contribute to the advancement of knowledge in black box models of the system theory in relation to the inputs, process, outputs and feedback in educational planning. Moreover, it is hoped that the findings of this study will add knowledge to the existing literature on the subject. In practice, the findings of this study will be significant to educational stakeholders at both the county and national government levels in formulation of policies on planning for educational facilities at the county and national levels. This study will also enable TSC to know the exact number of teachers who will be required in every sub-county in Siaya County to cater for the 100% transition from primary to secondary schools and formulating policies that address equitable distribution and effective utilization of teachers. The findings of this study will also be significant to the Ministry of Education and Kenya Institute of Curriculum Development in estimation of the educational resources required in sub-counties in Siaya County as the findings of this study will form the base for planning for the provision of physical

infrastructure in primary and secondary schools as the country implements the 2-6-6-3 system of education.

1.8 Limitations of the Study

Changes in policy involving teacher training, recruitment, deployment, transfers, transition rates, staffing norms and other unprecedented government policies could affect the trends and projections of teachers, number of schools, classrooms and toilets. Social, economic and cultural factors were not taken into consideration though they may influence enrolments. The researcher used Data Analysis Proformas to collect data on school age population, students' enrolment, number of primary and secondary schools in the county and the number of teachers in the county from the KNBS, MOE and TSC county offices. This posed some challenges as data collected from different sources varied to some degree. . However, triangulation data analysis was used to compare the data collected from these offices with data from official government education statistical documents.

1.9 Delimitations of the Study

The study was carried out in Siaya County with 656 primary schools and 240 secondary schools. Two of the secondary schools in Bondo sub-county are national special needs schools. These schools were not included in the projection as they are not integrated schools that can admit regular students. Ministry of Education and Teachers' Service Commission Siaya County statistics for 2019 and National Population Census Statistics of 24/08/2009 and 24/08/2019 were utilized to make projections on school age population and enrolment in primary and secondary schools. The number of teachers, classrooms, toilets and desks required by primary and secondary schools in Siaya County were projected. There are other educational resources that are vital for provision of quality education. However, this study only focused on the following:

teacher requirement, classrooms, toilets and desks (physical infrastructure requirement) and average school size as they are basic resources that a school must have in order to achieve a favourable learning environment (Inter-American Development Bank, 2016). Projections in this study were based upon past trend analysis of enrolment data and school age population from the year 2016 to 2020 to make projections from 2021 to 2030. Though carried out in Siaya County, findings for this study can be generalized for the entire country as the on-going educational reforms are affecting all levels of education in the country and the inadequacy of educational resources that are vital in provision of quality education is a nationwide challenge (KICD, 2016).

1.10 Theoretical framework

This study was underpinned on the black box model of the system theory. The idea of general systems theory was originally advanced by Von Bertalanffy in the 1930s. The most basic concept of system theory is that no one element exists in a vacuum, but that each always relates to other components of the system (Davis, 1979). The basic system theory of organizations is made up of five major components: inputs, a transformation process, outputs, feedback, and the environment (Daft, 2010).

Applied to this study, educational resources (students' enrollment, teacher requirement, physical infrastructure requirement and the average school size) are inputs that go through the transformation process (ratios recommended by Teachers' Service Commission and Ministry of Education) to get the desired output; quality education. In the black box model of system theory, the inputs and the out puts of a system are clearly portrayed for analysis but the central process of the system is not. However, the workings of the process can sometimes be inferred and described with sufficient accuracy to enable the analyst to design, redesign and in general to

manage and control the system and its performance. Hare (1967) as cited by Davis (1979) provides a readable introduction to the subject as shown in Figure 1.1.

The transfer function (T) is the ratio of the output to the input

$$T = \frac{Y}{X} = K$$
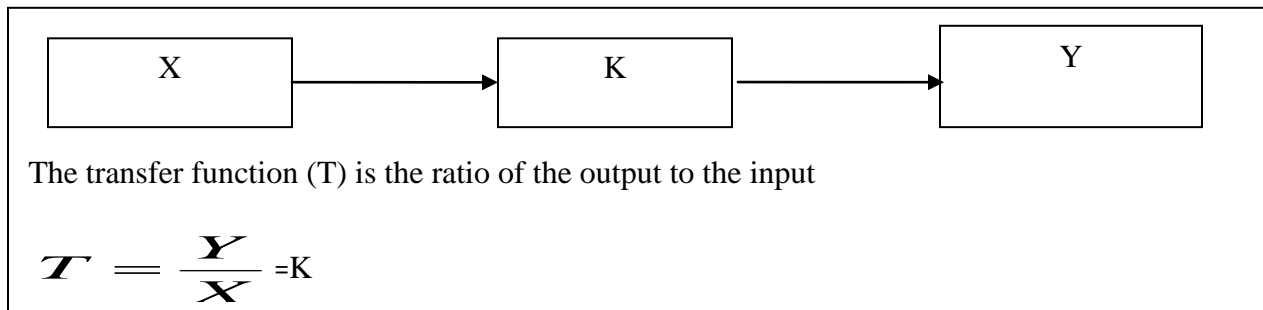
Figure Error! No text of specified style in document.**.1: Hare's 1967 Classic Systems Diagram showing single input (X) transformation (K) and single output (Y)**

According to Hare (1967), when a single input 'X' goes through a transfer function 'K' it results to a single output 'T'. Oliver (1997) as cited by Green (2014) also argues that it is possible to give details of the black box and show how inputs are transformed into outputs. He provides two requirements to rigorously describe transformation: first, by ordering of the functions and secondly, linking each input to a function. Figure 1:1 shows 'K' as a transfer function (process) which is the ratio of the output to the input. A simple schematic of the application of the black box model to educational planning is given in Figure 1.2.
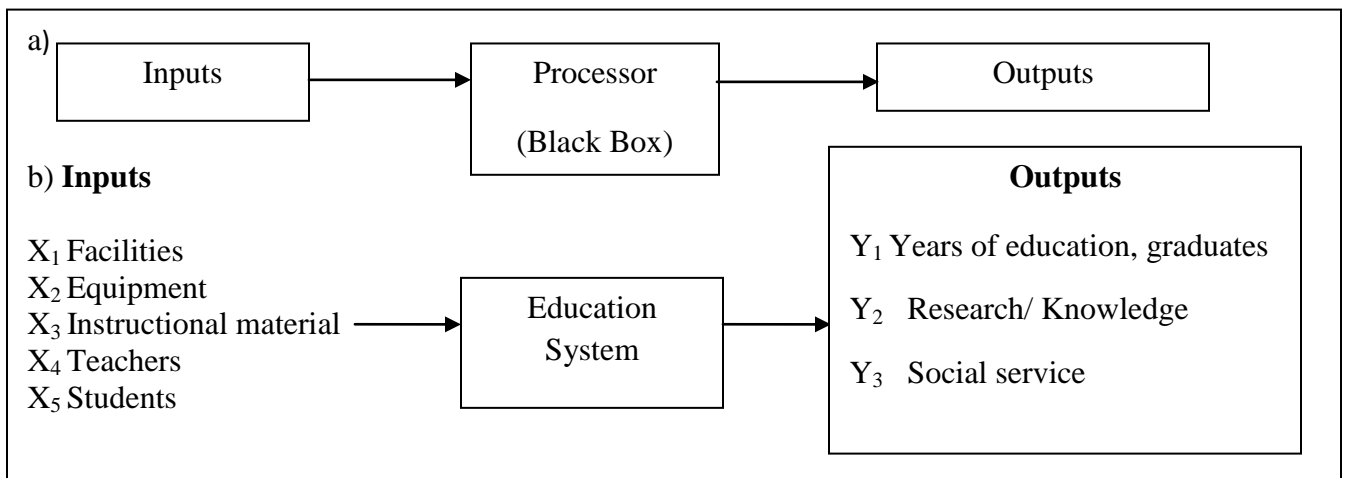
Figure Error! No text of specified style in document.**.2: Davis 1979 Black box Models as applied to education systems and processes**

When the inputs (facilities, equipment, instructional materials, teachers and students) go through the black box (Processor) which in this case is an education system, they are transformed into the desired outputs indicated by number of graduates, research, knowledge acquired and the social services given back to the society. In the study, as the input (students' enrolment, went through the processor (projected students' enrolment divided by Pupil Classroom Ratio, Pupil Desk Ratio, Pupil toilet Ratio as recommended by Ministry of education and Pupil Teacher Ratio as per TSC staffing Norms) the expected outputs were the indicators of quality education.

According to Davis (1979), there are six types of black box models applied in planning for education. These are; black box models for target setting and forecasting, black box models for tracing flows in a system, allocative black box models for modeling the attainment of objectives with fixed resources limits and input coefficients, black box models for analyzing in- put out-put relationships in a school system, Mathematical black box models for modeling of the learning process and lastly organizational black box models which cover organizational structures and processes in graphics. Since the purpose of this study was to project educational resource requirement for provision of quality education, black box models for target setting and forecasting were used.

Black box for target setting and forecasting are models and techniques for setting planning targets and forecasting the development of social and economic systems over time. Population projections or demographic forecasts provide the basis for most comprehensive planning. Demographic forecasts provide future estimates of school entrants and hence provide the basis for enrolment forecasting (Davis, 1979). In this study, school age population from the year 2021 to the year 2030 was first projected to form a basis for projection of school enrolment from the year 2021 to 2030. The projected school enrollment then formed basis upon which teacher

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requirement, physical infrastructure and average school size for provision of quality education were projected. . Figure 1.3 shows the application of the target setting and forecasting black box model of system theory to the current study.

IN-PUTS	PROCESS	OUT-PUTS
Projected Enrolment • Pupils enrolment in primary schools • Pupils enrolment in junior secondary schools • Projected enrolment in senior secondary schools	**Target setting models** • Projected Enrolment/ PTR • Projected Enrolment/PCR • Projected Enrolment/PDR (Primary) • Projected Enrolment/PDR (Secondary) • Projected Enrolment/PtR (Girls) • Projected Enrolment/PtR (Boys) • Projected Enrolment/AV.SS (Primary) • Projected Enrolment/AV.SS (Secondary)	**Indicators of Quality education** Pupil Teacher Ratio of 40:1 Pupil Classroom Ratio of 45:1 Pupil Desk Ratio of 3:1 Pupil Desk Ratio of 1: 1 Pupil toilet Ratio of 25:1 for Girls Pupil toilet Ratio of 30:1 for Boys Optimum school size of 540 pupils per primary school Optimum school size of 540 students per secondary school
Projected School age population • School age population at primary level (6-13 years and 6-11 years) • School age population at secondary level (14-17 years, 12-14 years and 15-17 years)		

FEEDBACK

Figure Error! No text of specified style in document.**.3: A schematic application of the Black box model of System theory in transformation of the input to the output**

Projected students' enrolment (which was projected based on the projected school age population) is the input which goes through the transformation process using the transfer functions; Projected students' enrolment divided by: the Pupil Teacher Ratio, Pupil Classroom Ratio, Pupil Desk Ratio, Pupil toilet Ratio and the Average School Size ratio (target setting models) to give output which should amount to; Pupil Teacher Ratio of 40:1, Pupil Classroom Ratio of 45:1, Pupil Desk Ratio 3:1 in primary and 1:1 in secondary, Pupil toilet Ratio of 30:1 for boys and 25:1 for girls and the optimum Average School Size of 540 pupils per school which, to this study, are indicators of quality education.

As the input (projected enrolment) goes through the various target setting models (process) to give the desired output (quality education) there is feedback at all the levels. Feedback tells whether a certain plan should be continued or not. For this reason, all educational development plans are made on a rolling basis, meaning, they are subject to modifications, revision, or changes depending on the feedback after some time of operation (Kaufman, 1988). The interaction between the projected enrolment and the target setting models will inform government policies especially on the staffing norms and the recommended ratios for the physical infrastructure. The interaction between the process (target setting models) and the output (quality education) gives feedback on the status of educational resources in schools and this will inform the government policy on funding of education especially in the era of 100% transition policy.

1.11 Conceptual Framework

According to UNESCO (2012), there are some basic features which are considered key to provision of quality education. These include the quality and quantity of the teaching workforce, the availability of adequate educational resources, a supportive learning environment and

suitable access to basic services in instructional settings like sanitation, clean water and electricity. All of these are important for the promotion of learning and educational performance. Quality education; the dependent variable; is attributed to provision of adequate educational resources (independent variable) as per the ratios recommended by the Ministry of Education and Teachers' Service Commission. Gross Enrolment Ratio approaching or surpassing 100% indicates that there is improved access to education by all children regardless of their age (UNESCO, 2009). Teachers are key resources in provision of quality education. The Pupil Teacher Ratio of 40:1 in primary and secondary schools implies that quality teaching and learning are taking place (RoK, 2008). This in turn leads to provision of quality education. It is in a classroom where learning takes place most of the time. Pupil Classroom Ratio of 45:1 is an indicator that the classroom is not crowded hence offering conducive environment to both the teacher and the learner which translates to provision of quality education (MoE, 2008).

Pupil toilet Ratio of 30:1 for boys and 25:1 for girls is a quality indicator which denotes adequacy of sanitation facilities and improved hygiene in schools. Pupil Desk Ratio of 3:1 in primary and 1:1 in secondary schools improves the personal comfort of the pupils and in turn increases the concentration span (MoE, 2008). Increased concentration span leads to improved academic performance which is an indicator of quality education. An optimum average school size of 540 pupils per primary and secondary school is a quality indicator of optimal utilization of teachers, classrooms, toilets and desks (RoK, 2015). Optimal utilization of educational facilities reduces the unit cost of education and increases the quality of the learning outcomes. However, changes in population growth rate and political factors, TSC staffing norms, Ministry of Education guidelines and policies and socio-economic factors (intervening variables) may moderate the effect of students' enrolment, number of teachers, physical infrastructure, and

school size (independent variables) on provision of quality education (dependent variable). The interaction between the independent (educational resource requirement) and the dependent variable (Quality education) is shown in Figure 1.4.

Independent Variable	Intervening Variables	Dependent Variable
Educational Resources **Student Enrolment** • Age **Teacher** • Number of teachers (Primary) • Number of teachers (Secondary) **Physical Infrastructure** • Classroom • Toilets • Desks **School Size** • Student Enrolment per school	Population Growth Rate Political factors TSC Staffing Norms Ministry of Education Guidelines and Policies Socio-Economic issues	**Quality Education Indicators of quality education** 100% Net Enrolment Ratio 100% Gross Enrolment Ratio Pupil Teacher Ratio of 40: 1 (Primary) Pupil Teacher Ratio of 40:1 (Secondary) Pupil Classroom Ratio of 45:1(Primary) Pupil Classroom Ratio of 45:1(Secondary) Pupil toilet Ratio of 30: 1 for boys (Primary and secondary) Pupil toilet Ratio of 25:1 for Girls (Primary and secondary Pupil Desk Ratio of 3:1 (Primary) Pupil Desk Ratio of 1:1 (Secondary) Minimum of 360 (8-4-4) and 270 (2-6-6-3) pupils per primary school Minimum of 180 (8-4-4) and 135 (2-6-6-3) students per secondary school

Figure Error! No text of specified style in document.**.4: Conceptual Framework depicting the independent variable; educational resources, and the dependent variable; quality education**

1.12 Definition of key operational terms

Average school size: This is the optimum number of pupils that a school is supposed to have in order to improve efficiency in utilization of the teacher resource and the physical infrastructure. According to the Ministry of Education (2015), the recommended average school size of at least 3 streams per class with a class size of 45. This is equivalent to 540 pupils per school.

Curriculum Base Establishment: Total number of teachers required to teach in a school depending on the number of streams and subjects taught.

Educational resource requirement: In this context, educational resource requirement refers to students' enrolment, number of teachers, physical infrastructure (classrooms, toilets and desks) and average school size. These are the independent variables in the study.

Projection: In this context, projection refers to estimation of school age population, students' enrolment and educational resource requirement in Siaya County from the year 2021 to 2030.

Provision: Provision in this context is the availing of adequate educational resources as recommended by the Ministry of Education and Teachers' Service Commission.

Quality education: Quality education in this context refers to Pupil Teacher Ratio of 40:1 as recommended by TSC staffing Norms, Pupil Classroom Ratio of 45:1, Pupil Desk Ratio of 3:1 in primary and 1:1 in secondary, adequate number of toilets for toilets whose indicators are Pupil toilet Ratio of 30:1 for boys and Pupil Toilet Ratio of 25:1 for girls and optimum average school size of 540 students per school as recommended by Ministry of Education guidelines and policies. Quality education is the dependent variable in this study.

School age population: The population of the school-age period, conventionally defined as ages 6-13 years in primary schools and 14-17 years in secondary schools under the 8-4-4 system of

education and 6-11 years in primary, 12-14 years in junior secondary and 14-17 years in senior secondary under the 2-6-6-3 system of education

School enrolment: Total number of children enrolled in primary and secondary schools at any given time.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This section reviews the related literature on projection of educational resource requirement for provision of quality education in primary and secondary schools in Siaya County by 2030 under the following sub-themes: school age population, school enrolment and provision of quality education, teacher requirement for provision of quality education, physical infrastructure for provision of quality education and average school size for provision of quality education.

2.2 School age population, school enrolment and provision of quality education

Projection of the future size of school age population enrolled at any level of education constitutes the starting point of educational planning. This is so because it provides the basis of estimating future number of schools, classrooms, teachers and other facilities. The objective of projection would be to develop a basic frame of reference for the future. Demographic factors and development of education are interrelated in many ways (Ahmed, 2000). Expenditures on education are proportionate to enrolment and consequently depend indirectly on the school age population (Ta-Ngoc, 2003).

In education, population projections provide education planners with the expected number of pupils/students in future, if the education system does not change. They also inform on the future trend and pattern of education parameters, particularly the resources required in the education system (Agboola and Adeyemi, 2013). Projections of school age population are therefore important since they indicate the total number of children who should attend school (UNESCO, 2006). Aghenta (2001) as cited by Agboola and Adeyemi (2013) opine that knowledge of future school age population is important for education planners to make informed decision regarding

educational facilities and staffing. Enrolment projections constitute the numerical basis for planning the future supply of educated labour as well as the future needs for teachers, classrooms and other facilities (UNESCO, 1984). This implies that for meaningful education planning to take place, an educational planner needs to know school age population which will be used to calculate school enrolment rates. The enrolment rates will enable the stakeholders in the education sector to plan for provision of adequate vital educational resources well in advance and this will in turn improve quality of education.

According to the 2019 national census, there were 47.6 million Kenyans, of which 36 percent are aged 4-17 years and are of pre-primary, primary and secondary school going age, collectively regarded as basic education. The official school age in Kenya is classified as follows: 4-5 years for pre-primary, 6-13 years for primary and 14-17 years for secondary. The largest share of the school going age population constitutes primary school going children who make up 21 percent of the population, followed by nearly 10 percent secondary school going-children and over 5 percent who comprise pre-primary going children. Nearly 10 percent of Kenyans are of tertiary education going age. A large share of the total population of Kenya is of school going age and in order to cater for such numbers, the country needs to dedicate more resources to the education sector (ROK, 2019).

2.2.1 A review of population projection models

There are various methods of projecting population (mathematical, economic and cohort-component methods). Some are very sophisticated and rigorous while others are simple and less sophisticated. Identifying which projection model is optimal for a specific type of projection depends on several factors. Of crucial importance is whether the projections are to be carried out for larger geographical areas (e.g. projections at national level) where uncertainty is lower, or

smaller areas (e.g. projections at county level) where migration makes future population developments more volatile and projections more difficult (KNBS, 2012). The most commonly used projection methods are discussed below.

(i) Cohort Component Method

Age-sex cohort component method depends upon the assumptions on the dynamics of the population parameters: dynamics of fertility, mortality, expectation of life, survivorship ratio, migration etc. In the computation process, separate projections are made for males and females in the 5 year age bands for each five year interval of the projection period. The number of persons of a given sex and five year age group five years after the base year is obtained by multiplying the base population by age-sex specific survivorship ratios. Algebraically:

$$P_{x+5}^{t+5} = P_x^t \bullet S_{xtox+5}^{t+2.5} + NM_{x+5}^{ttot+5}$$

Where 'P' is the number of persons of a given sex at midyear 't' in 5 year age group x, S represents the sex specific survivorship ratio of a given sex and NM is the net number of in-migrants during the five year interval. This method is the standard method for population projection. World Bank, UNESCO, UN-organizations and Planning Commission use this method for population projection (Ahmed, 2000). Using the cohort component method of projecting population by age and sex, Kenya National Bureau of Statistics (2012) projected that there would be 50.3 million Kenyans in 2020.

The cohort-component method is widely used because it accounts separately for the components of growth, can accommodate a number of different theoretical models and projection techniques, and provides projections of demographic characteristics and the size of the total population (Mehta, 2004). However, it is a data-intensive method (have heavy data requirements, hence

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time consuming) that requires the collection or calculation of many age- and sex-specific fertility, mortality, and migration rates which are rarely available at the sub-regional levels.

(ii)The growth rate method

For computing the annual rate of growth (simple), the following formula can be applied to the information at any two points of time.

$$r = \frac{1}{n}\left[\frac{p_n - p_0}{p_0}\right] \times 100$$

Where;

r = annual rate of growth

P_n = population in the current year

P_o = population in the base year
n = number of intermediary years.

A slightly improved method is the **Compound Rate of Growth** method, which can be computed with the help of the following formula.

$$R = [(P_n / P_o)^{1/n} - 1] \times 100$$

Therefore projection of population for a particular year is carried out by the formula;

$$P_n = P_o (1+R/100)^n$$

One of the limitations of this method is that while computing the rate of growth, it considers information at only two points of time. Thus, it fails to utilize the available statistics fully.

(iii)The constant ratio share method of population projection

The constant ratio share method is based on the ratio of the district population to that of the state population. After the ratio of the district to state population is obtained, assumptions are made on the future values of ratios. Once, the future values of ratios are fixed, the population of the

district can be obtained by applying that ratio to the projected state population in that year. This can be repeated to any year for which the projected state population is available. In the absence of the projected state population, first the same needs to be projected independently before the exercise of district level projection can be undertaken. Thus, the ratio (R) is defined as:

$$R = Pi^{[t]} \Big/ Pc^{[t]}$$

Where Pi (t) is population of i-th district at time 't' and Pc(t) is the population of the state at time 't' to which district 'i' belongs. The ratio method assumes that population projections in case of the larger area (state), to which the smaller area (district) belongs, is available. If population projections at the state level are not available, the methodology suggested above cannot be directly applied. In that case, either the state level population needs to be first projected or independent projection exercises at the district level need to be undertaken.

In choosing which projection method to use, it is important to note that there is no superior method than the other for all purposes. However, each projection method has its strengths and weakness that must be evaluated according to, among others, its face validity, cost, data requirements, ease of application, and other parameters (KNBS, 2012). Detailed demographic data is generally not available at the block and district levels and hence it is not possible to undertake detailed population projection exercises at these levels. But to develop elementary education plans at these levels, information on a few other demographic variables is also required. Population in the age groups of 6-11 (6+ to 10+), 11-14 (11+ to 13+), 6-14 (6+ to 13+) years and single age-6 population are some such variables (Mehta, 2004).

Kamunya (2012) used cohort component method of population projection to project school age population for primary schools in Central Province. The projected school-age population was

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used to generate school-age population for the respective counties of Nyeri, Kirinyaga, Murang'a, Nyandarua, and Kiambu using ratio method of population projection. The study found out that, in Central Province, there was a population of 813,000 pupils in 2010, and it was set to increase to 965,000 pupils in 2020 and 1.08 million pupils by 2030. Oloo (2017) used age sex cohort component method of population projection to project school age population in Kenya for the period 2013 to 2030. Ahmed (2000) also used age sex component method of projection to project school age population in Bangladesh for the period 2000- 2020. Since components of population change like migration rates, birth rates and death rates for the entire country are easily available at the national and regional levels, cohort component method of population projection was the most suitable method for these studies.

According to KNBS (2012), one of the uses of projected population is distribution of resources. National, regional and local planners all need, for various purposes, to have some idea of likely future changes in size, composition and distribution of the population in their respective areas. The new structure of devolved governance in Kenya introduces a greater demand for projected population figures at sub-national level like never before. However, most of school age projections carried out have been at the national and regional levels using cohort component methods of projecting population as requisite input information about the components of population change is always available. On the need to have school age population at the county level, Kamunya (2012) argues out that continued lack of data on educational demand can result in serious oversight, which may lead to poor distribution of resources within the counties hence the need to provide projected school-age population at county level.

There was therefore need for projection of school age population at the county level that would inform distribution of educational resources among the school age population at the county level as the county is a planning unit under devolved governance. Since detailed demographic data is generally not available at the county and sub-county levels, school age population for Siaya County for the period 2021 to 2030 was therefore projected using the compound rate of growth method of population projection.

According to 1999, 2009 and 2019 Kenya Population and Housing census, Siaya County had enumerated population of 712, 309, 842, 304 and 993, 183 respectively. Using 842,304 (2009 census) as base population, KNBS statistical abstract (2019), using the constant ratio share method, projected this population to reach 1,027,795 in 2019. However, using the compound rate of growth method of population projection, Siaya population was projected to reach 996, 962 by 2019. Subtracted from the enumerated population for 2019, the projected population using constant ratio share method was 34, 612 (3.48% deviation) more than the enumerated population while the projected population using the compound rate of growth method was 3,179 (0.38% deviation) more than the enumerated population. Population projected using the compound rate of growth method is therefore more accurate than population projected using the constant ratio share method. This informed the choice of method for projection of school age population in Siaya County for the period 2021 to 2030.

Projection of school enrolment, on the other hand, constitutes the starting point for studying the effects of population growth and distribution on educational resource requirements. School enrolments provide the basis for estimating the future supply of educated labour as well as the future needs for teachers, classrooms and other facilities. In short educational systems must be planned to serve the major economic and social objectives of the society: efficient economic

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development, demand for education, the pursuit of social justice, and a greater access to knowledge for its own sake (Ahmed, 2000). Agboola and Adeyemi (2013) also state that student enrolment at any level of education is very crucial to the achievement of the nation overall goals through education. There is need to know the actual number of students that are enrolled in the educational system because other school characteristics such as human, facilities, funds depend on it. Population of a country at any given time is also important because enrolment of school age is a function of a nation's demographic characteristics. Enrolment changes every year because of population dynamics. Increase or decrease in school age population could have direct impact on school enrolment.

For the purpose of estimating future school enrolment, special attention must of course be given to the population in the school-going ages. There is need for carefully prepared estimates of future school enrolment. Such estimates would help to avoid the risk of unexpected surprises, haphazard guesses, or impractical policies adopted without sound bases. In short, as educational planning is essential to well-balanced economic and social development, so are estimates of future school enrolment an indispensable element in educational planning (UNESCO, 1980).

According to UNESCO (1980), there are several ways in which estimates of future school enrolment would be useful to those who are responsible for the administration and planning of education in a developing country. First and foremost, a serious shortage of teachers may often be the result of failure to anticipate the growth of the school-age population. With a rapidly growing population, an ever-increasing number of teachers will be needed just to keep a country's education at the same level. Since teachers cannot be produced instantly on demand, the far-sighted administrator would want to know just how many new teachers must be trained in

the years to come. The answer will depend in part on how many children will have to be taught. Therefore the potential school enrolment must be estimated in advance.

Secondly, to know how many and what kinds of schools must be built or otherwise provided, plans must be made early enough to enable budgets to be submitted and approved, funds to be appropriated and other steps to be authorized by the proper authorities. For this purpose, the future school enrolment must be estimated in some detail as to the level of education, type of school, and even the area or locality involved. Thirdly, before introducing a new law or changing an existing one on compulsory education, it would be only prudent and reasonable to find out what would be the probable size of the educational task under such a new law or amendment. This would require first an estimate or a series of alternative estimates of the potential school enrolment, depending on the type 'of contemplated change.

This therefore implies that projected school age population and projected school enrolment forms a base upon which planning for educational resources that are vital in provision of quality education is made. In Kenya, the pupils demand for primary education is growing annually and dictates manpower requirement to satisfy the demand. Mutua and Namaswa, (1992) as cited by Kipng'eno (2014) pointed out that the number of children of school going age, number of children born annually and the number of children of age-group who need education but out of school need to be determined. Projection on school's enrolment therefore helps educational planners and policy makers to forecast human resources needed in future time.

School enrolment can be projected using either mathematical or analytical methods. Mathematical methods require aggregate enrolment data of at least five to ten years, and only total enrolment can be projected by employing both the linear and non-linear equation methods.

These methods involve an extrapolation of the past into the future and the assumption that the past trend in enrolment would continue into the future. While in analytical methods, apart from actual enrolment, estimation, assumptions and targets on items like promotion, drop-out, repetition and apparent entry rates are required. The demographic pressures on education can also be captured by the analytical techniques as the computation of the apparent entry rate is based on the population of school entrance age, that is, 6 years. There exist many different types of flow models, ranging from rather primitive ones to very sophisticated model systems. According to Mehta (2004), there are basically three methods of enrolment projections namely; rate of growth, enrolment ratio and grade-transition method. Enrolment can also be projected by using the method of least squares.

The simplest technique of enrolment projections is the rate of growth method. It only requires enrolment data at two points of time; enrolment in the current year and enrolment in the base year. This method assumes a constant rate of increase over the projection period. By this method, one can project aggregate (total) enrolment at different levels of education. One of the important drawbacks of rate of growth method is that the population factor is completely missing, though enrolment is considered to be a function of population.

The Grade Transition Model is particularly well suited for projecting the future implications of continuing present trends in intake, promotion, repetition, drop-out and graduation rates. It should be noted that in order to be able to calculate transition rates for each age-group in each grade, one needs data on repeaters as well as enrolment by age and grade. However, most of the countries collecting data on enrolment by age and grade do not collect information on the age of the repeaters easily (UNESCO, 1980). One disadvantage of grade transition model is that this method requires detailed data on repeaters, drop outs and survivors which is not always available

at sub national level (Mehta, 2004). Moreover, in 2013, repetition of classes in Kenya was outlawed by the Ministry of Education through Circular No MOE/HRS/3/7/4 (World Bank, 2014). This means that transition in primary schools from one class to the other was to be calculated at 100%. The repetition parameter therefore cannot be used in projection of school enrolment. Grade transition model could therefore not be used to project enrolment in this study. Enrolment ratio method is another method which captures demographic pressures like the grade transition model. It is based on enrolment ratio, which is calculated on the basis of past data, and is extrapolated into the future by applying a suitable mathematical technique or a specific logic. It is assumed that 6-13 and 6-11 (in case of primary enrolment) and 14-17, 12-14 and 15-17 (for secondary enrolment) years age groups projected population is available along with the enrolment figures. Results would be more reliable if net enrolment ratio is used instead of gross enrolment ratio. One disadvantage of this method is that it does not take into account the internal dynamics of enrolment from year to year and from one grade to another. However, since enrolment for the last five years for pupils in primary and secondary schools in sub-counties in Siaya County was available, this study used enrolment ratio method to project enrolment.

A total of 937,372 candidates sat for their K.C.P.E examinations in 2015. However, in 2019, only 699,706 candidates sat for K.C.S.E examinations. This is equivalent to 74.65% completion rate. According to Kenya National Examination Council (KNEC), 751,150 students are registered for K.C.S.E examinations in the year 2020. However, there were 952, 388 pupils who sat K.C.P.E exams in 2016. This means that the 751,150 candidates registered for K.C.S.E exams in 2020 is 78.87% of 2016 K.C.P.E candidature. This is an indicator of drop-out between grades. The national transition rate from primary to secondary stood at 95% in 2019 (MOE, 2019). This implies that despite the FPE, FDSE and 100% transition policies, transition rate from grade to

grade and from primary to secondary is not at 100%. Since repetition in schools was banned, enrolment can only best be projected by observing the enrolment trends for the past years and extrapolate the same trend into the future. This makes enrolment ratio method the best in projection of pupils' enrolment. The current study used the enrolment ratio method to project school enrolment in primary, junior and senior secondary schools under the 2-6-6-3 system of education.

A review of methods of enrolment projection reveals that each one of them has certain advantages and disadvantages over the others. The choice of models to be used is, however, severely restricted by the type of data available, particularly in developing countries (UNESCO, 1980). In order to estimate future school enrolment, at least four general types of basic information are needed. The first relates to the population of school age, the second to pupil enrolment, the third to various rates and ratios derived from the first two types of data, and the fourth to questions of administrative policy affecting education in general and school enrolment in particular (Mehta,2004).

Several studies in Kenya have projected students' enrolment in order to form a base upon which to establish educational resources required. Oloo (2017) did a study on projection of optimal allocation of educational resources in Primary and Secondary schools in Kenya during 2013 to 2030. One of the objectives of the study was to make projections of enrolments by primary and secondary education for the period 2013 to 2030. Cohort projection model was used to generate desired enrolments. Mbeche (2003) also did a projection of enrolment in Bachelor of Education programme to meet the demand of teachers for integrated English in public secondary schools in Kenya. However, due to disparities in school enrolment across the counties in Kenya, projected enrolment at the national level cannot be used for planning of educational resources at the county

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level as it is based on the average school enrolment in the 47 counties. There was need to project enrolment at the county level as it would give a more realistic estimate of student enrolled in Siaya County.

Projection of school enrolment by Oloo (2017) and Mbeche (2003) used grade transition model (cohort component projection). Repetition rate was one of the internal efficiency indicators that was used in these models. Currently, tracing repetition rates in schools is not easy as repetition of classes in Kenya was outlawed by the Ministry of Education through Circular No MOE/HRS/3/7/4 in 2013. Due to changes in education policies, projection of enrolment in the current study was carried out using enrolment ratio method.

The on-going education reforms in the country are affecting the school age population at different levels of education. Primary and secondary school ages have been changed from 6-13 and 14-17 years respectively as it were under the 8-4-4 system of education to 6-11, 12-14 and 15-17 for primary, junior and senior education levels respectively under the 2-6-6-3 system of education. Number of schooling years at primary level of education has been consequently reduced from eight to six years while number of schooling years at secondary education level has increased from four to six years. Projections by Oloo (2017) and Mbeche (2003) were based on the 8-4-4 system of education. There was therefore need for projection of school age population and school enrolment based on the aforementioned educational reforms to provide a base upon which educational resources for primary, junior and senior education levels under the 2-6-6-3 system of education would be planned for well in advance and enable the county to achieve quality education envisaged in Kenya Vision 2030.

2.3 Teacher requirement for provision of quality education

Teacher resource is a vital input into the education process as teachers are responsible for the delivery of the curriculum and hence are critical in determining the quality of education (Kimaru, Kiprotich & Kosgei, 2014). Every education system is only as good as the teachers who provide the hands-on schooling. Study after study has confirmed the teachers' critical role in improving education quality and learning outcomes, which is why SDG 4 calls specifically for a major increase in the supply of qualified teachers and more support from the international community for teacher training in developing countries (UNESCO, 2016).

Teachers play a key role in the teaching-learning process. It is therefore imperative to ensure that schools are adequately staffed with qualified and well-trained teachers. Knowing how many teachers are needed in a system is crucial in advancing its success (Mulkeen 2010). Predicting the number of teachers is based on estimated demand for schooling considering the school age population, gross enrolment rate and average pupil teacher ratio. It is then necessary to estimate number of new teachers needed as a result of additional positions and teacher attrition including both private and public schools (UNESCO 2010). Projections are based on the assumption that the past trends will continue to operate in the future and are usually extrapolations of past and present population trends into the future (Kodiko, 2014).

The number of primary teachers in Sub- Saharan Africa may have to rise by 68 percent, from 2.4 to four million in the period from 2006 to 2015 in order to meet the requirements of providing universal primary completion (UIS 2006). Even where there are sufficient teachers, they are not always employed where they are most needed, or specialized in the appropriate subjects. Student enrollment directly influences teacher demand. An increase in the school-age population corresponds with an increase in the number of teachers needed in the education system, as long

as pupil-teacher ratios remain constant. Future public school enrollment numbers can be estimated by looking at birth rates, public school attendance rates, and immigration and migration patterns. These indicate how many school-age children will enter school. Once the number of students entering school is estimated, historical data can be used to model how many students will stay in school and for how long (Mulkeen, 2010).

Estimating teacher demand means forecasting the number of teachers necessary to teach the forecasted number of pupils. According to ILO (2012), the number of teachers needed is not only dependent on the number of pupils but also on system efficiency and how teachers are deployed to meet education, quality and equity goals. It was observed that teacher requirement depends on three main factors: The number of people to be taught (enrolment), the relationship between the number of people to be taught and teachers (pupil teacher ratio) and the number of new teachers needed to replace those leaving the profession.

In Kenya, teachers' recruitment and deployment is done by the Teachers Service Commission (TSC). The TSC was established by the TSC Act CAP 212 of the Laws of Kenya (Republic of Kenya, 1968). TSC since its inception in 1967 had been employing teachers through supply-driven process. It was until 1998 when the government of Kenya froze teacher recruitment as a cost cutting measure. Consequently, there was understaffing in schools. This led to adoption of demand driven policy on teacher recruitment in 2001. Under demand-driven teacher recruitment policy the government has been employing limited number of secondary school teachers annually (Maithya & Akala, 2014).

According to the Ministry of Education Approved Basic Education Statistical Booklet (2019), teacher shortages still exist due to national staffing norms of assigning a teacher per classroom in

primary schools and Curriculum-based Establishment (CBE) for staffing in secondary schools. There is also disparity in the distribution of teachers among the counties. The national staffing norm of assigning a teacher per physical classroom in primary schools does not put into consideration pupils' enrolment at all and this has led to high Pupil Teacher Ratio. A high teacher pupil-ratio implies that each teacher has to be responsible for a large number of pupils. In other words, the higher the pupil/teacher ratio, the lower the relative access of pupils to teachers. It is generally assumed that a low pupil teacher ratio signifies smaller classes, which enables the teacher to pay more attention to individual students, which may in the long run result in a better performance of the pupils. In the current study, determination of teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030 was based on the projected pupils' enrolment and the recommended Pupil Teacher Ratio of 40:1.

2.3.1 Methods used in projection of teacher requirement

Enrolment statistics form the basis for many investment decisions in education. A teacher is the most important academic input especially at the primary level and teacher's salaries accounts for a major share of recurring expenditure on education. Projections on requirements of teachers follow enrolment projections. The most commonly used methods of teacher projections are pupil teacher ratio and method based on the number of pupils per class and hours taught by a teacher (Kipng'eno, 2014).

i. Pupil Teacher Ratio Method

The pupils-teacher ratio method calls for a calculation based on the pupil-teacher Ratio formula. In projecting teacher requirements, the base year ratio is computed, and on the basis of resources available, the pupil-teacher ratio is projected or fixed in the future. While taking into account the total additional requirement of teachers, one should consider the rate of replacement of teachers.

The steps for projecting teacher requirements can be divided into two parts: Calculating the total number of teachers required and calculating the net additional teachers required during the year. Net additional requirement of teachers is then obtained by considering the annual replacement of teachers on account of attrition like death, resignation, retirement among other things, on the part of teachers. Calculations are based on the following pupil-teacher ratio formula:

$$T_s^t = \frac{E_s t}{R_s^t} \quad \text{Where;}$$

T_s^t = Number of teachers at a particular time (t) and for particular stage or school (s);

E_s^t = Enrolment at particular time (t) for particular stage or school (s); and

R_s^t = Teacher-Pupil Ratio at a particular time (t) for particular stage or school (s).

One of the basic assumptions of this method is that it is the number of students and not their grade distribution which is important. The distinction between stage and school needs to be carefully noted. For stage-wise enrolment, stage-wise teachers are required for calculating teacher-pupil ratio. This method, though very simple, is suitable for making projections mainly at the primary stage of education where specialized teaching is not a norm. For other stages of education, this method is not suitable.

According to Teachers service commissions staffing manual of 2008, deployment of teachers in primary schools is based on an establishment of one teacher per class plus 2.5 percent of the total number of teachers in a sub-county. This is applied while at the same time maintaining the official PTR of 40:1. Therefore the estimation factor of establishing the projected primary school teachers required each year is total enrolment in a year divided by 40 and then add 2.5% which is summarized as (N/40)+ 2.5/100*N/40) where N stands for total enrolment.

(ii) Method Based on Number of Pupils per Class and Hours Taught by Teacher

This is a method used for projections of teacher requirements in the future. It takes into account the size of the class, the number of hours the students receives instructions per week and the number of hours taught by a teacher per week. This method requires a number of information which includes enrolment at every grade; average number of hours per week for a student as per the time-table; average number of students taught at the same time by one teacher; and average number of student-hours per week taught by a teacher. According to this method, the requirement of teachers is determined by the following procedure:

$$T= \frac{E \times Hs}{R \times H_t}$$

Where,

T = Number of teacher required;

E = Projected enrolment;

R = Average number of students per teacher or per instructional group or size of average class;

Hs = Average number of weekly hours per student which is generally prescribed in the school curricula; and

Ht = Average number of weekly hours per full-time teacher.

The above equation is very useful for planning purposes. All the different factors can be planned, as none of them is constant. In this equation, the number of teachers required is directly proportional to the number of pupils and the average weekly hours per student. If the number of

hours taught per week by the teacher is equal to the number of hours of teaching required by the students, the equation will become simple and identical to the PTR method

$$T = \frac{E}{R}$$

In case, the authorities decide the teacher-pupil ratio or the same is prescribed as a norm, then the method presented above may not be used to work out the number of teachers. Naturally, the educational administrator will consider certain factors, such as the immediate past trend in teacher-pupil ratio, logic for increased or reduced ratio, their financial implications and availability of funds.

According to TSC staffing manual of 2008, deployment of secondary school teachers in Kenya is according to the curriculum Based Establishment. Each teacher is required to teach a minimum of 27 lessons per week translating to 18 hours in a week. Each stream of a class has at least 9 lessons of 40 minutes translating to 30 hours in a week. Institutional administrators are however allocated a lower work load to allow them more time for administrative duties. This is done while at the same time striving to achieve the official PTR of 40:1.The estimation factor for the projection of secondary school teachers' required in a year is generated as follows: one stream is allocated 30 hours in a week while one teacher covers 18 hours per week giving a factor of (30/18 *N/40) which is summarized as (1.667*N/40) where N is the total secondary schools enrolment in a given year (ROK, 2008c).

In Kenya, there was a general increase in PTR from 34:1 in 2002 to 45:1 in 2008 nationally in primary schools. Republic of Kenya (2005C) as cited by Oloo (2017) noted that there was need to urgently implement the TSC teachers staffing norms of 2005 that recommended balancing of

teachers and decentralization of teachers recruitment for primary and secondary levels of education in Kenya and that that would allow the government to distribute primary school teachers across regions based on the recommended PTR 45:1 for high potential and 25:1 for ASAL regions. TSC came up with a manual of staffing functions in 2008 from a research done in 2005 which stipulated that in primary schools, there would apply two scenarios where first, one teacher per class plus 2.5 percent with no provision for administrative allowance and a second one of PTR of 45: 1 in high potential areas and 25:1 in low potential areas with provision of 0.75 full time equivalent administrative allowance (Oloo, 2017). The projection done is shown in Table 2.1

Table Error! No text of specified style in document.**.5: Teacher requirement for primary schools in Kenya**

Primary schools	Teachers on Duty	Projected Total	Gap
Scenario 1 (PS1)	170, 611	215, 791	45,180
Scenario 2 (PS2)	170, 611	193, 350	22, 739

Source: Study on new teachers staffing norms (ROK, 2005c)

Table 2.1 indicates that scenario 1 would project teacher requirement for primary schools to be 215,791 in 2005 giving a shortage of 45, 180 teachers while scenario 2 gave a projection of 193,350 teachers in 2005 giving a shortage of 22,739 teachers. The study also analyzed two scenarios for the secondary schools as follows. First scenario was based on the existing staffing norm where the weekly work load per teacher was 27 lessons (18 hours) per week of student-teacher contact time and second scenario was based on the recommended staffing norm where the weekly work load per teacher was 30 lessons (20 hours) per week of student teacher contact hour. The projections then done for secondary level were as shown in Table 2.2.

Table Error! No text of specified style in document.**.6: Teacher Requirement for secondary schools in Kenya**

Secondary schools	Teachers on Duty	Projected total	Gap
Scenario 1 (SS1)	57,209	65,609	8,400
Scenario 2 (SS2)	57,209	63,139	5,900

Source: Study on new teachers staffing norms (ROK, 2005c)

Table 2.2 indicate secondary school teacher requirement using scenario 1 as 65,609 teachers giving a shortage of 8,400 teachers whereas scenario 2 projected 63,139 teachers giving a shortage of 5,900 teachers in 2005.

The Ministry of Education, Science and Technology 2013-2018 National Education Sector Plan policy target was to improve efficiency in utilization of education sector human, financial and capital resources by ensuring primary education PTR of 45:1 for high potential areas; and 25:1 for low potential areas; and class size of 50, to have at least 3 streams per class in all secondary schools, class size of 45 students and average PTR of 35:1 by 2018 (ROK, 2015). However, as much as this policy target seeks to improve quality of basic education, the pupil teacher ratio of 45:1 in primary is still high especially as the country implements competency based curriculum which is learner-centred hence requiring low pupil teacher ratio. Secondly, teachers at any given time will teach the number of pupils (class size) who are in class at that time. Therefore the policy of Pupil Teacher Ratio of 45:1 and Class size 50 need to be harmonized as this has always led to high pupil teacher ratio as the class size has actually replaced the pupil teacher ratio. Internationally, the recommended PTR is 40:1.

Both Oloo (2017) Wamukuru (2011) projected teacher requirement at the national level. However, these two projections on teacher requirement are too general and do not consider the

regional disparities in distribution of teachers. A critical challenge, according to Republic of Kenya (2006), relates to teachers' availability. There is inequitable distribution of teachers at the primary school level. There are also regional inequalities. According to ROK (2019), the PTR at primary level was 39:1 for public schools and 24:1 for private schools. At the secondary level, public schools had a PTR of 29:1 as compared to 19:1 in private schools. However, there is also disparity in the distribution of teachers among the counties. The projections at the national level are based on the average teacher requirement in the country and may not give the exact number of teachers that each county requires hence the disparities and inequalities. This study therefore projected teacher requirement in primary and secondary schools in Siaya County by determining the exact number of teachers required in each of the six sub-counties and summing them up to come up with teacher requirement at the County level by 2030.

Kurgat, Kiptoo and Kisilu (2014) did a study on projecting students' enrolment and teacher demand in secondary schools in 2015: A survey of selected secondary schools in Kenya. The projection of teacher demand in this study was based on Pupil Teacher Ratio. According to Mehta (2004), PTR method, though very simple, is suitable for making projections mainly at the primary stage of education where specialized teaching is not a norm. For other stages of education, this method is not suitable. This method therefore may not give a realistic teacher requirement at the secondary school level since it does not consider subject specialization. Secondary school teachers staffing needs in Kenya are determined based on the CBE (Maithya & Akala, 2014). This study sought to predict teacher requirement in primary schools in Siaya County using PTR method and teacher requirement in secondary schools using method based on number of pupils per class and hours taught by teacher.

Kimaru, Kiprotich and Kosgei (2014) did a study on projection of primary schools' teacher recruitment and demand by the year 2015 in Nandi Central District, Kenya**.** This study used number of teachers, projected annual teacher increment and projected annual teacher wastage rate to project teacher demand by 2015. This study left out a very important component of teacher projection which is students' enrolment. According to Mehta (2004), projections on requirements of teachers follow enrolment projections. In the current study pupils' enrolment was projected first and then used to project teacher requirement in primary and secondary schools in Siaya County.

2.4 Physical infrastructure requirement for provision of quality education

The Sustainable Development Goal 4 (Target 4a) addresses the need for adequate physical infrastructure and safe, inclusive environments that nurture learning for all regardless of background or disability status. The quality of education given in any school setting bears direct relevance to the availability of physical facilities and the overall atmosphere in which learning takes place. Where school facilities are deficient or defective, teaching and learning stand to suffer, thereby creating a negative impact on the goals of education (Ekpoh, 2018).

School infrastructure include classrooms, laboratories for the science practical, the halls and open fields for games, games equipment, dormitories, sanitation facilities and others. It is in the classrooms that the day to day formal teaching and learning take place, in the libraries, learners get the opportunity to conduct their own personal studies or research as the resource materials are found therein, it is in the fields that extra-curricular activities take place, learners and teachers need to be housed in the school and at the same time need sanitation facilities like toilets, waste disposal services and clean water etc. For this reason, school infrastructure is a very

important component in ensuring successful education. It is a fact that schools vary in the kinds of infrastructure they have put in place to enable learning for quality education (Oyoo, 2013).

According to the Ministry of Education's Safety Standards Manual for schools in Kenya (2008), physical facilities include structures such as classrooms, offices, toilets, dormitories, libraries, laboratories, kitchen, water tanks, play-ground equipment, among others. These facilities can be either permanent or temporary structures. Such physical structures should be appropriate, adequate and properly located, devoid of any risks to users or to those around them. They should also comply with the provisions of the Education Act (Cap 211), Public Health Act (Cap 242) and Ministry of Public Works building regulations/standard.

According to Rivera (2016), investments to improve school infrastructure has effects on the education quality at least in the following three dimensions. First, physical infrastructure increases attendance and completion of academic cycles. Secondly, it motivates teachers and thirdly, it improves learners' results. Classroom, toilet and desk requirement are the physical infrastructure that were projected in the current study as they are basic resources that a school must have in order to achieve favourable learning environment (Inter-American Development Bank, 2016).

Recent studies have emphasized the importance of the availability of physical facilities in provision of quality education. Ajayi and Ayodele (2001) opine that the availability of these resources are quite important to achieving effectiveness in instructional delivery and supervision in the school system. Classrooms are key infrastructural facilities in the school where the teaching learning process takes places. Spacious classroom gives the teacher and student good room for interaction.

Classrooms are important infrastructures in a school setting since learners spend most of their time in these facilities. It is important to observe the following: The size of the classroom, in terms of length and width, should be as specified in the Ministry of Education building specifications i.e. 7.5mx 5.85m or 7.5m x 6.0m. Such classrooms should accommodate a maximum of 30 learners in one seater desks or 40 learners in two seater desks in line with the provisions of the Ministry of Education circular on Health and Safety Standards in Educational Institutions (2008). The classrooms should be properly lit and ventilated. The floors should be level and kept clean always. For cemented floors, any cracks should be repaired in good time. Similarly, for mud walls and floors teachers should ensure that they are regularly smeared with fresh mud and floors smeared with cow dung to prevent the development of cracks and the generation of dust that can pose risks to the health of both teachers and learners. In all cases, efforts should be made to cement all the classroom floors.

The quality and adequacy of physical facilities and equipment have a direct bearing on quality of education. A school with inadequate classrooms will be forced to accommodate more students than recommended. Inadequate physical infrastructure, according to Ejiro (2011), is one of the worst problems facing effective implementation of educational programmes including the Universal Basic Education. Arisi (2002) stressed that inadequate classroom spaces have resulted in over-crowding in schools.

National Education Sector Plan 2013-2018 (2015) notes that although there has been marked progress towards realizing universal primary education (UPE), and increasing access to secondary education, the Kenyan Government faces various challenges in providing quality education, which may hamper realization of Kenya Vision 2030. One of the major challenges

cited is weak balance between the quantity (access and participation) and quality of education across all levels of education. Due to FPE, FDSE and 100% transition policies, there are problems of overcrowding in counties where enrolment rates are high, and pupil teacher ratios and pupil classroom ratios in the public sector are stretched beyond national standards. This in turn affects the quality of education. Using the projected enrolment, this study projected the classroom requirement in primary and secondary schools in Siaya County from 2021 to 2030. This was to ensure that there is healthy balance between access and participation (quantity) and adequacy of classrooms (quality of education).

According to the MoE safety manual (2008), the furniture in classrooms, especially the desks, should be appropriate for use by both male and female learners. Poorly constructed or inappropriate desks can lead to physical deformities such as curvature of spine, contraction of chest, roundness of shoulders or a confirmed stoop. They can also create tension and fatigue among learners. The class teacher should ensure that the desks are arranged in a manner that facilitates easy and orderly movement of learners in the classroom. Ideally, each desk should have no more than 3 learners and the space between any two desks should be at least 2 feet.

A review of the literature from 1990-2010 by Glewwe, Hanushek, Humpage and Ravina (2012) on School Resources and Education Outcomes in Developing Countries found out that desks, tables and chairs indicated a positive relationship with test scores. These reviewers noted that all the four high quality studies that had been conducted on the impact of school infrastructure on test scores found out that desks, tables and chairs had a positive impact on test scores hence terming them as promising. This implies that adequate desks, chairs and tables enhance provision of quality education. A preliminary survey conducted in primary and secondary schools in 2018 in Siaya County on the status of physical facilities found out that the pupil desk ratio in primary

schools in the county was 5:1 instead of 3:1 as recommended by the Ministry of Education Safety Manual (2008). The current study projected the desk requirement in primary and secondary schools in Siaya County for the period 2021-2030.

Sanitation infrastructure includes all the structures constructed for the purposes of disposal of human waste and for cleanliness. A safe school must have sanitation facilities built up to the required standards and kept clean with high standards of hygiene. In order to enhance safety, the following must be observed: Proper consideration should be given for staff sanitation, with at least one closet for 12 persons and with separate provision for ladies and gentlemen. In mixed schools, girls' sanitation areas must be separate and offer complete privacy. All sanitary facilities and equipment should be in the best state of repair, serviceable and inspected regularly (MOE, 2008). Studies show that safe, adequate water and sanitation facilities in schools, coupled with hygiene education, reduce the incidence of diarrhoea and other water-borne diseases (UNICEF, 2009). Furthermore, inadequate access to sanitation may have a negative impact on enrolment and attendance, especially of girls, and on school performance.

Several studies conducted to establish the relationship between physical infrastructure and academic performance have found out that adequacy of classrooms, sanitation facilities, desks, chairs and tables and physical condition of physical infrastructure are linked with improved academic performance, which is one of the dimensions of defining quality education (Aloyo, 2015; Mokaya, 2013; and Akomolafe and Adesua, 2016). Similarly, following the introduction of free primary and free secondary education in Kenya in 2003 and 2008 respectively, several studies carried out to establish the impact of free primary and secondary education on quality education established that free primary and secondary education have led to increased enrolment

in schools and that the increased enrolment has exerted a lot of pressure on the existing physical facilities hence impacting negatively on quality of education.

However, very few projections have been conducted to establish the physical infrastructure requirement for primary and secondary schools especially at the county in order to plan for their provision as studies conducted have established that they are key in provision of quality education. Using the projected students' enrolment, this study projected the number of classrooms, number of desks and number of toilets required in primary and secondary schools in Siaya County by the year 2030.

2.5 Average school size for provision of quality education

For years in the United States of America, the size of schools was mostly conditioned by an arguable concept of economics that considered that the larger the school, the lower the cost per student (Barrett et. al, 2019). Boser (2013) arguing for larger school size cites various reasons why small districts are more expensive than larger districts. For one, small districts often have small schools, and small schools can have higher overhead costs. It is not too hard to imagine that running a school with only 100 students is more expensive than running one with 600 students. The issue, in short, is economies of scale, which The Economist (2008) defines as factors that cause the average cost of producing something to fall as the volume of its output increases. Another issue is that small districts often still have to provide their students with a full array of course offerings even if there are fewer students. This can mean, for example, hiring a chemistry teacher for only four chemistry students.

Many researchers have also investigated the effect that school size has on the academic performance of students, specifically for learners on an elementary or high school level, and have

mostly found that the academic performance of students is higher in larger schools when compared to learners enrolled in smaller schools (Barrett et al. 2019). For example, Barnes and Slate (2014) investigated the relationship between school district size and student performance of Limited English Proficient students in Texas for the school year concluded in 2011. They used data obtained from the Texas Education Agency Academic Excellence Indicator System to indicate school district size, and Texas Assessment of Knowledge and Skills to measure subjects, including English and Mathematics pass rates for these students. They found student achievement to be significantly higher for Limited English Proficient students in larger school districts when compared to moderate-size and small-size school districts (Barnes & Slate, 2014).

However, there is a lot of more recent evidence that small schools yield better academic results (Barrett et al. 2019). The landmark 2002 report "Dollars and Sense: The Cost Effectiveness of Small Schools" (Bingler et al. 2002) examined 489 schools whose designs were submitted to design competitions between 1990 and 2001 and concluded that small schools can be built and operated cost-effectively according to a broad variety of measures. The same study also mentioned that small schools are not effective solely by virtue of being small but rather work best when they take advantage of being small. The study also found out that the most common drawbacks of larger schools were: higher transportation costs, higher administrative overheads, lower graduation rates, higher absenteeism, higher rates of vandalism and lower teacher satisfaction.

A subsequent comparative, longitudinal study in 2010 (Bloom, Levy, and Unterman 2010) of these "small schools" in New York found that their pupils made academic progress that was significantly ahead of the students in the control group, who were typically in bigger and older schools. This effect was found in the first year of high school but continued right through to

senior year, yielding greatly increased graduation rates. Leithwood and Jantzi's (2009) major 2009 literature review on the question of school size looked back over 45 years of research but focused especially on the previous nine years' output. They concluded that smaller schools contribute positively to student outcomes, including higher student achievement, better attendance, higher graduation rates, and greater engagement in extracurricular activities. They also strongly suggested that these effects are more powerful in relation to disadvantaged children. Their conclusions regarding school size were that elementary schools should be limited to 500 pupils or, if serving a high proportion of disadvantaged pupils, then a maximum of 300 pupils. Their equivalent figures for secondary schools were 1,000 and 600 pupils.

In Kenya, average school size at any given level of education (Pre primary, primary and secondary level) is a function of total enrolment of that particular level of education divided by total number of schools at that particular level of education. With class size of 45 at both primary and secondary levels of education, the recommended minimum average school sizes for single streamed primary and secondary schools under the 8-4-4 system of education are 360 and 180 respectively. Republic of Kenya (1964:72) states that a school should be large enough to secure maximum economies in building and equipment. One of the policy targets in the National Education Sector Plan (2013-2018) is to ensure that all secondary schools have at least 3 streams per class and a class size of 45 students (ROK, 2015). This would bring the average school size to 540. However, there are schools in Kenya which are under enrolled and others that are over enrolled. This means that the schools do not operate optimally hence they have high unit costs. Table 2.3 shows enrolment, number of schools, number of teachers and TSC current expenditure on teachers' salaries between 2013 and 2017 in Kenya.

Table Error! No text of specified style in document.**.7: Recurrent expenditure in primary and secondary schools in Kenya 2013-2017**

Year	Primary schools			Secondary schools			Recurrent expenditure (Ksh in billions)
	Enrolment (millions)	Teachers	Schools	Enrolment (millions)	Teachers	Schools	
2013	9,857.6	199,686	21, 205	2,104.3	65,337	6807	154, 778.10
2014	9,951.0	200, 697	21, 718	2,331.7	78, 719	7680	157, 209.10
2015	10,090.8	210, 697	22, 414	2,559.0	85, 231	8297	180, 970.14
2016	10,279.7	214, 919	22, 939	2, 720.6	88, 891	8592	190, 947.22
2017	10,403.7	217, 152	23,584	2, 830.8	93, 631	9111	201, 893.01

Source: Economic survey, 2018

Table 2.3 shows that there was an increase in enrolment, number of teachers and schools in both primary and secondary schools between 2013 and 2017. According to 2014 basic education statistical booklet, average school size for primary schools in 34 counties in Kenya was below 360, which is the minimal average school size. The national average school size was 338. However, a minimum of nine teachers is required in each single stream school whether the pupils' enrolment is 360 or below. This means that teachers end up being under utilized in cases where the average school size is low. Between 2013 and 2017 as indicated in Table 2.3, there was an increase of 17, 466 primary school teachers and 28, 294 secondary school teachers totaling to 45, 760 teachers. The implication of this increment is that expenditure on recurrent expenditure rose from Ksh 154, 778.10 billion in 2013 to Ksh 201,893.01 billion in 2017 which totals to Ksh 47, 114.91 billion. Teachers' salary takes the largest share of the education budget and therefore underutilization of teachers due to low average school size is very costly.

According to the Secondary School Fees Taskforce Report 2014, the national average enrolment per public secondary school was 277 students as compared to the recommended optimal size of a school at 540 students. It added that the teaching service is constrained by the existence of small schools (average of 277 students) that are not viable and undermine optimal utilization of teachers, with average teaching load of 22.7 lessons per week as compared to the expected 27. This task force recommended that secondary schools should have a minimum enrolment of 180 students to attract provision of TSC teachers and that no new secondary schools should be established except in the more marginalized parts of Kenya. This taskforce also recommended the merging of non-viable and uneconomical schools to free the otherwise thinly spread teaching force. The current study sought to project the average school size that would optimally utilize the projected teachers and physical infrastructure and enhance provision of quality education in primary and secondary schools in Siaya County by 2030.

A study by Olel and Othuon (2005) as cited by Oloo (2017) recommended that public secondary schools should strive to attain a minimum of three streams as a way of increasing enrolment and improve the utilization of resources at the school level while benefiting from economies of scale. A report of the taskforce on the re-alignment of the education sector to the constitution of Kenya 2010 (2012) also recommended that three streams be the minimum size of school in order to improve access and quality of secondary education. The Ministry of Education Science and Technology, on Teachers Service Commission Staffing Norms, revealed that, on average a secondary school teacher teaches 22 lessons a week or maintains 14.6 contact hours. This was lower than the 18 hours of teaching that secondary schools were expected to maintain (Republic of Kenya, 2005).

Findings of a study by Munyasia (2017) on influence of B.O.M teachers' wage bill on provision of quality education in public secondary schools in Gem sub-county, Siaya also indicate that over 57% of secondary schools in Gem Sub County had students' enrolment of between 100 and 200. Such schools need at least nine TSC teachers in order to teach all the subjects. Schools with low average school size do not ensure optimal utilization of teachers and physical infrastructure.

Despite the government's recommendation for schools to have at least three streams per school to enhance effective utilization of the available educational resources, most schools are still single streamed. This may be attributed to the increasing number of schools at both the primary and secondary levels of education. According to the Ministry of Education Basic Education Statistical Booklet (2019), the national average school size for primary schools in Kenya was 363. The county with the least average school size at primary school level was Baringo County with 197. Baringo County had a total of 729 public primary schools with total enrolment of 143,618. Siaya County with a total enrolment of 253, 492 spread in the 653 public primary schools had an average school size of 388. The secondary schools in Siaya County had total enrolment of 91, 962 spread in 243 public secondary schools hence the average school size of 378. The too many single streamed primary and secondary schools have worsened the teacher shortage which is a major hindrance to provision of quality education in the county. The current study projected the average school size in primary and secondary schools in Siaya County by 2030 in order to establish the optimum average school size that would effectively utilize the projected number of teachers and physical infrastructure by 2030.

CHAPTER THREEE
RESEARCH METHODOLOGY

3.1 Introduction

This section covered research design, description of the area of study, the study population, sample and sample techniques, data collection instruments, validity of instruments, reliability of data instruments, data collection procedures, methods of data analysis and ethical consideration and informed consent.

3.2 Research Design

The study used trend analysis of past time series of school age population, students' enrolment in primary and secondary schools and government policies on education and descriptive survey research design. Descriptive survey design was suitable for this study because it enabled the researcher to collect detailed data and description of teacher requirement, physical facilities requirement and average school size in relation to provision of quality education in primary and secondary schools in Siaya County.

This study also adopted the trend analysis design by applying projected school age population to project school enrolment. Ahmed (2000) used trend analysis when projecting the population, enrolment and the costs to the state primary, secondary and higher education in Bangladesh for the period 2000 – 2020. Projected school enrolment was used to project teacher requirement, classrooms and desks and average school size for primary and secondary schools in Siaya County by 2030. This design enabled the researcher to observe trends in school age population and school enrolment between 2016 and 2020 in order to make projections on school age population, school enrolment, teacher requirement, classrooms, desks and toilets and average school size in primary and secondary schools in Siaya County for the period 2021 to 2030.

3.3 Area of Study

This study was carried out in Siaya County. The county is divided into six sub-counties namely Siaya Bondo, Gem, Rarieda, Ugenya and Ugunja. Siaya County is one of the six counties in Nyanza region. The land and water surface areas are approximately 2,530 km² and 1,005 km2 respectively. The water surface area forms part of Lake Victoria (the third largest fresh water lake in the world). It approximately lies between latitude 0º 26´ South to 0º 18´ North and longitude 33º 58´ and 34º 33´ East (Siaya County 2017 – 2018 Annual Development Plan).

According to 2019 Kenya Population Census, the county had a population of 993, 183. It is the fifth densely populated county of the six counties in Nyanza region. The school age population (6-17 years) for Siaya County is 34.16% of the total population. It has the fourth largest school age population after Migori (36.09%), Homabay (35.78%) and Kisii (34.21%) counties. However, Siaya County's primary and secondary schools' Gross Enrolment Ratios (GER) are the second and third highest at 115% and 87.8% respectively in Nyanza region. Nationally, the GER for primary and secondary are 99.6% and 71.2% respectively (ROK, 2019). A high Gross Enrolment Ratio implies that more children regardless of their age in the county have access to education.

The Poverty Index for Siaya County was 33.8% as captured in the 2018 Economic Survey. The main food crops include; maize, sorghum, millet, beans, cowpeas, cassava, sweet potatoes and groundnuts while the cash crops are cotton, rice and sugar cane. The average farm size for a small scale farmer is 1.5 ha and 7.0 ha for a large scale farmer. Due to small farm holdings and the resulting limited benefits economies of scale, the practice of mechanized agriculture is heavily constrained (Siaya County 2017 – 2018 Annual Development Plan). Although it is ranked third nationally by NASCOP (2020) with a HIV prevalence of 15.3% for the persons

aged 15-64 years, it is important to note that the HIV prevalence for Siaya County is on the declining trend as it stood at 24.8% in 2015.

Siaya County was selected for this study for the following reasons. First and foremost, despite the high HIV prevalence in the county (third highest nationally), more children are accessing education in primary and secondary schools as indicated with the high GER of 115% in primary and 87.8% in secondary. Secondly, Siaya County was among the counties that recorded the lowest standardized mean scores in National Assessment System for Monitoring Learner Achievement (NASMLA) for Grade 3 learners in numeracy and literacy competencies conducted by Kenya National Council of Examination in 2018 (ROK, 2019).

In Mathematics, Grade 3 pupils in Siaya County were ranked position 45 out of 47 counties with standardized mean score of 431.8. The national standardized mean score for Mathematics was 500. Kiswahili in Siaya County had standardized mean score of 429 hence ranked position 44 out of 47 counties. Nationally, the standardized mean score for Kiswahili was 499.7. English had standardized mean score of 458.5 and ranked position 39 out of the 47 counties. The national mean score for English was 498.1 (ROK, 2019). This is an indicator that although access to education in Siaya County has increased, quality of education in the county is still low. The increased access to education is exerting pressure on the existing educational resources as established from findings of the preliminary survey conducted in 2018. There was therefore need to project educational resource requirement in primary and secondary schools that would enable the county achieve quality education envisaged in Kenya Vision 2030.

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3.4 The Study Population

Target population comprised of 6-17 years old population which was 339, 251 according to 2019 census. This population was 234, 382 in primary schools and 104, 869 in secondary schools according to 2019 census results. This study population was very crucial to the projection of school age population and enrolment in primary and secondary schools in Siaya County. This study also targeted the TSC County Human Resource Officer and the County Quality Assurance and Standards Officer in Siaya County to provide qualitative data on teacher requirement and physical infrastructure in schools respectively.

3.5 The Study Sample and Sampling Procedures

This study used saturated sample of all 339, 251 and all 272,226 (6-17 years old) population of 2019 and 2009 respectively. The study also used saturated sample of all pupils enrolled in primary and secondary schools in Siaya County between 2016 and 2020 to obtain projections for primary and secondary schools. The whole 2019 and 2009 school age population and all pupils' enrolled in primary and secondary schools from 2016 to 2020 in Siaya County were vital for carrying out the necessary projections in the county and therefore the researcher could not afford to use representative samples to make generalizations about the same. Table 3.1 shows the sample frame for the secondary data used in the study.

Table Error! No text of specified style in document.**.8: Sample Frame for School age population and enrolment used in the study**

		Primary				
Year	Total Enrolment	Enrolment used	%	Total 6-13 Years Population	6-13 Years Population used	%
2016	234,850	234,850	100	219,505	219,505	100
2017	239,627	239,627	100	224,340	224,340	100
2018	246,668	246,668	100	229,300	229,300	100
2019	249,567	249,567	100	234,382	234,382	100
2020	254,479	254,479	100	239,591	239,591	100
		Secondary				
Year	Total Enrolment	Enrolment used	%	Total 14-17 Years Population	14-17 Years Population used	%
2016	67,422	67,422	100	97908	97908	100
2017	78,496	78,496	100	100,172	100,172	100
2018	85,709	85,709	100	102,493	102,493	100
2019	93,771	93,771	100	104,869	104,869	100
2020	102,339	102,339	100	107,303	107,303	100

Purposive sampling was used to select TSC County Human Resource Officer and County Quality Assurance and Standards Officer. The TSC Human Resource Officer was purposively selected for this office has pertinent information regarding teacher recruitment, transfers and retirement in the county. The Quality Assurance and Standards Officer was also purposively selected for the office has key information regarding status of physical infrastructure in schools and it monitors, evaluates and reports on quality of education in the county.

3.6 Instruments for Data Collection

The data for this study was collected by use of Data Analysis Proformas and Key Informant Interview (KII) guides. The researcher referred to data collection forms generated by MOE – EMIS section and KNBS in Kenya to develop the Data Analysis Proformas. The selection of the Data Analysis Proforma and Key Informant Interview guide was guided by; the nature of data that was supposed to be collected as well as objectives of the study. The Data Analysis Proforma was used in data collection as it enabled the researcher to gather data on school age population, enrolment and number of teachers from KNBS, MOE and TSC respectively. The key informants' interview guides enabled the researcher to solicit more detailed information from the TSC County Human Resource Officer and County Quality Assurance and Standards officer on teacher requirement and physical facilities in the county respectively.

3.6.1 Data Analysis Proforma for Kenya National Bureau of Statistics (DAPKNBS)

There was one Data Analysis Proforma for the Kenya National Bureau of Statistics. This proforma sought information on population estimates for school age population in Siaya County (See appendix B). Data on school age population from KNBS Siaya office was compared to data provided in 2009 and 2019 Kenya Population and Housing Census publications to establish the reliability of the collected data. This information was used by the researcher to project school age population for primary and secondary school in the six sub-counties in Siaya County for the period 2021 to 2030. This was very important for the study as it was from the projected school age population that pupils' enrolment was projected.

3.6.2 Data Analysis Proforma for Ministry of Education

There were two Data Analysis Proformas for the Ministry of Education. Data Analysis Proforma for Ministry of Education Primary Enrolment (DAPMOEPE) sought information on total

enrolment from 2016 to 2020 per gender per sub-county in primary schools (Appendix C). Data Analysis Proforma for Ministry of Education Secondary Enrolment (DAPMOESE) sought information on total enrolment from 2016 to 2020 per gender per sub-county. It also sought data on the category and number of schools per sub-county (See appendix D). These proformas were also used to collect data on enrolment at per sub-county and county levels. This was important as it enabled triangulation of data sets for the sub-counties and data collected from the county office to establish consistency. Enrolment data from the Ministry of Education assisted the researcher to compute enrolment ratios by method of least squares. These ratios were then used to project enrolment in primary and secondary schools in sub-counties in Siaya County. The projected enrolment was further used to project teacher requirement, physical infrastructure and average school size for the period 2021 to 2030.

3.6.3 Data Analysis Proforma for Teachers Service Commission (DAPTSC)

The Data Analysis Proforma for Teachers Service Commission (DAPTSC) sought information on the current number of teachers and number of schools per sub-county and the total number of teachers and schools in the county as per the TSC records (See appendix E). Collection of the same data set for the sub-county level and the county level was meant to enable triangulation. This data enabled the researcher to establish teacher requirement per sub-county and the total number of teachers required in the whole county.

3.6.4 Key Informant Interview guide (KII Guide) for TSC County Human Resource Officer

Key informant interview guide targets one person or participant to provide the needed information. Individual interviews can take different forms i.e. face-to-face, one-on-one, in person interview or telephone conversations (Creswell, 2009:178). The interview identifies one individual referred to as key informant who has special knowledge, status or communication

skills that they are willing to share with the researcher. Key Informant Interview guide (KII Guide) for TSC County Human Resource sought information on the major causes of teacher shortage in Siaya County, measures put in place to retain teachers in the county and measures put in place to ensure that the current shortage of teachers in the county does not affect provision of quality education (See appendix F). This qualitative data enabled the researcher to interpret the teacher requirement projection appropriately by answering the 'why' questions from quantitative data analysis.

3.6.5 Key Informant Interview guide (KII Guide) for CQASO

The Key Informant Interview guide for CQASO gathered information on factors affecting pupils' enrolment in primary and secondary schools in the county, measures put in place by the county to ensure that all the school going age children are enrolled in schools, reasons for inadequacy of physical facilities in primary and secondary schools in Siaya County and mechanisms put in place as a county to ensure that schools have adequate physical facilities as they implement the competency based curriculum (See appendix G). This data enabled the researcher to draw conclusions on school age population, pupils' enrolment and physical facilities in primary and secondary schools in Siaya County.

3.7 Validity of Data Instruments

Amin (2005) as cited by Candle (2010) says that a research instrument is valid if it actually measures what it is supposed to measure and when the data collected through it accurately represents the respondents' opinions. The validity of Data Analysis Proforma and Key Informant Interview guides to be used for this study were ascertained based on construct, content and face validity. The study ensured that all the items in each instrument were representative of the entire content being measured as represented by the objectives of the study. This was ascertained by

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ensuring that all the objectives of the study were addressed by the items in the Data Analysis Proforma and the Key Informant Interview Guide as defined in the study. The Data instruments were then presented to experts in research methodology and the researcher's supervisors in the Department of Education Management and Foundations, Maseno University who scrutinized and advised on their construct, content and face validity. Their comments were then incorporated in the revised instruments for eventual data collection. This ensured construct, content and face validity of the instruments.

3.8 Reliability of Data Instruments

Reliability refers to the consistency of a measuring tool or the degree to which that instrument produces equivalent result for repeated trials (Eisinga, TeGrotenhius & Pelzer, 2014). The reliability of the Data Analysis proforma was ascertained through test- retest method. After development of the KNBS Data Analysis Proforma, Data Analysis Proforma for Ministry of Education Primary Enrolment, Data Analysis Proforma for Ministry of Education Secondary Enrolment and Data Analysis Proforma for Teachers Service Commission, they were administered to the personnel in charge of data at KNBS, MOE and TSC county offices twice in a lapse of two weeks as recommended by Orodho (2009). The scores of the two tests were then correlated using Pearson's (r) Product Moment of at a set p-value of 0.01. The Data Analysis Proformas for KNBS, MOE (Primary), MOE (Secondary) and TSC yielded Pearson's correlation coefficients of 0.99, 0.98, 0.98 and 0.91 respectively at α=0.01 an indication that Data Analysis proformas for collecting data from KNBS, MOE and TSC were reliable. According to Danel (1979), reliability co-efficient of 0.6 to 0.8 should be attained to indicate a high degree of reliability. The findings were used to remove inconsistencies, ambiguities and weaknesses to make the instruments reliable.

3.9 Data Collection Procedures

Prior to collection of data, the researcher sought for approval and authorization to conduct the research from Maseno University Ethics and Review Committee. The researcher then sought for permission from the County Director of Education, TSC County Director and the KNBS office Siaya to conduct the research and collect relevant data from their offices. The researcher then visited the Kenya National Bureau of Statistics, Ministry of Education sub-county and county offices and Teachers' Service Commission sub-county and county offices on the agreed dates to conduct the interviews and administer the Data Analysis Proformas. A total number of 16 (1 for TSC, 14 for Ministry of Education and 1 for KNBS) Data Analysis Proformas were delivered by the researcher in person so as to have an opportunity to explain the purpose of the study, clarify the type of data and for the years required, request for relevant published documents and assure participants of total confidentiality. All Data Analysis Proformas were collected after two weeks for analysis.

3.10 Method of Data Analysis

Data obtained from the Data Analysis Proformas was organized so as to be sure that it is accurate before being uniformly entered into the worksheet for Micro Soft Excel Version 12.1 as complete as possible. The county population projection was carried out using the compound rate of growth method. After projection of Siaya County school age population for the period 2021 to 2030, the sub-county school age population projections were carried out using Sub-national Projection Toolkit, a mathematical extrapolation toolkit, developed by US Census Bureau to carry out population projections at sub- national level.

The sub-national projection toolkit required projected population for single years per gender between 2021 and 2030 for the whole county as well as enumerated population for 2009 and

2019 for single years per gender per sub-county. Once this data was fed into the programme, it projected population for the single year for the specified gender per sub-county using the compound rate of growth method. This applied to 6-17 population for both males and females. After projecting the population per age per gender (6-17 years) for each sub-county, single years for ages 6-13 and 6-11 were added to give primary school age population under 8-4-4 and 2-6-6-3 systems of education respectively and single years for ages 14-17 were added to give 8-4-4 secondary school age population, 12-14 were added to give junior secondary school age population and 15-17 were added to give senior secondary school age population.

To project enrolment in primary and secondary schools in the sub-counties, enrolment ratios from 2016 to 2020 were calculated using the following formulae:

$$ER = \frac{E^t}{Pp^t} * 100$$

Where;

ER is enrolment ratio

E^t is enrolment for a particular year

Pp^t is projected population for a particular year

Enrolment ratios during 2021-2030 were then projected by method of least squares summarized by the general formula Y = a + b. X. Here, we take 'X' as year, 'a' constant and 'b' slope which gave the best-fitting line. Enrolment from 2021-2030 was obtained by multiplying enrolment ratio of a particular year with the projected population for that year.

Pupils' enrolment for classes 1-8 (6-13 years old) for the period 2016-2020 was computed to establish the enrolment trend in primary schools for the last five years. This enrolment trend was used in projection of pupils' enrolment in primary schools under the 8-4-4 system of education

from 2021-2023. Pupils' enrolment for classes 1-6 (6-11 years old) for the period 2016-2020 was also computed to establish the enrolment trend in primary schools for the last five years. This enrolment trend was used to project pupils' enrolment under the 2-6-6-3 system of education from 2024-2030. Enrolment for classes 7, 8 and form one (12, 13 and 14 years) for the period 2016-2020 was also computed. This enrolment trend was used to project students' enrolment in junior secondary schools from 2023-2030. Enrolment for form two to form four (15, 16 and 17 years) for the period 2016-2020 was computed to enable projection of enrolment in senior secondary schools for the period 2026 to 2030. Enrolment for form one to form four (14-17 years) for the period 2016-2020 was computed to enable projection of enrolment in secondary schools under 8-4-4 system of education for the period 2021 to 2027.

The projected enrolment in primary, junior and senior secondary schools was used to project the teacher requirement, physical infrastructure requirement (classrooms, desks and toilets) and the average school size in primary, junior secondary and senior secondary schools respectively in Siaya County. The number of projected primary school teachers required each year was obtained by taking projected total enrolment in a year divided by 40 and then add 2.5% which is summarized as (N/40)+ 2.5/100*N/40) where N stands for total projected enrolment. For secondary schools, the estimation factor for the projection of teachers' required in a year was generated as follows: one stream is allocated 30 hours in a week while one teacher covers 18 hours per week giving a factor of (30/18 *N/40) which is summarized as (1.667*N/40) where N is the total secondary schools enrolment in a given year (ROK, 2008c).

To project the required classrooms, desks and toilets, projected enrolment together with the recommended government standards were applied. For classrooms, the projected enrolment was divided by the pupil class ratio of 45:1. For desks in primary schools, the projected enrolment

was divided by the desk pupil ratio if 1:3. For secondary schools, the required lockers and chairs was determined by dividing the projected enrolment with the pupil locker/chair ratio of 1:1. For toilets, the number of toilets for girls was determined by dividing the projected number of girls' enrolment by the pupil toilet ratio of 25:1 while for boys, the projected boys' enrolment was divided by pupil toilet ratio of 30:1.

The projected average school sizes for primary school per sub-county were determined by dividing the projected enrolment with the number of existing primary schools in every sub-county. Average school size for junior secondary schools was projected by dividing the projected enrolment for years 12-14 (Classes 7, 8 and Form 1) with the total number of schools categorized as sub-county schools in every sub-county while senior secondary average school size for a sub-county was determined by diving the projected enrolment for the years 15-17 (Form 2, Form 3 and Form 4) with the total number of schools categorized as county, extra county and national schools in that sub-county. Different tables, line graphs and pie charts were used to present school age population projections, projections of school enrolment, projections of teacher requirement, projection of physical infrastructure and average school size in Siaya County for the period 2021 to 2030.

Qualitative data analysis means non-empirical analysis (Ahawo, 2016). It does not require quantifiable data. In this study, qualitative data analysis involved content analysis where the content of the Key Informant Interview guides was analyzed in order to identify the main themes that emerged from the responses given by the respondents. The researcher carefully went through the descriptive responses given by respondents to each question in order to understand the meaning they communicate. From these responses the researcher developed broad themes that reflected these meanings. The information was systematically analyzed for content in order to

come up with logical conclusions and recommendations. Having identified the responses that fall within different themes, the next step was to integrate the themes into the text of the report.

3.11 Ethical consideration and informed consent

A permit and research authorization letter was obtained from Maseno University Ethics Review Committee (Appendix AD). Thereafter, Siaya County Director of Education and TSC County Director were notified of the research before the study was undertaken. An introductory letter seeking respondent's permission to be part of the study was given to all potential participants (Appendix A).

To enhance informed consent, participants were thoroughly briefed beforehand on the research problem, the need for scientific research on the problem, the reasons behind the setting of the research (area of the study) and the benefits, rights and dangers involved in their participation. The participants signed a consent form. Privacy and confidentiality is of paramount importance as each person has the freedom to decide the time, extent, and circumstances under which they would withhold or share information. The researcher assured the subjects of the confidentiality of information offered (Kombo and Tromp, 2006). The research data was stored in a personal computer that had a password only known to the researcher. Since the data was for academic use, it was to be stored by the researcher up to the time Maseno University would have examined and awarded the researcher and disseminated the research work to the public.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents results and discussion of the findings of the study on Projection of Educational Resource Requirement for Provision of Quality Education in Primary and Secondary Schools in Siaya County by 2030, Kenya. The results and discussion of the findings of the study are based on the objectives of the study which were to; project school age population and school enrolment for primary and secondary schools in Siaya County by 2030, determine teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030, establish the physical infrastructure (classrooms, toilets and desks) requirement for provision of quality education in primary and secondary schools in Siaya County by 2030 and determine the average school size for provision of quality education in primary and secondary schools in Siaya County by 2030.

4.2 School age population and enrolment in primary and secondary schools in Siaya County by 2030

The first objective of the study was to project school age population and enrolment for primary and secondary schools in Siaya County by the year 2030. School age population was first projected to enable the projection of school enrolment.

4.2.1 Projection of primary school age population in Siaya County by 2030

Projection of school age population was crucial to the study as it enabled the researcher to project school enrolment which was subsequently used to project teacher requirement, physical infrastructure (Classrooms, toilets and desks) and average school size. School age population for the six sub-counties in Siaya County was projected separately (Appendices J, K, L, M, N, O)

then added up to get the county school age population. Table 4.1 shows the projected primary school age population in Siaya County by 2023.

Table Error! No text of specified style in document.**.9: Projected Primary school age population in Siaya County by 2023**

Year	2021			2022			2023			Dev.
Age	M	F	T	M	F	T	M	F	T	%
6	14369	14420	28788	14533	14608	29141	14699	14799	29498	2.46
7	14031	14406	28437	14242	14673	28915	14456	14945	29401	3.39
8	13257	13862	27119	13456	14066	27522	13657	14274	27930	2.99
9	15201	15232	30432	15479	15532	31011	15763	15838	31601	3.84
10	16243	15729	31972	16542	16015	32557	16846	16306	33152	3.69
11	15329	15526	30855	15869	16066	31935	16427	16625	33052	7.12
12	17016	16876	33892	17429	17387	34817	*	*	*	*
13	16694	16742	33436	17195	17314	34509	17710	17906	35616	6.52
Total (6-13)	122,140	122,792	244,933	124,744	125,662	250,406	109,559	110,693	220,251	-10.08

**** School age population excluded

Table 4.1 presents projected primary school age population from the year 2021 and 2023 in Siaya County. Primary school age population in Siaya County is projected to increase from 244, 933 in 2021 to 250,406 in 2022. The official school age in Kenya is classified as follows: 4-5 years for pre-primary, 6-13 years for primary and 14-17 years for secondary. The Ministry of Education (2019) observes that while the fertility rates went down nationally as indicated in the results of the Kenya Population and Housing Census 2019, the learner population growth rates, especially at the entry levels of lower primary, showed an upward trend. This explains the

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increase in primary school age population in Siaya County between the year 2021 and 2022. However, this population will decrease from 250,559 in 2022 to 220,251 in 2023. This decrease is occasioned by the transition of the 12 year olds to junior secondary schools in the year 2023.

A key reform that has been made in Kenya to realize national educational aspirations as provided in the Constitution and Vision 2030, which includes numeracy, literacy, life skills and industry relevant skills, is the introduction of the Competence Based Curriculum (CBC). In the implementation of the new curriculum, the 8-4-4 structure will eventually be replaced by the 2-6-6-3 structure which consists of 2 years of pre-primary (for ages 4-5); 3 years of lower primary and 3 years of upper primary (for ages 6-11); and 3 years of junior secondary, 3 years of senior secondary (for ages 12-17 years) as well as 3 years of university education (ROK, 2019).

The first junior secondary school cohort (12 years) under CBC will be admitted to junior secondary in the year 2023. This explains the exclusion of 12 year old population in the year 2023 from Table 4.1 above. The exit of age 12 school population will therefore affect the overall primary school age population. The primary school age population in Siaya County is therefore projected to decrease by 10.08% from 244,933 in 2021 to 220,251 in 2023. This trend is very crucial to educational planners especially with regard to planning of educational resources in primary schools in Siaya County between the year 2021 and 2023. The pressure about inadequacy of physical infrastructure and shortage of teachers in primary schools in the county will ease by the year 2023. Table 4.2 shows the projected primary school age population between 2024 and 2030.

Table Error! No text of specified style in document.**.10: Projected Primary school age population from 2024 t0 2030 in Siaya County**

Year	2024			2025			2026			Dev
Age	M	F	T	M	F	T	M	F	T	%
6	14867	14993	29859	15037	15188	30225	15208	15387	30595	2.47
7	14673	15222	29895	14893	15505	30398	15117	15792	30909	3.39
8	13861	14484	28345	14068	14698	28766	14278	14914	29192	2.99
9	16052	16150	32202	16347	16468	32815	16647	16792	33439	3.84
10	17156	16603	33759	17472	16905	34377	17794	17212	35006	3.69
11	17006	17203	34209	17604	17802	35406	18224	18421	36645	7.12
Total (6-11)	**93,615**	**94,655**	**188,270**	**95,421**	**96,565**	**191,986**	**97,268**	**98,519**	**195,786**	**3.99**

Year	2027			2028			Dev
Age	M	F	T	M	F	T	%
6	15382	15588	30970	15558	15792	31350	1.23
7	15344	16085	31429	15574	16383	31958	1.68
8	14491	15134	29626	14708	15357	30065	1.48
9	16952	17123	34075	17263	17460	34723	1.90
10	18121	17525	35646	18455	17844	36298	1.83
11	18866	19062	37928	19530	19725	39255	3.50
Total (6-11)	99,156	100,517	199,673	101,088	102,561	203,649	1.99

Year	2029			2030			Dev
Age	M	F	T	M	F	T	%
6	15735	15998	31734	15915	16207	32122	7.58
7	15808	16687	32495	16046	16997	33042	10.53
8	14928	15584	30512	15151	15814	30964	9.24
9	17580	17804	35384	17902	18155	36057	11.97
10	18794	18168	36962	19140	18498	37639	11.49
11	20218	20411	40628	20930	21121	42050	22.92
Total (6-11)	103063	104652	207715	105083	106792	**211875**	**12.54**

Table 4.2 presents the projected primary school age population in Siaya County between 2024 and 2030. In the year 2024 CBC, would have been fully implemented at primary level of education and primary school age population will comprise of 6-11 years old population only.

According to the results from Kenya Population and Housing Census (KPHC) 2019, the primary school age population (6-11) in Siaya County was 170,877. However, this population is projected to increase by 12.54% from 188, 270 in 2024 to 211,875 in 2030. It is also important to note that primary school age population for girls in Siaya County will be higher than the projected school age population for boys. In order to enhance provision of quality education, Sustainable Development Goal 4 target 4a requires member states to build and upgrade facilities that are gender sensitive (UNESCO, 2020). A higher girls' primary school age population implies that more toilets for girls need to be planned for by 2030. Figure 4.1 presents 6-13 years school age population between 2021 and 2023 and 6-11 years school age population between 2024 and 2030 in Siaya County.
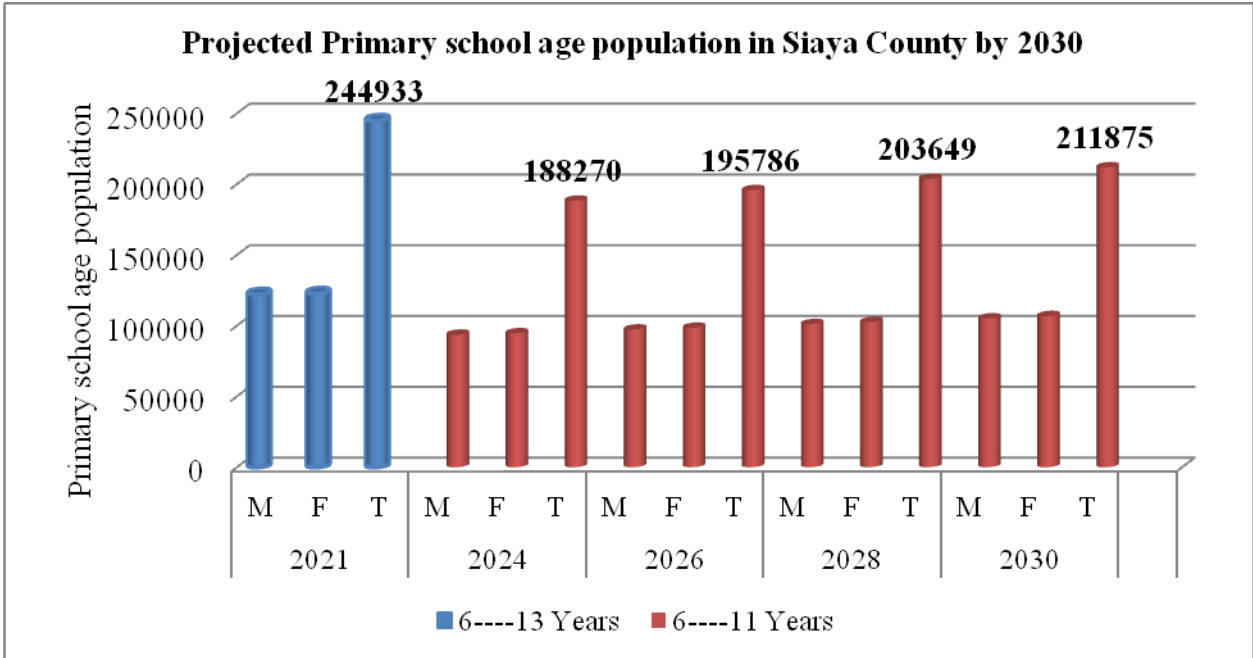
Figure Error! No text of specified style in document.**.5: Projected primary school age population in Siaya County by 2030**

The primary school age population (6-11) in Siaya County will have an upward trend from 2024 up to the end of the projection period. This population will increase from 188, 270 in 2024 to

211,875 in 2030. Increase in school age population means that more children will be enrolled in schools at any given time. According to the results from KPHC (2019), Siaya County had an enumerated population of 993,183. The population aged 6-17 years (primary and secondary school age population) was 339, 251 in 2019 which translates to 34.1% of the total population (APPENDIX H). Primary school age population takes the largest share of 23.6% (234,382) leaving 10.5% (104,869) for secondary school age population. A large share of the total population of Kenya is of school going age and in order to cater for such numbers, the country needs to dedicate more resources to the education sector (ROK, 2019).

4.2.2 Projection of secondary school age population in Siaya County by 2030

Secondary school level of education in Kenya has been categorized into junior secondary school and senior secondary school levels under the 2-6-6-3 structure of education. However, the 8-4-4 structure of education will be in place until the year 2027 when the last cohort will complete the secondary level of education. Table 4.3 presents the projected secondary school age population in Siaya County by 2022.

Table 4.3

Projected secondary school age population for Siaya County by 2022

Table **Error! No text of specified style in document.**.11: Projected secondary school age population for Siaya County by 2022

Year	2021			2022			Trend
Age	M	F	T	M	F	T	%
14	14949	14729	29678	15377	15175	30551	
15	14587	14120	28707	14912	14451	29362	
16	12967	12973	25940	13272	13287	26559	
17	13037	12434	25470	13240	12635	25875	
TOTAL (14-17)	**55540**	**54255**	**109,795**	**56800**	**55548**	**112,348**	**2.33**

Table 4.3 presents projected secondary school age population in Siaya County by 2022. The (14-17) school age population is projected to increase by 2.33% from 109,795 in 2021 to 112, 348% in 2022. According to KPHC (2019), the 14-17 school age population in Siaya County was 104,869 in 2019. This was 10.5% of the total school age population. The secondary school age population that will be enrolled in secondary schools between the year 2021 and 2022 will be learning under the 8-4-4 system of education.

During the piloting of CBC in Kenya in 2017, the International Bureau of Education (IBE) - UNESCO (2017) as cited by Cheptoo and Ramdas (2018) found out that the teachers missed major resources and strained in trying to accommodate large classes in the use of the new learner-centered CBC approaches. The secondary school age population under 8-4-4 system of education will be running concurrently with 2-6-6-3 and therefore based on the projected secondary school age population, adequate number of teachers and physical infrastructure should be planned for well in advance to avoid last minute rush which compromises provision of quality education. Table 4.4 shows the projected secondary school age population under the 8-4-4 system of education and the 2-6-6-3 system of education

Table Error! No text of specified style in document.**.12: Projected secondary school age population for Siaya County from 2023 to 2030**

Junior Secondary School Age Population (12-14)									
Year	2023			2024			2025		Trend
Age	M	F	T	M	F	T	M	F	T	%
12	17853	17914	35767	18287	18457	36744	18731	19016	37748	
13	*	*	*	18242	18518	36760	18789	19151	37940	
14	*	*	*	*	*	*	16733	16595	33328	
TOTAL (12-14)	17,853	17,914	35,767	36,528	36,975	73,504	54,253	54,762	109,015	204.80
8-4-4 Secondary School Age Population (14-17)									
	M	F	T	M	F	T	M	F	T	
14	15816	15634	31450	16268	16107	32375	*	*	*	
15	15243	14790	30033	15582	15137	30719	15929	15491	31421	

Age	M	F	T	M	F	T	M	F	T	Trend %
16	13584	13609	27193	13903	13939	27843	14230	14277	28508	
17	13447	12839	26286	13657	13047	26704	13870	13258	27128	
TOTAL (14-17)	**58090**	**56872**	**114962**	**59411**	**58230**	**117641**	**44030**	**43027**	**87056**	**-24.27**
(12-14) &(14-17)	**75943**	**74787**	**150,730**	**95939**	**95205**	**191166**	**98282**	**97789**	**196,072**	**30.08**

Junior Secondary School Age Population (12-14)							
Year		2026			2027		Trend
Age	M	F	T	M	F	T	%
12	19186	19593	38779	19653	20186	39839	
13	19352	19806	39158	19933	20483	40416	
14	17211	17097	34308	17703	17615	35318	
Total (12-14)	**55750**	**56496**	**112246**	**57289**	**58284**	**115573**	**3**

8-4-4 Secondary School Age population (14-17)						
	M	F	T	M	F	T
14	*	*	*	*	*	*
15	*	*	*	*	*	*
16	14565	14623	29188	*	*	*
17	14087	13472	27559	14307	13690	27997
Total (14-17)	**28652**	**28096**	**56747**	**14307**	**13690**	**27997**	**-51**

Senior Secondary School Age Population (15-17)						
	M	**F**	**T**	**M**	**F**	**T**
15	16283	15855	32138	16646	16227	32872
16	*	*	*	14907	14978	29885
17	*	*	*	*	*	*
Total (15-17)	**16283**	**15855**	**32138**	**31553**	**31204**	**62758**	**95**

Junior Secondary School Age Population (12-14)									
Year		2028			2029			2030		Trend
Age	M	F	T	M	F	T	M	F	T	%
12	20130	20798	40928	20620	21428	42048	21121	22078	43198	
13	20530	21184	41714	21146	21908	43054	21780	22657	44437	
14	18209	18148	36357	18730	18697	37427	19265	19263	38528	
Total (12-14)	**58870**	**60129**	**118999**	**60495**	**62033**	**122528**	**62166**	**63997**	**126163**	**6.02**
Trend				**(2023-2030)**						**252.73**

Senior Secondary School Age Population (15-17)									
	M	F	T	M	F	T	M	F	T	
15	17016	16607	33623	17395	16997	34391	17782	17395	35177	
16	15258	15341	30599	15617	15713	31330	15984	16094	32078	
17	14530	13912	28442	14757	14137	28894	14987	14365	29353	
Total (14-17)	**46804**	**45860**	**92664**	**47768**	**46846**	**94614**	**48753**	**47854**	**96607**	**4.26**

Table 4.4 shows the secondary school age population in Siaya County by 2030. The 2-6-6-3 system of education will be fully implemented in primary schools in Kenya by the year 2024. However, secondary schools in Kenya will continue accommodating school age population (14-17) which is under 8-4-4 system of education until the end of the year 2027.

There will be 35,767 twelve year olds in Siaya County by 2023. This population forms the grade 7 in junior secondary school in the year 2023. The junior secondary school age population in Siaya County is projected to increase by 204.8% from 35,767 in 2023 to 109,015 in 2025. As the 35,767 junior secondary school age population will be joining grade 7 in 2023 in schools categorized as junior secondary schools, there will be 114, 962 (14-17) secondary school age population under the 8-4-4 system of education in Siaya County. The double in-takes (12-14 and 14-17) between 2023 and 2025 will increase the secondary school age population for junior secondary level by 30.08% from 150,730 to 196,072 within this period. If not well planned for, the double in-takes will worsen the shortage of physical infrastructure and teachers and in turn hinder provision of quality education.

However, the 8-4-4 secondary school age population will decrease by 24.27% from 114,962 to 87,056 in 2025 as schools will not be admitting the 14 year old population under the 8-4-4 system of education. In the year 2027, the last cohort under the 8-4-4 system of education (17 year old population) totaling to 27,997 will be exiting secondary schools hence paving way for full implementation of CBC at junior and senior secondary levels of education. Overall, the junior secondary school age population will increase by 252.74% from 35,767 in 2023 to

126,164 in 2030. Increase in school age population should go hand in hand with increase in provision of educational resources.

The first cohort under senior secondary school age population (15 year old population) will be admitted to senior secondary school level at grade 10 in the year 2026. There will be 32,138 (15 year) population in Siaya County. The senior secondary school age population (15-17) in the county is projected to increase by 200.6% from 32,138 in 2026 to 96,607 in 2030. The 252.74% and 200.6% increments in junior and senior secondary school age population calls for increase in budgetary allocation in the education sector to cater for additional educational resources as school age population at any given time determines students' enrolment. Figure 4.2 shows the projected secondary school age population in Siaya County by 2030.
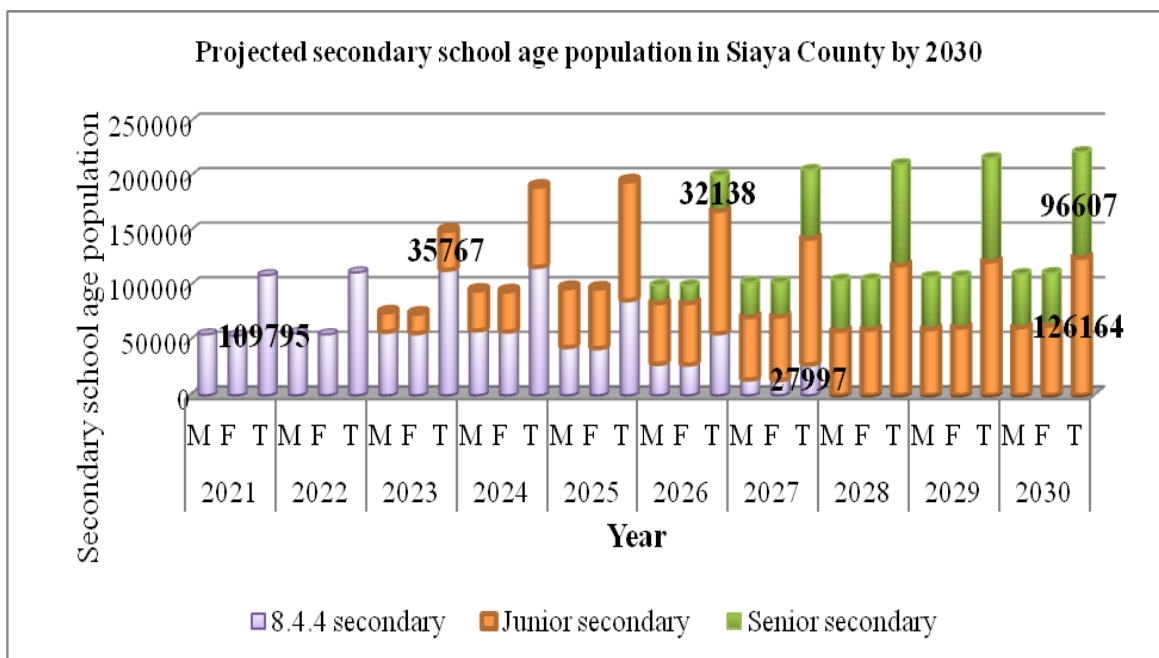
Figure Error! No text of specified style in document.**..6: Projected secondary school age population in Siaya County by 2030**

Figure 4.2 shows the projected secondary school age population in Siaya County between 2021 and 2030. Between 2021 and 2027, the 8-4-4 secondary school age population will share

educational facilities with the 2-6-6-3 secondary school age population. However, the 8-4-4 secondary school age population will maintain a downward trend and will completely be phased out by 2028. The 8-4-4 secondary school age population is projected to decrease from 109, 795 in 2021 to 27,997 in 2027. Junior secondary school age population in Siaya County is on the other hand projected to increase from 35,767 in 2023 to 126, 163 by 2030. Senior secondary school age population is projected to increase from 32,138 in 2026 to 96,607 in 2030.

According to Kenya Population and Housing Census (2009), the school age population (6-17) in Siaya County was 272,226 with 137,723 males and 134,503 females. In 2019, the (6-17) population had risen to 339,251 with 170,218 males and 169,033 females (KPHC, 2019). This translates to a growth rate of 2.225% per annum. Projection in this study was carried out using the compound rate of growth method. The 6-17 school age population in Siaya County is therefore projected to reach 434,645 in the year 2030 with 216,002 males and 218,643 females. Planning for provision of educational resources in Siaya County should therefore be done bearing in mind that school age population in this county will increase by 28.12% between 2019 and 2030.

Cheptoo and Ramdas (2020) note that the 8-4-4 curriculum experiences challenges ranging from insufficient infrastructures and resources, inadequately trained teachers, a large number of learners in the classrooms, unskillful graduates, and increased dropouts and hence failed to accomplish its mandate of education for self reliance. Critics of competence based curriculum have also argued out that CBC is an expensive curriculum for it flourishes best with low Pupil Teacher Ratio, adequate physical infrastructure and small class sizes which are lacking in our schools. Quality education in Siaya County will only be achieved if the projected primary school age population of 211,875, junior secondary school age population of 126,163 and senior

secondary school age population of 96,607 is made the base for planning and budgeting for adequate educational resources in the standard ratios recommended by the Ministry of Education.

4.2.3 Projection of primary schools' enrolment in Siaya County by 2030

Projection of enrolment was crucial to the study as it enabled the researcher to project teacher requirement, physical infrastructure requirement and average school size by the year 2030. The primary schools' enrolment projections in the six sub-counties were summed up to give the projected enrolment in primary schools in the whole county (Appendices U, V,W). Table 4.5 presents projected primary schools' enrolment in Siaya County by 2030.

Table Error! No text of specified style in document.**.13: Projected enrolment in primary schools in Siaya County by 2030**

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	130,347	129,516	**259,864**	122,140	122,793	**244,933**	9220	8453	
2022	132,947	131,734	**264,682**	124,745	125,661	**250,406**	9852	8595	**1.85**
2023	116,556	115,340	**231,897**	109,558	110,693	**220,251**	9010	7521	**-12.39**
2024	105,321	103,608	**208,929**	93,615	94,655	**188,270**	12329	9974	**-9.90**
2025	107,050	105,261	**212,311**	95,421	96,566	**191,987**	12660	10132	1.62
2026	108,800	106,927	**215,726**	97,268	98,518	**195,786**	12991	10281	1.61
2027	110,568	108,052	**218,621**	99,156	100,038	**199,194**	13498	10479	1.34
2028	112,360	110,016	**222,375**	101,088	102,312	**203,400**	14054	10848	1.72
2029	114,168	111,718	**225,886**	103,063	104,397	**207,460**	14619	11231	1.58
2030	**115,997**	**113,435**	**229,432**	**105,084**	**106,792**	**211,876**	**15,193**	**11,827**	**9.81**
2030							**-4,280**	**-5,184**	
Enrolment trend (%)	**10.14**	**9.48**	**9.81**						

Table 4.5 shows that enrolment in primary schools in Siaya County is projected to increase by 1.85 % from 259, 864 in 2021 to 264,682 in 2022. This may be attributed to the increase in projected primary school age population within this period. This enrolment is projected to decrease by 12.39% from 264,682 in 2022 to 231,897 in 2023 as the 12 year old population (Grade 7) transits to junior school under the 2-6-6-3 system of education. In the year 2024, CBC would fully be implemented in primary schools in Kenya. Only children aged 6-11 should be enrolled in primary schools at this time. The transition of the 13 year old population at the end of 2023 after completion of primary level of education will further reduce enrolment in primary schools in Siaya County by 9.90% from 231,897 to 208,929.

However, the primary school enrolment in Siaya County under the new system of education will increase by 9.81% from 208,929 in 2024 to 229,432 in 2030. Boys' enrolment will increase by 10.14% from 105,321 in 2024 to 115,995 in 2030 while girls' enrolment will increase by 9.48% from 103,608 in 2024 to 113,435 in 2030. The minimal difference between enrolment for girls and boys in primary schools in Siaya County is an indicator that many girls are accessing education just like boys and therefore schools should gear towards increasing physical facilities that are gender sensitive like toilets. While the national primary schools' Gross Enrolment Ratio (GER) is 99.6%, the GER for primary schools in Siaya County is 115% (ROK, 2019). A Gross Enrolment Ratio of 115% is an indicator of increased access to education regardless of the age (UNESCO, 2009). The increased access to education without expansion of educational resources exerts pressure on the available teachers and physical facilities which eventually impacts negatively on the quality of education in the county.

Projection of enrolment per sub-county indicate that Bondo sub-county will have 3,403 boys and 3,841 girls out of school by 2030, Ugenya sub-county will have 877 boys and 763 girls out of

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school by 2030 and Siaya sub-county will have 580 girls out of school by 2030 (Appendices U, W). This means that a total of 9,464 children aged between 6-11 years in Siaya County will be out of school by 2030. Findings of a survey by National Council for Population and Development (2017) on 2015 Kenya National Adolescents and youth survey Siaya County, estimated that 9,384 of primary school were out of school in the county by 2015. Measures therefore need to be put in place to ensure that this population is enrolled in schools by 2030. The CQASO cited poverty as one of the main factors affecting enrollment of pupils to schools in Siaya County. According to the Economic survey (2018), the poverty index for Siaya County is 33.8%.

The primary school age population (6-11) is projected to reach 211,876 by 2030. However, 229,432 pupils will be enrolled in primary schools in Siaya County by 2030. This implies that 17,556 of the children who will be enrolled in primary schools in Siaya County in 2030 will be a combination of overage and underage children. Findings from National Assessment System for Monitoring Learner Achievement (NASMLA) Class 3 Study (2020) established that a substantial percentage (46.5%) of the Class 3 pupils were overage, an increase of 6.0 percentage points from the 40.5% reported in the NASMLA Class 3 Study (2016). The overall mean age of the Class 3 pupils was 10.6 years compared to the mean of 9.6 years and 9.1 years reported in the NASMLA Class 3 Studies of 2016 and 2010 respectively.

Hungi, Ngware and Abuya (2014) as cited by Karogo et.al (2020) observe that irrespective of pupil gender, grade repetition, wealth background, school type or geographical location, Grade 6 pupils perform their best in literacy when they are in the age category ranging from 10 years 6 months, to 11 years 5 months. Hungi et al. (2014) further observed that, in general, younger pupils were likely to achieve better than older pupils in literacy regardless of the background

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under consideration. The over age factor in primary schools in Siaya County should therefore be addressed as it is an impediment towards provision of quality education.

4.2.4 Projection of enrolment in junior secondary schools in Siaya County by 2030

The junior secondary schools' enrolment projections in the six sub-counties (Appendices X, Y and Z) were summed up to give the projected enrolment in junior secondary schools in the whole county. Table 4.6 presents projected junior secondary school enrolment in Siaya County by 2030.

Table Error! No text of specified style in document.**.14: Projected enrolment in junior secondary schools in Siaya County by 2030**

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	56087	56268	112355	55540	54256	109796	547	2012	
2022	**60444**	**61745**	**122188**	**56801**	**55548**	**112349**	**3643**	**6197**	**8.75**
2023	**78434**	**76727**	**155162**	**75943**	**74786**	**150729**	**2491**	**1941**	**38.10**
2024	101593	99560	201153	95939	95205	191144	5654	4355	79.03
2025	**106698**	**104229**	**210927**	**98282**	**97788**	**196070**	**8416**	**6441**	**87.73**
2026	93865	91843	185708	84401	84591	168992	9464	7252	-11.96
2027	81485	79493	160978	71596	71974	143570	9889	7519	**-13.32**
2028	**68506**	**67509**	**136015**	**58869**	**60130**	**118999**	**9637**	**7379**	**-15.93**
2029	71997	70837	142833	60496	62033	122529	11501	8804	5.01
2030	**75624**	**74300**	**149924**	**62166**	**63998**	**126164**	**13458**	**10302**	**10.23**
Enrolment trend (%)	**34.83**	**32.05**	**33.44**						

The junior secondary school enrolment in Siaya County is projected to increase by 8.75% from 112,355 in 2021 to 122,188 in 2022. Due to double intake in junior secondary schools in the county between 2023 and 2025, the enrolment is projected to increase by 87.73% from 112,355 in 2021 to 210,927 in 2025. This implies that educational facilities in junior secondary schools in Siaya County need to be increased in anticipation of the increased enrolment between 2023 and 2025. As the 15-17 years school age population under the 8-4-4 system of education completes the secondary school education, junior secondary school enrolment in Siaya County is projected to decrease by 13.32% from 185,708 in 2026 to 160,978 in 2027. However, due to increase in 12-14 school age population between 2028 and 2030, the junior secondary school enrolment is also projected to increase by 10.23% from 136,015 in 2028 to 149,923 in 2030.

Junior secondary school enrolment in Siaya County is therefore projected to increase by 33.44% from 112,355 in 2021 to 149,928 in 2030. Ugenya sub-county will have the highest increment of 82.25% at junior secondary school level from 14,837 in 2021 to 27,040 in Siaya County by 2030. Findings of Fwaya (2014) on Challenges of Implementing Free Day Secondary Education strategy among public secondary schools in Ugenya sub-county indicate that since the execution of FDSE, secondary school enrolment in the sub-county rose by 44.8% between 2008 and 2012 and that with this increment, the sub-county was experiencing shortages in teaching staff and physical facilities.

The total junior secondary school enrolment for boys and girls in Siaya County is also projected to increase by 34.83% and 32.05% respectively by 2030. More boys than girls will be enrolled in junior secondary schools in Siaya County by 2030. There will be 23,760 students in junior secondary schools by 2030 who do not fall within the 12-14 years age bracket. They will be either underage or overage. However, there will also be 3,250 girls in Bondo sub-county

(Appendix X) within the 12-14 years age bracket who will be out of school in 2030. There is therefore need to put measures in place to ensure that girls in Bondo sub-county are enrolled in schools.

According to the findings of Siaya County adolescents and youth survey (2015), it was estimated that 32,000 secondary school age children were out of school in 2015. This means that by 2030, most of the secondary school age population in Siaya County will have been enrolled in either junior or senior secondary schools in the county. This calls for expansion of educational facilities in both junior and senior secondary schools in anticipation of the increased enrolment

On factors affecting enrolment of pupils in primary and secondary schools in Siaya County, the CQASO noted that due to high poverty levels and high HIV prevalence rate (15.3%), children enrolled in schools late. Some pupils who are being sponsored by Non-governmental Organizations and well wishers get the help after they have stayed out of school for long and have to enroll in school when they are already overage. According to Kenya Population-based HIV Impact Assessment; (KENPHIA, 2018), Siaya County HIV prevalence is 15.3% and this is the third highest HIV prevalence across all the 47 counties in Kenya. Measures should therefore be put in place to ensure that children join grade one at 6 years as required and that there is 100% transition of pupils from one grade to the other. An increase of 33.44% in junior secondary school enrolment demands that more financial resources should be allocated to schools earmarked as junior secondary schools to recruit more teachers and to put up more classrooms, toilets and desks to enhance provision of quality education at this level of education.

4.2.5 Projected enrolment for senior secondary schools in Siaya County by 2030
The senior secondary schools' enrolment projections in the six sub-counties (Appendices AA and AB) were summed up to give the projected enrolment in senior secondary schools in the

whole county. Table 4.7 shows projected enrolment for senior secondary schools in Siaya County by 2030.

Table Error! No text of specified style in document.**.15: Projected enrolment for senior secondary schools in Siaya County by 2030**

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	**54815**	**61542**	**116357**	**44935**	**43950**	**88885**	**9880**	**17592**	
2027	58200	66333	124532	45860	44895	90755	12340	21438	7.03
2028	61698	71298	132996	46804	45860	92664	14894	25438	6.80
2029	65317	76446	141763	47769	46847	94616	17548	29599	6.59
2030	**69055**	**81781**	**150835**	**48753**	**47854**	**96607**	**20302**	**33927**	**6.40**
Enrolment trend (%)	**25.98**	**32.89**	**29.63**						**29.63**

The first cohort under the 2-6-6-3 system of education will transit to senior secondary level in the year 2026. Enrolment at senior secondary school level in Siaya County is projected to increase by 29.63% from 116,357 in 2026 to 150,835 in 2030. The projected school age population for senior secondary schools in Siaya County by 2030 is 96,607. With 150,835 students enrolled at this level, it implies that 54,229 students enrolled will be either overage or underage. Boys' enrolment is projected to increase by 25.98% from 54,815 in 2026 to 69,055 in 2030 while girls' enrolment is projected to increase by 32.89% from 61,542 in 2026 to 81,781 in 2030.

Girls' enrolment across all the six sub-counties will be higher than enrolment for boys. A total of 1,053 boys in Siaya County (from Siaya sub-county- Appendix AA) will be out of school by 2030. Concerted effort by educational stake holders should be made to ensure that all children are enrolled in schools by 2030. To ensure that provision of quality education is not compromised, planning for teachers and physical infrastructure at senior secondary school level in Siaya County should be based on the projected enrolment of 150, 835 students.

According to 2014 Basic Education Statistical Booklet, of the three levels of education in Kenya, secondary schools recorded the highest annual growth of 8.2% followed by primary at 5.1% and then ECDE at 1.0%. Generally, the demand for education has increased over the years. The relative demand is highest at secondary level of education and is attributed to the ripple effects from FPE and FDSE (ROK, 2017). According to 2019 Basic Education Statistical Booklet, while the GER for secondary schools in Kenya was 71.2%, the GER for secondary schools in Siaya County was 87.8% (ROK, 2019). This is an indicator that there is a high demand for secondary education in Siaya County. Planning for provision of adequate educational resources at junior and secondary school levels will ensure that the many students who are enrolling for secondary education will acquire requisite skills, knowledge, values and attitude that will propel the nation towards achieving Kenya Vision 2030.

4.3 Teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030

The second objective of this study was to project teacher requirement in primary and secondary schools in Siaya County. Table 4.8 shows the projected teacher requirement in primary schools in Siaya County.

Table Error! No text of specified style in document.**.16: Projected teacher requirement for primary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	1524	1153	1250	1065	948	719	6659	
2022	**1537**	**1152**	**1275**	**1093**	**975**	**749**	**6782**	**1.85**
2023	1339	990	1122	963	859	670	5942	-12.39
2024	**1224**	**918**	**1026**	**877**	**699**	**610**	**5354**	**-9.90**
2025	1230	921	1051	900	704	634	5440	1.62
2026	1236	925	1077	924	709	657	5528	1.61
2027	1241	928	1103	948	714	668	5602	1.34
2028	1246	930	1130	973	718	700	5698	1.72
2029	1251	932	1158	999	723	726	5788	1.58
2030	**1255**	**934**	**1186**	**1024**	**727**	**752**	**5879**	**9.81**
Trend (%)	2.53	1.82	15.59	16.80	4.10	23.23	9.81	

Table 4.8 shows projected primary teacher requirement in the six sub-counties of Siaya County for the period 2021 to 2030. Due to the projected increment in enrolment in primary schools between 2021 and 2022, the number of teachers required in the county is projected to increase by 1.85% from 6,659 in 2021 to 6,782 in 2022. This teacher requirement is however projected to decrease by 12.39% from 6,782 in 2022 to 5,942 in 2023. This will be as a result of transition of the 12 year old school population to junior secondary schools hence a reduction in primary school enrolment in the year 2023. Under the 2-6-6-3 system of education, teacher requirement for primary schools in Siaya County is projected to increase by 9.81% from 5,354 in 2024 to 5,879 in 2030. To teach the projected 229, 432 pupils at primary school level, Siaya County will therefore require 5,879 teachers to meet the recommended PTR of 40:1. This will uplift the deteriorating standards of education in the county. Table 4.9 shows the current staffing in primary schools in Siaya County.

Table Error! No text of specified style in document.**.17: Staffing in Primary schools in Siaya County in 2020**

Sub-county	No of schools	Curriculum Base Establishment	Teachers on Duty	Teachers on Duty (%)	Teacher shortage	Teacher shortage (%)
Siaya	133	1485	1339	90.2	146	9.8

Bondo	128	1331	1138	85.5	193	14.5
Gem	119	1441	1202	83.4	239	16.6
Rarieda	119	1156	1045	90.4	111	9.6
Ugenya	86	905	866	95.7	39	4.3
Ugunja	71	748	735	98.3	13	1.7
Siaya County	**656**	**7066**	**6325**	**89.5**	**741**	**10.5**

Source: TSC Siaya County office, 2020,

Table 4.9 shows that the highest shortage of primary school teachers (16.6%) in Siaya County is in Gem sub-county. Teacher requirement in Siaya County is projected to reach 6,659 in the year 2021. The Teachers on Duty by the end of the year 2020 were 6,325. This implies that 334 teachers need to be employed in the county by the end of the year 2021 to address the teacher shortage in the county. However, based on data on total number of teachers collected from TSC Siaya County, there is a shortage of 741 teachers in the county. This indicates that the numerous (656) primary schools in Siaya County have few enrolled pupils hence exerting more pressure on the teacher requirement. Low enrolment in primary schools leads to under-utilization of teachers.

However, the current shortage of teachers in Siaya County will only last up to the year 2022. In the year 2023, the teacher requirement in the county will be 5,942. If the county will maintain 6,325 teachers employed by the Teachers' Service Commission, then there will be no shortage of teachers in primary schools in the year 2023. However, mechanisms need to be put in place to address the current teacher shortage so that it does not affect the quality of education in both the 8-4-4 and the 2-6-6-3 systems of education. As the Teachers' Service Commission deploys primary school teachers who have met the requirements of teaching in secondary schools across the country, it should do so in phases and also recruit more intern teachers to temporarily curb teacher shortage in primary schools between the years 2021 and 2022 and also manage the transition crisis in junior secondary schools in the year 2023. This will cut on costs of education

without compromising quality of education both at the primary and junior secondary levels of education.

4.3.1 Projected teacher requirement for junior secondary schools in Siaya County by 2030

The teacher resource is vital in provision of quality education. Under the 2-6-6-3 structure of education, junior secondary education will comprise of grades 7, 8 and 9. The projected teacher requirement for junior secondary schools in the six sub-counties in Siaya County is shown in Table 4.10.

Table Error! No text of specified style in document.**.18: Projected teacher requirement for junior Secondary schools in Siaya County**

by 2030

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	**886**	**837**	**945**	**799**	**618**	**597**	**4682**	
2022	955	906	1034	866	683	650	5092	8.75
2023	**1357**	**1120**	**1158**	**1024**	**1058**	**751**	**6466**	**38.10**
2024	1775	1436	1494	1318	1384	976	8383	79.03
2025	**1867**	**1483**	**1554**	**1373**	**1484**	**1030**	**8790**	**87.73**
2026	1654	1298	1352	1196	1332	906	7739	-11.96
2027	1445	1118	1160	1030	1164	792	6709	-13.32
2028	**1221**	**940**	**977**	**871**	**989**	**670**	**5668**	**-15.51**
2029	1285	975	1018	910	1057	708	5953	5.01
2030	**1353**	**1011**	**1060**	**950**	**1127**	**747**	**6248**	**10.23**
Trend (%)	**52.73**	**20.83**	**12.19**	**18.88**	**82.25**	**25.04**	**33.44**	

Table 4.10 shows the projected teacher requirement for junior secondary schools in the six sub-counties. As junior secondary schools admit grade 7 students in 2023, there will be the 8-4-4 students in the same schools. Teacher requirement in junior secondary schools in Siaya County is projected to increase by 38.10% from 4,682 in 2021 to 6,466 in 2023. In 2024 and 2025, the double intakes (Form ones under 8-4-4 and Grade 7 under 2-6-6-3 systems of education) will

increase the teacher requirement by 87.73% from 4,682 in 2021 to 8,790 in 2025. The teacher requirement in the county will however decrease by 13.32% from 7,739 in 2026 to 6,709 in 2027 as the students under 8-4-4 system of education completes the secondary education level. In 2028, only the junior secondary enrolment will be in junior secondary schools. Teacher requirement will again increase by 10.23% from 5,668 in 2028 to 6,248 in 2030. Teacher requirement in junior secondary schools in Siaya County is therefore projected to increase by 33.44% from 4,682 in 2021 to 6,248 in 2030. By 2030, increment in teacher requirement will be highest in Ugenya sub-county at 82.25% and lowest in Gem sub-county at 12.29%. Currently, Siaya County has 2,920 teachers in secondary schools. Table 4.11 shows the distribution of teachers in secondary schools in Siaya County in the year 2020.

Table Error! No text of specified style in document.**.19: Staffing in secondary schools in Siaya County in 2020**

Sub-county	No of schools	Curriculum Base Establishment	Teachers on Duty	Teachers on Duty (%)	Teacher shortage	Teacher shortage (%)
Siaya	51	889	584	65.7	305	34.3
Bondo	41	860	568	66.0	292	34.0
Gem	47	748	574	76.7	174	23.3
Rarieda	48	890	530	59.6	360	40.4
Ugenya	32	566	358	63.3	208	36.7
Ugunja	24	535	306	57.2	229	42.8
Siaya County	**243**	**4488**	**2920**	**65.1**	**1568**	**34.9**

Source: TSC Siaya County office, 2020

Table 4.11 shows that the teacher shortage in secondary schools in Siaya County is 34.9%. The shortage of 34.9% means that Boards of management for secondary schools in Siaya County have to hire 34.9% of the total teaching force. Expenditure on wage bill of BOM teachers hampers the expansion of educational facilities as the funds meant for expansion are being used to pay wages for teachers hired by Boards of management (Munyasia, 2017).

Teacher requirement in junior secondary schools in Siaya County is projected to reach 8,790 by 2025 as schools in the county admit students at junior secondary level. There are currently 2,920 teachers in secondary schools in Siaya County. This is just but 33.2% of the teachers required in junior secondary schools by 2025. On causes of teacher shortages in the county, the TSC County Human Resource Officer indicated that the ever increasing enrolment in schools due to 100% transition policy does not match the TSC rate of employing teachers hence causing teacher shortage in the county.

Lack of teachers trained in technical subjects like drawing and design, Agriculture, Computer studies and sciences is another cause of teacher shortage in the county as pointed out by the TSC County Human Resource Officer. Schools with vacancies in these subjects have sometimes failed to get teachers even after TSC advertising the subject combinations. As secondary schools implement CBC, universities should endeavor to train enough teachers to teach technical and science subjects in secondary schools in Kenya. Table 4.12 shows the projected teacher requirement for senior secondary schools in Siaya County by 2030.

4.3.2 Projected teacher requirement for senior secondary schools in Siaya County by 2030
The senior secondary school level will comprise of grades 10, 11 and 12. Table 4.12 shows the projected teacher requirement for senior secondary schools in Siaya County by 2030.

Table Error! No text of specified style in document.**.20: Projected teacher requirement for senior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %
2026	**830**	**894**	**1074**	**827**	**696**	**528**	**4849**	
2027	877	959	1157	882	754	561	5190	7.03
2028	926	1027	1242	939	815	594	5543	6.80
2029	976	1098	1330	997	877	629	5908	6.59

2030	1028	1172	1421	1058	943	665	6286	6.40
Trend (%)	23.78	31.10	32.23	27.95	35.49	25.96	29.63	

Table 4.12 shows the projected teacher requirement in senior secondary schools in Siaya County by the year 2030. The first senior secondary school cohort under the 2-6-6-3 system of education will join Grade 10 in the year 2026. However, senior secondary schools shall continue hosting the 8-4-4 students till the year 2027. Teacher requirement in senior secondary schools in Siaya County is therefore projected to increase by 29.63 % from 4,849 in 2026 to 6,286 in 2030. Projection of teacher requirement in junior secondary schools indicates that by 2030, Siaya County will need 6,248 teachers to teach in junior secondary schools.

The teacher requirement in junior and senior secondary schools in Siaya County by 2030 will therefore stand at 12,534. The 2,920 teachers in secondary schools in Siaya County therefore constitute 23.3% of the total teacher requirement by 2030. The Teachers' Service Commission therefore needs to plan to hire 9,614 teachers for both junior and senior secondary schools in Siaya County by 2030. Failure to provide adequate number of teachers will compromise the education standards in the county. Figure 4.3 shows the projected teacher requirement for primary, junior and senior secondary schools in Siaya County by the year 2030.
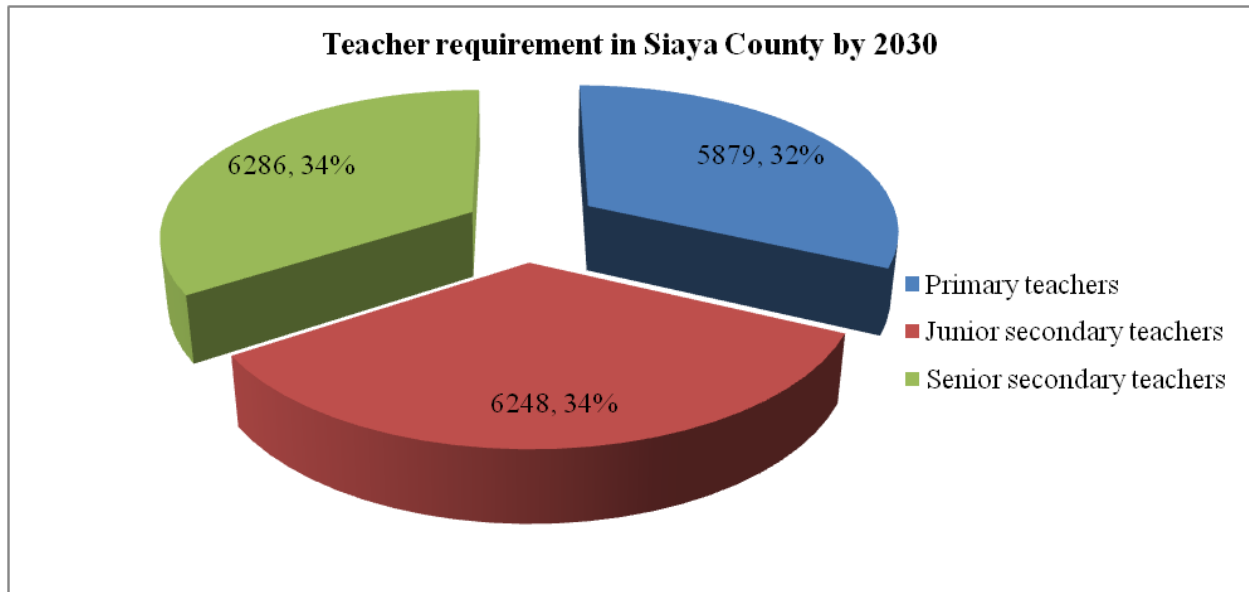
Figure Error! No text of specified style in document.**.7: Teacher requirement in Siaya County by 2030**

Figure 4.3 shows the total teacher requirement in primary, junior and senior secondary schools in Siaya County. The county will need a total of 18,413 teachers in primary, junior secondary and senior secondary schools by the year 2030. Junior and senior secondary schools will each take 34% of the teaching force in Siaya County while primary schools will take 32%. Teachers' Service Commission should therefore plan to increase the teaching force in secondary schools in Siaya County in order to achieve quality education envisaged in Kenya vision 2030.

4.4 Physical infrastructure requirement for provision of quality education in primary and secondary schools in Siaya County by 2030

The third objective of the study was to project the physical infrastructure requirement for primary, junior and senior secondary schools in Siaya County by 2030. The educational resources projected in this study are classrooms, toilets and desks. Using the projected enrolment, required classrooms were projected using the pupil classroom ratio of 45:1, required toilets for boys and girls were projected using the pupil toilet ratio of 30:1 and 25:1 respectively.

The desks required were projected using the pupil desk ratio of 3:1 in primary schools and 1:1 in secondary schools.

4.4.1 Projection of classroom requirement in primary schools in Siaya County by 2030

Enrolment determines the quantity of educational facilities required in schools at any particular time. Table 4.13 shows the projected classrooms for primary schools in the six sub-counties in Siaya County by 2030.

Table Error! No text of specified style in document.**.21: Projected classroom requirement for primary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	1322	1000	1084	923	822	623	5775	
2022	**1333**	**999**	**1106**	**948**	**846**	**649**	**5882**	**1.85**
2023	1161	859	973	835	745	581	5153	-12.39
2024	**1062**	**796**	**890**	**761**	**606**	**529**	**4643**	**-9.90**
2025	1067	799	912	781	610	550	4718	1.62
2026	1072	802	934	801	615	570	4794	1.61
2027	1076	805	957	822	619	579	4858	1.34
2028	1081	807	980	844	623	607	4942	1.72
2029	1085	809	1004	866	627	629	5020	1.58
2030	**1088**	**810**	**1028**	**888**	**631**	**652**	**5098**	**9.81**
Trend (%)	**2.53**	**1.82**	**15.59**	**16.80**	**4.10**	**23.23**	**9.81**	

Table 4.13 shows the projected classroom requirement for primary schools per sub-county in Siaya County. The classroom requirement in primary schools in Siaya County will increase by 1.85% from 5,775 in 2021 to 5,882 in 2022. However, with the reduction of primary schooling years from eight to six years under the 2-6-6-3 system of education, the twelve and thirteen year olds will be joining the junior secondary school level hence reducing the classroom requirement in primary schools by 12.39% from 5,882 in 2022 to 5,153 in 2023. Classroom requirement in primary schools under the 2-6-6-3 system of education in Siaya County is, however, projected to increase by 9.81% from 4,682 in 2024 to 5,098 in 2030.

According to the CQASO, inadequacy of physical infrastructure in schools in Siaya County is attributed to the ever increasing pupils' enrolment. Findings from the preliminary survey (Table 1.4) indicate that there are 5,820 permanent and 244 temporary classrooms in primary schools in Siaya County. This implies that no more classrooms should be constructed even with the projected increase in pupils' enrolment between 2021 and 2022. By 2030, 722 permanent classrooms in primary schools in Siaya County will be empty as classes 7 and 8 are phased out from the primary level of education. The preliminary survey (Table 1.4) indicates that Ugunja sub-county has the highest number of temporary classrooms. This could be efforts being made to accommodate the increasing enrolment. There are currently 641 permanent classrooms in Ugunja sub-county. More 11 classrooms will therefore be required in Ugunja sub-county by 2030 to accommodate the increasing primary school enrolment.

4.4.2 Projection desk requirement in primary schools in Siaya County

The projected enrolment was used to project the desk requirement in primary schools in Siaya County by the year 2030. In primary schools, the recommended pupil desk ratio is 3:1. To project the number of desks required in primary schools, projected enrolment was divided by the pupil desk ratio of 3:1. The results are shown in Table 4.14

Table Error! No text of specified style in document.**.22: Projected desk requirement for primary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	19828	14997	16259	13849	12337	9352	86621	
2022	**19998**	**14988**	**16592**	**14222**	**12687**	**9741**	**88227**	**1.85**
2023	17413	12882	14594	12525	11170	8714	77299	-12.39
2024	**15923**	**11936**	**13346**	**11409**	**9090**	**7939**	**69643**	**-9.90**
2025	16002	11986	13673	11711	9156	8243	70770	1.62

2026	16077	12029	14010	12020	9221	8551	71909	1.61
2027	16147	12070	14351	12337	9283	8686	72874	1.34
2028	16213	12102	14703	12659	9344	9104	74125	1.72
2029	16273	12129	15062	12989	9404	9438	75295	1.58
2030	**16326**	**12153**	**15427**	**13326**	**9463**	**9784**	**76477**	**9.81**
Trend (%)	**2.53**	**1.82**	**15.59**	**16.80**	**4.10**	**23.23**	**9.81**	

Table 4.14 shows the projected desk requirement in primary schools in Siaya County by the year 2030. Desk requirement in Siaya County will increase by 1.85% from 86,621 in 2021 to 88,227 in 2022. Under the 2-6-6-3 system of education, desk requirement in primary schools in Siaya County will increase by 9.81% from 69,643 desks in 2024 to 76,477 desks in 2030. There are currently 50,550 desks in primary schools in Siaya County translating to a pupil desk ratio of 5:1 as indicated in Table 1.4. This implies that by 2021, the desk shortage in the county will be 36,071. Under the 2-6-6-3 system of education, desk requirement in primary schools in Siaya County will increase by 9.81% from 69,643 desks in 2024 to 76,477 desks in 2030. According to 2014 Basic Education Statistical Booklet, Siaya County had 27,007 desks that were over loaded in primary schools. Ideally, each desk should have no more than 3 learners and the space between any two desks should be at least 2 feet (MOE, 2008). The recommended ratio for pupil desk ratio in primary schools is 3:1. As the enrolment in primary schools in Siaya County increases between 2024 and 2030, the desk requirement will also increase. A plan should be put in place to increase the current number of 50,550 desks to 76,477 desks by 2030. Based on the current number of desks in primary schools in the county, an additional 25,927 desks will have to be provided to pupils by 2030 to adhere to the recommended pupil desk ratio of 3:1. This will improve the personal space for learners; which is vital in provision of quality education.

4.4.3 Projection of toilet requirement for males and females in primary schools in Siaya County

Pupil toilet ratio is an important education parameter for it is a measure of the level of sanitation and hygiene in a school. Table 4.15 shows the results for projected number of toilets for girls in primary schools in Siaya County by 2030.

Table Error! No text of specified style in document.**.23: Projected toilet requirement for girls in primary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	1193	893	960	832	737	566	5181	
2022	**1201**	**891**	**975**	**856**	**758**	**589**	**5269**	**1.71**
2023	1046	759	853	757	670	530	4614	-12.44
2024	**965**	**705**	**791**	**677**	**542**	**464**	**4144**	**-10.17**
2025	969	708	812	695	547	481	4210	1.60
2026	972	710	833	714	551	497	4277	1.58
2027	976	712	855	733	555	492	4322	1.05
2028	979	713	877	752	559	520	4401	1.82
2029	981	714	900	772	564	537	4469	1.55
2030	**983**	**715**	**923**	**792**	**568**	**556**	**4537**	**9.48**
Trend (%)	**1.93**	**1.40**	**16.80**	**17.05**	**4.64**	**19.63**	**9.48**	

Table 4.15 shows the projected toilet requirement for girls in primary schools in Siaya County. In total, the toilet requirement for girls in Siaya County is projected to increase by 1.71% from 5,181 in 2021 to 5,269 in 2022. Under the 2-6-6-3 system of education, toilet requirement for girls in primary schools in Siaya county is projected to increase by 9.48% from 4,144 toilets in 2024 to 4,537 toilets in 2030. There are currenty 2,554 permanent and 123 temporary toilets for girls in primary schools in the county. This translates to pupil toilet ratio of 50:1 instead of 25:1 Finances should therefore be set aside for gradual construction of 1,983 toilets for girls to ensure that the recommended ratio of 25:1 is adhered to. According to UNICEF (2009), inadequate access to sanitation may have a negative impact on enrolment and attendance, especially of girls,

and on school performance. Table 4.16 shows the projected toilet requirement for boys in primary schools in Siaya County by 2030.

Table Error! No text of specified style in document.**.24: Projected toilet requirement for boys in primary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	989	756	826	692	620	464	4345	
2022	**999**	**756**	**846**	**709**	**637**	**483**	**4432**	**1.99**
2023	870	655	749	622	559	430	3885	-12.33
2024	**788**	**606**	**676**	**577**	**457**	**407**	**3511**	**-9.64**
2025	793	609	691	592	460	424	3568	1.64
2026	797	611	707	607	463	441	3627	1.63
2027	802	614	723	623	466	459	3686	1.63
2028	806	616	739	639	468	477	3745	1.62
2029	810	618	756	656	471	496	3806	1.61
2030	**813**	**619**	**773**	**672**	**473**	**515**	**3867**	**10.14**
Trend (%)	**3.14**	**2.22**	**14.42**	**16.56**	**3.57**	**26.65**	**10.14**	

Table 4.16 shows the projected number of toilets for boys in primary schools in Siaya County. Toilet requirement for boys in primary schools in Siaya County is projected to increase by 1.99% from 4,345 in 2021 to 4,432 in 2022. Under the 2-6-6-3 system of education, the toilet requirement for boys in primary schools in Siaya County is projected to increase by 10.14% from 3,511 in 2024 to 3,867 in 2030. There are currently 2,623 permanent toilets for boys in primary schools in the county. This implies that more 1,244 toilets for boys will need to be contructed between 2021 and 2030 to meet the recommended pupil toilet ratio of 30:1 for boys. On inadequacy of physical infrastructure, the CQASO attributed inadequacy of toilets in primary schools in Siaya County to poor workmanship. Some primary schools in the county had no toilets as the existing ones sink during rainy seasons. However, the CQASO reported that non-

governmental organizations and Constituency Development Fund have been instrumental in putting up sanitation facilities in schools in Siaya County.

4.4.4 Projection of classroom requirement for junior secondary schools in Siaya County by 2030

The recommended pupil classroom ratio is 45:1. To project the number of classrooms required in junior secondary schools in Siaya County by 2030, the projected enrolment was divided by the pupil classroom ratio of 45:1. Results for this projection are shown in Table 4.17.

Table 4.17

Table Error! No text of specified style in document.**.25: Projected classroom requirement for junior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	**472**	**446**	**504**	**426**	**330**	**318**	**2497**	
2022	509	483	551	462	364	346	2715	8.75
2023	**723**	**597**	**617**	**546**	**564**	**400**	**3448**	**38.10**
2024	947	766	796	703	738	520	4470	79.03
2025	**995**	**791**	**829**	**732**	**791**	**549**	**4687**	**87.73**
2026	882	692	721	638	711	483	4127	-11.96
2027	770	596	618	549	621	422	3577	-13.32
2028	**651**	**501**	**521**	**465**	**527**	**357**	**3023**	**-15.51**
2029	685	520	543	485	563	377	3174	5.01
2030	**722**	**539**	**565**	**506**	**601**	**398**	**3332**	**10.23**
Trend (%)	**52.73**	**20.83**	**12.19**	**18.88**	**82.25**	**25.04**	**33.44**	

Table 4.17 shows the projected number of classrooms for junior secondary schools in Siaya County by 2030. Unlike in primary schools where the number of classrooms is projected to decrease, the number of classrooms in junior secondary schools in Siaya County is projected to increase by 33.44% from 2,497 in 2021 to 3,332 in 2030. Siaya sub-county is projected to have the highest increment in classroom requirement of 52.73% between 2021 and 2030. Due to double intake in junior secondary schools in Siaya County between 2023 and 2025, classroom requirement is projected to increase by 87.73% from 2,497 in 2021 to 4,687 in 2025. However,

classroom requirement in junior secondary schools in Siaya County is projected to drop by 13.32% from 4,127 in 2026 to 3,577 in 2027. This is as a result of a decrease in enrolment between 2025 and 2027 as the 8-4-4 students gradually complete the secondary school level of education. Since junior secondary level will be domiciled in sub-county secondary schools in Kenya, it is important that these categories of schools in Siaya County are expanded to accommodate the increasing enrolment by the year 2025.

Since increment in enrolment at this level will be due to double intakes between 2023 and 2025, it is only logical to put up more classrooms in the existing schools instead of putting up more schools to accommodate the increased enrolment. The classroom requirement in the year 2025 need to be planned for well in advance to ensure that quality of education in junior secondary schools in Siaya County is not compromised during the transition period. Although enrolment is projected to decrease by the year 2028, the classrooms constructed by 2025 to address the challenge of double intake will still be required as enrolment is projected to have an increasing trend after the year 2028. To achieve the Pupil Classroom Ratio of 45:1, which is an indicator of quality education, a total of 3,332 classrooms need to be constructed in Siaya County for the junior secondary level of education. Table 4.18 shows the projected classroom requirement in senior secondary schools in Siaya County by 2030.

Table Error! No text of specified style in document.**.26: Projected classroom requirement for senior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %
2026	**443**	**477**	**573**	**441**	**371**	**282**	**2586**	
2027	468	511	617	470	402	299	2767	7.03
2028	494	548	662	501	434	317	2955	6.80
2029	520	585	709	532	468	335	3150	6.59
2030	**548**	**625**	**758**	**564**	**503**	**355**	**3352**	**6.40**

Trend (%)	23.78	31.10	32.23	27.95	35.49	25.96	29.63

The enrolment in senior secondary schools in Siaya County is projected to increase between 2026 and 2030. This will consequently lead to an increase in classroom requirement by 29.63% from 2,586 classrooms in 2026 to 3,352 classrooms in 2030. There are currently 2,037 classrooms in all the secondary schools in Siaya County. A total of 6,684 classrooms will be required to accommodate enrolment in both junior and senior secondary schools in Siaya County. This implies that comprehensive plans should be put in place to construct more 4,647 classrooms in Siaya County by 2030.

Senior secondary level is meant to be domiciled in county, extra county and national schools in the county. Educational resources in the existing county, extra-county and national schools in Siaya County need to be expanded to enhance provision of quality education in the county by 2030. The CQASO noted that one of the mechanisms being put in place to ensure that schools have adequate physical facilities is the sensitization of parents on their role in provision of quality education. Most parents in Siaya County are reluctant in supporting construction of physical facilities in schools as they regard education free. Reference was made to the press statement on Fees Guidelines for Public Secondary Schools in Kenya released on 15th February, 2015 which state that all future infrastructural projects will be undertaken through Constituency Development Fund (CDF) or any other government financing mechanisms and parents were no longer to be charged extra levies meant for infrastructure improvement in schools.

4.4.5 Projection of desk requirement for junior and senior secondary schools in Siaya County by 2030

Projection of number of desks required in secondary schools by the year 2030 was projected by dividing projected students' enrolment in the sub-counties in Siaya County by the pupil desk

ratio of 1:1. This means that in junior and senior secondary schools, the number of projected desks will be equal to projected enrolment. Results for desk requirement in junior secondary schools in Siaya County are presented in Table 4.19.

Table Error! No text of specified style in document.**.27: Projected desk requirement for junior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	21258	20082	22681	19169	14837	14328	112355	
2022	22905	21734	24815	20769	16377	15589	122188	8.75
2023	**32557**	**26874**	**27776**	**24563**	**25382**	**18009**	**155162**	**38.10**
2024	42600	34467	35842	31627	33203	23413	201153	79.03
2025	**44791**	**35575**	**37283**	**32941**	**35617**	**24719**	**210927**	**87.73**
2026	39699	31135	32449	28704	31973	21747	185708	-11.96
2027	34669	26817	27825	24724	27937	19006	160978	-13.32
2028	**29287**	**22556**	**23448**	**20903**	**23735**	**16086**	**136015**	**-15.51**
2029	30846	23396	24430	21827	25352	16983	142833	5.01
2030	**32469**	**24266**	**25445**	**22787**	**27040**	**17916**	**149924**	**10.23**
Trend (%)	52.73	20.83	12.19	18.88	82.25	25.04	33.44	

Table 4.19 shows the projected desk requirement for junior secondary schools in Siaya County by 2030. Enrolment in junior secondary schools in Siaya County is projected to increase by 38.10% from 112,355 in 2021 to 155,162 in 2023. The number of desks in junior secondary schools is consequently projected to increase by 38.10% from 112,355 in 2021 to 155,162 in 2023. Due to double intakes between 2023 and 2025, the desk requirement is projected to increase by 87.73% from 112,355 in 2021 to 210,927 in 2025. However, due to gradual phasing out of the 8-4-4 enrolment between 2026 and 2027, desk requirement in junior secondary schools in the county is projected to drop by 13.32% from 185,708 in 2026 to 160,978 in 2027. The desk

requirement will again increase by 10.23% from 136,015 in 2028 to 149,923 in 2030 due to increase in enrolment of students aged 12-14 years.

Siaya sub-county will have the highest increment in desk requirement at junior secondary school level at 52.73% while Gem sub-county will have the least desk requirement at 12.19% between 2021 and 2030. Desk requirement in junior secondary schools in Siaya County will therefore increase by 33.44% from 112,355 in 2021 to 149,923 in 2030. Schools categorized as sub-county secondary schools in Siaya County therefore need to plan for provision of a total 155,162 desks to cater for the 8.4.4 enrolment currently in school and Grade 7 students who will be joining them in the year 2023. This planning will enhance provision of quality education even with the on-going education reforms in the country. Table 4.20 shows the projected desk requirement in senior secondary schools in Siaya County by the year 2030.

Table Error! No text of specified style in document.**.28: Projected desk requirement for senior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County
2026	**19920**	**21448**	**25781**	**19838**	**16701**	**12669**	**116357**
2027	21048	23014	27765	21162	18092	13451	124532
2028	22214	24646	29808	22526	19545	14257	132996
2029	23418	26346	31918	23934	21051	15097	141763
2030	**24656**	**28120**	**34091**	**25382**	**22628**	**15958**	**150835**
Trend (%)	**23.78**	**31.10**	**32.23**	**27.95**	**35.49**	**25.96**	**29.63**

Enrolment in senior secondary schools in Siaya County is projected to increase by 29.63% from 116,357 in 2026 to 150,835 in 2030. The number of desks at this level of education is

consequently projected to increase by 29.63% from 116,357 in 2026 to 150,835 in 2030 since the pupil locker ratio in secondary schools is 1:1. The increment in desk requirement will be highest (35.49%) in Ugenya sub-county which shall be requiring 22,638 desks in 2030. Siaya sub-county will have the least increment (23.78%) in desk requirement in senior secondary schools by

Unlike in junior secondary schools where double intake between the years 2023 and 2025 will exert a lot of pressure on the existing educational resources, transition to senior secondary schools in Siaya County will be smoother as enrolment at this level is projected to increase gradually between 2026 and 2030. There are currently 102,235 desks in all the secondary schools in the county. A total of 300,758 desks will be required to accommodate 149,923 junior and 150,835 senior students by 2030. More 198,523 locker/chairs will need to be provided by 2030. More financial resources therefore need to be allocated to all secondary schools to expand the existing desk requirement gradually to meet the recommended pupil desk ratio of 1:1.

4.4.6 Projection of toilet requirement for junior and senior secondary schools in Siaya County by 2030

The number of toilets required in both junior and senior secondary schools in Siaya County was projected using the recommended pupil toilet ratio of 25:1 for girls and 30:1 for boys. The projected enrolment for boys and girls in junior and junior secondary schools was divided by these ratios to establish the toilet requirement for boys and girls in secondary schools in Siaya County by 2030. Projected toilet requirement for girls in junior secondary schools in Siaya County is presented in Table 4.21.

Table Error! No text of specified style in document.**.29: Projected toilet requirement for girls in junior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	**482**	**376**	**428**	**354**	**301**	**309**	**2251**	
2022	524	411	473	388	337	337	2470	9.73
2023	**706**	**501**	**524**	**491**	**482**	**365**	**3069**	**36.36**
2024	929	639	675	634	629	475	3982	76.94
2025	**981**	**653**	**702**	**661**	**672**	**501**	**4169**	**85.24**
2026	879	564	608	582	601	441	3674	-11.88
2027	771	483	522	499	523	382	3180	-13.45
2028	**656**	**407**	**435**	**428**	**450**	**325**	**2700**	**-15.07**
2029	694	418	453	448	479	342	2833	4.93
2030	**734**	**429**	**470**	**469**	**510**	**360**	**2972**	**10.06**
Trend (%)	**52.20**	**14.05**	**9.95**	**32.26**	**69.07**	**16.74**	**32.05**	

Table 4.21 shows the projected number of toilets for girls in junior secondary schools in Siaya County. The number of toilets for girls in junior secondary schools in Siaya County is projected to increase by 36.36% from 2,251 in 2021 to 3,069 in 2023 as a result of increased enrolment that will arise due to transition of Grade 7 to junior secondary schools in 2023. Due to double intakes at this level of education between 2023 and 2025, toilet requirement for girls in junior secondary schools in Siaya County is projected to increase by 85.24% from 2,251 in 2021 to 4,169 in 2025.

However, as the 8-4-4 enrolment gradually exits junior secondary schools by 2027, toilet requirement for girls in the county will drop by 13.45% from 3,674 in 2026 to 3,180 in 2027. This requirement will again increase gradually by 10.06% from 2,700 in 2028 to 2,972 in 2030. The girls' toilet requirement at junior secondary level of education is therefore projected to increase by 32.05% from 2,251 in 2021 to 2,972 in 2030. Siaya sub-county will have the highest increment in toilet requirement for girls in junior secondary school at 52.2% while Gem sub-county will have the least increment at 9.95%. To enhance provision of quality education at

junior secondary school level in Siaya County, 2,972 toilets will be required by 2030 to achieve

the recommended Pupil Toilet Ratio of 25: 1 for girls. Table 4.22 shows the projected number of

toilets for girls in senior secondary schools in Siaya County for the period 2026 to 2030.

Table Error! No text of specified style in document.**.30: Projected toilet requirement for girls in senior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %
2026	**475**	**424**	**540**	**389**	**368**	**265**	**2462**	
2027	506	458	588	418	402	282	2653	7.79
2028	538	494	636	448	437	299	2852	7.49
2029	570	531	686	478	474	317	3058	7.22
2030	**604**	**571**	**739**	**510**	**512**	**336**	**3271**	**6.98**
Trend (%)	**27.25**	**34.63**	**36.65**	**30.92**	**39.17**	**26.67**	**32.89**	

Toilet requirement for girls in senior secondary schools in Siaya County is projected to increase

by 32.89% from 2,462 in 2026 to 3,271 in 2030. Ugenya sub-county will have the highest

increment in toilet requirement for girls in senior secondary schools at 39.17% from 368 in 2026

to 512 in 2030. There are currently 2, 045 toilets for girls in secondary schools in Siaya County.

However, a total of 6,243 (2,972 for junior and 3,271) toilets will be required by girls in both

junior and secondary schools in Siaya County by 2030. There is therefore need to plan for

provision of 4,198 toilets more toilets by 2030 in these categories of institutions. Table 4.23

shows the projected toilet requirement for boys in junior secondary schools in Siaya County by

2030.

Table Error! No text of specified style in document.**.31: Projected toilet requirement for boys in junior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %
2021	307	356	400	344	243	220	1870	
2022	327	382	433	369	265	239	2015	7.77
2023	**497**	**478**	**489**	**410**	**444**	**296**	**2614**	**39.84**

2024	645	616	632	526	582	384	3386	81.13
2025	**675**	**642**	**658**	**547**	**628**	**407**	**3557**	**90.24**
2026	591	568	575	472	565	358	3129	-12.03
2027	513	492	493	408	495	316	2716	-13.19
2028	**430**	**413**	**419**	**340**	**416**	**266**	**2284**	**-15.93**
2029	450	431	437	354	446	281	2400	5.10
2030	**471**	**451**	**456**	**369**	**477**	**297**	**2521**	**10.39**
Trend (%)	**53.44**	**26.81**	**14.19**	**7.37**	**95.85**	**34.73**	**34.83**	

0

Table 4.23 shows the projected number of toilets for boys in junior secondary schools in Siaya County. The number of toilets for boys is projected to increase by 90.24% from 1,870 in 2021 to 3,557 in 2025 in junior secondary schools in Siaya County. This is due to double intakes between the year 2023 and 2025 as junior secondary schools will be admitting students under 8-4-4 and 2-6-6-3 systems of education simultaneously. However, the toilet requirement will decrease by 13.19% from 3,129 in 2026 to 2,716 in 2027. This is after the exit of the 8-4-4 group of students. The toilet requirement for boys in junior secondary schools in Siaya County is further projected to increase by 10.39% from 2,284 in 2028 to 2,521 in 2030 as a result of an increment in 12-14 school age population. Toilet requirement for boys in junior secondary schools in Siaya County is therefore projected to increase by 34.83% from 1,870 in 2021 to 2,521 in 2030. Compared to projected number of toilets for girls, more toilets will need to be put up for girls than for boys because of the lower pupil toilet ratio for girls. Ugenya sub-county will need more toilets for boys by 2030 as compared to other sub-counties within Siaya County. Table 4.24 shows the projected toilet requirement for students in senior secondary schools in Siaya County by 2030.

Table Error! No text of specified style in document.**.32: Projected toilet requirement for boys in senior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %
2026	**268**	**362**	**409**	**337**	**250**	**201**	**1827**	
2027	280	385	436	357	268	213	1940	6.17
2028	293	410	463	378	287	226	2057	6.01

2029	305	435	492	399	307	239	2177	5.89
2030	**318**	**462**	**521**	**421**	**327**	**252**	**2302**	**5.72**
Trend (%)	**18.66**	**27.66**	**27.37**	**25.08**	**30.96**	**25.19**	**25.98**	

Toilet requirement for boys in senior secondary schools in Siaya County will increase by 25.98% from 1,827 in 2026 to 2,302 in 2030. This is due to the increasing trend in enrolment. Ugenya is projected to have the highest increment in boys' enrolment at senior secondary school level and therefore the toilet requirement for males will increase by 30.96% from 250 toilets in 2026 to 327 in 2030. There are currently 1,731 toilets for boys in secondary schools in Siaya County. A total of 4,823 toilets for boys will be required by both junior and senior secondary schools by 2030. This implies that more 3,092 toilets for boys will need to be constructed by 2030 to achieve the government recommended Pupil Toilet Ratio of 30:1 for boys.

4.5 Average school size for provision of quality education in primary and secondary schools in Siaya County by 2030

Siaya County has a total of 656 primary schools distributed across the six sub-counties. Table 4.25 shows the number of primary schools, enrolment and average school size in every sub-county in Siaya County.

Table Error! No text of specified style in document.**.33: Average school size for primary schools in Siaya County in 2020**

Sub-county	No of schools	Enrolment	Average school size
Siaya	133	58573	440
Bondo	128	44872	351
Gem	119	47162	396
Rarieda	119	40542	341
Ugenya	86	35978	418
Ugunja	71	25359	357

Siaya County		656		252486			385	

Table 4.25 shows that the average school size for primary schools in Siaya County in 2020 is 385. The recommended class size for primary schools in Kenya is 45. This translates to a school size of 360 in a single streamed primary school. Bondo, Rarieda and Ugunja sub-county have average school sizes that are below 360 meaning that most of their classes operate below 45 pupils. An increase in average school size will enhance optimal utilization of physical infrastructure as well as human capital. Table 4.26 shows the projected average school size for primary schools in Siaya County by 2030.

Table Error! No text of specified style in document..**34: Projected Average school size for primary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend (%)
2021	447	352	410	349	430	395	396	
2022	**451**	**351**	**418**	**359**	**443**	**412**	**403**	**1.85**
2023	393	302	368	316	390	368	354	-12.39
2024	**359**	**280**	**336**	**288**	**317**	**335**	**318**	**-9.90**
2025	361	281	345	295	319	348	324	1.62
2026	363	282	353	303	322	361	329	1.61
2027	364	283	362	311	324	367	333	1.34
2028	366	284	371	319	326	385	339	1.72
2029	367	284	380	327	328	399	344	1.68
2030	**368**	**285**	**389**	**336**	**330**	**413**	**350**	**9.81**
Trend (%)	**2.53**	**1.82**	**15.59**	**16.80**	**4.10**	**23.23**	**9.81**	

Table 4.26 shows the projected average school size for primary schools in Siaya County by 2030. Between 2021 and 2022, the average school size for primary schools in Siaya County will increase by 1.85% from 396 in 2021 to 403 in 2022. Following the introduction of 2-6-6-3 system of education in Kenya, the number of years spend in primary schools will reduce from eight to six years. The number of classes in single streamed primary schools will also reduce from eight to six. This implies that with the recommended class size of 45, enrolment of single streamed primary school will reduce to 270 pupils from 360. Siaya County has 656 primary schools. Under the 2-6-6-3 system of education, average school size for primary schools in Siaya County is projected to increase by 9.81% from 318 in 2024 to 350 in 2030. Ugunja sub-county will have the highest average school size of 413 pupils per school while Bondo sub-county will have the least average school size of 285. Bondo sub-county has 128 primary schools while Ugunja sub-county has 71 primary schools. The higher the number of schools in the sub-county, the lower the average school size.

Reviews of literature on average school size for elementary schools by Kathleen (1996) and Klonsky (2006) indicate that an effective size for an elementary school is in the range of 300-400 students. Klonsky (2006) observes that a study by the Consortium on Chicago School Research found that in smaller elementary schools, it is easier to maintain personal interaction and informal exchange between participants and that a later Consortium study confirmed that small elementary schools, where enrollment is less than 350 students, have consistently more positive reports on most measures of school leadership, parental involvement, and professional community and orientation. Leithwood and Jantzi's (2009) review of empirical evidence about school size effects also recommend that elementary schools should be limited to 500 pupils or, if serving a high proportion of disadvantaged pupils, then a maximum of 300 pupils.

Based on the recommended average school size for an elementary school (which is equivalent to primary schools in Kenya) by Kathleen (1996), Klonsky (2006)) and Leithwood and Jantzi (2009), the projected average school size of 350 pupils for primary schools in Siaya County is within the recommended range of 300-500 pupils per school. This means that most primary schools in Siaya County will need to be double streamed since the average school size of 350 is above 270 which is the minimum average size for single streamed primary schools. Enrolment in primary schools in Siaya County is projected to reach 229,432. With the recommended optimum average school size of 540 pupils, only 425 primary schools will be required in Siaya County and these will enhance the optimal utilization of the projected educational resources and in turn lead to provision of quality education in the county.

4.5.1 Projection of average school size for secondary schools in Siaya County

There are 238 secondary schools in Siaya County. Table 4.27 shows the sub-county, county, extra-county and national schools per sub-county in Siaya County.

Table Error! No text of specified style in document.**.35: Categories of secondary schools in Siaya County**

Sub county	Sub-county schools	County schools	Extra county schools	National schools	Total no of schools
Siaya	46	1	2	1	50
Bondo	28	7	3	1	39
Gem	36	5	6	0	47
Rarieda	38	6	3	0	47
Ugenya	27	2	2	0	31
Ugunja	20	1	3	0	24
Siaya County	**195**	**22**	**19**	**2**	**238**
%	**81.93**	**9.24**	**7.98**	**0.84**	**100%**

According to a report of 3rd National Conference on Curriculum Reforms (KICD, 2019), junior secondary will be domiciled in secondary schools. One of the recommendations that has been made by the taskforce which was constituted in 2019 to advise on the curriculum reforms in Kenya is that the sub-county schools should accommodate the junior secondary schools (grades 7, 8 and 9) while county, extra-county and national schools should be the senior secondary schools (grades 10, 11 and 12). Siaya County has a total of 240 secondary schools. Bondo sub-county has 41 secondary schools. However, two of them are categorized as national special schools and they do not admit regular learners. Table 4.27 shows that 81.93% of secondary schools in Siaya County are sub-county schools, 9.24% are county schools, 7.98% are extra-county schools and 0.84% are national schools. This means that 195 (81.93%) sub-county secondary schools in Siaya County will host the junior secondary level while the remaining 43 (18.07%) made up of 22 county schools, 19 extra-county schools and 2 national schools will host the senior secondary school level.

The projected enrolment in junior secondary schools in every sub-county was therefore divided by the total number of schools categorized as sub-county in that sub-county to get the average school size. The average school size was further subdivided by 135 (Minimum number of students in a single streamed junior secondary school) to get the number of streams per junior secondary school). Table 4.28 shows the projected average school size for junior secondary schools in Siaya County by the year 2030.

Table Error! No text of specified style in document.**.36: Projected Average school size for junior secondary schools in Siaya County by 2030**

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %

Year								
2021	462	717	630	504	550	716	576	
2022	498	776	689	547	607	779	627	8.75
2023	**708**	**960**	**772**	**646**	**940**	**900**	**796**	**38.10**
2024	926	1231	996	832	1230	1171	1032	79.03
2025	**974**	**1271**	**1036**	**867**	**1319**	**1236**	**1082**	**87.73**
2026	863	1112	901	755	1184	1087	952	-11.96
2027	754	958	773	651	1035	950	826	-13.32
2028	**637**	**806**	**651**	**550**	**879**	**804**	**698**	**-15.51**
2029	671	836	679	574	939	849	732	5.01
2030	**706**	**867**	**707**	**600**	**1001**	**896**	**769**	**10.23**
Trend (%)	**52.73**	**20.83**	**12.19**	**18.88**	**82.25**	**25.04**	**33.44**	
No of streams	**5.23**	**6.42**	**5.24**	**4.44**	**7.42**	**6.64**	**5.70**	

Average school size in junior secondary schools in Siaya County is projected to increase by 33.44% from 576 in 2021 to 769 in 2030. The minimum average school size for junior secondary schools is 135 (45 students per class multiplied by 3 classes). Average school size of 769 in 2030 is equivalent to six streams per class in junior secondary school in the county. The recommended optimal size of a school in Kenya is 540 students. Based on this recommendation, it implies that every junior secondary school in Kenya should be a four streamed school (Optimal size (540) divided by minimum enrolment (135). Since the projected average school size for junior secondary schools in Siaya County by 2030 is 769 translating to 6 streams per class, Siaya County will need to go above the recommended optimal size of four streams and expand the existing sub-county secondary schools in Siaya County to have at least 6 streams per class (810 students per school). According to Leithwood and Jantzi (2009), the recommended average school size for secondary schools should be limited to 1,000 and if serving a high proportion of disadvantaged students, a maximum and 600 students. An average school size of 769 in junior secondary schools will still be within a range that will enhance optimal utilization of educational

resources which is an important aspect in provision of quality education. Average school size in senior secondary schools was also determined by dividing the projected enrolment in senior secondary schools with the total number of schools categorized as county, extra-county and national schools in that sub-county. The total number of county, extra-county and national schools in Siaya County is 43. Table 4.29 shows the projected average school size in senior secondary schools in Siaya County by 2030.

Table **Error! No text of specified style in document.**.37: Projected average school size for senior secondary schools in Siaya County by 2030

Year	Siaya	Bondo	Gem	Rarieda	Ugenya	Ugunja	Siaya County	Trend %
2026	**4980**	**1950**	**2344**	**2204**	**4175**	**3167**	**2706**	
2027	5262	2092	2524	2351	4523	3363	2896	7.03
2028	5553	2241	2710	2503	4886	3564	3093	6.80
2029	5854	2395	2902	2659	5263	3774	3297	6.59
2030	**6164**	**2556**	**3099**	**2820**	**5657**	**3990**	**3508**	**6.40**
Trend (%)	23.78	31.10	32.23	27.95	35.49	25.96	29.63	
No of streams	45.66	18.94	22.96	20.89	41.90	29.55	25.98	

Table 4.29 shows the projected average school size for senior secondary schools in Siaya County by 2030. There are only 43 secondary schools in Siaya County that are categorized as county extra-county and national schools. Due to projected increase in enrolment in senior secondary schools in Siaya County, the average school size at this level is projected to increase by 29.63% from 2,706 in 2026 to 3,508 in 2030. On average, each senior secondary school in Siaya County will need to have 26 streams per class by 2030 to accommodate the projected enrolment at this level.

The distribution of sub-county, county, extra-county and national schools in Siaya County as indicated in Table 4.27 shows that Bondo and Gem sub-counties will each have 11 schools

categorized as senior secondary schools. Rarieda sub-county will have nine senior secondary schools while Siaya, Ugenya and Ugunja sub-counties will each have four senior secondary schools. The fewer number of senior secondary schools in Siaya, Ugenya and Ugunja sub-counties will result to overcrowding in these sub-counties. Siaya, Ugenya and Ugunja sub-counties will have average school sizes of 6,164, 5,657, and 3,990 respectively by 2030.

An average school size of 3,508 by 2030 in senior secondary schools in Siaya County will lead to overcrowding and this will impact negatively on provision of quality education in senior secondary schools in Siaya County. Findings of a study by Naz, Khan, Daraz, Rehman, Hussain, Ibrahim and Alam (2015) on Assessing the consequential Role of Infrastructural Facilities in Academic Performance of students in Pakistan indicate that small size schools have greater academic achievements and performance as compare to large size school. Besides, small size school enhances class participation, increases attendance ratio and students confidence level, decreases drop out, remove fear and hesitation and enhances students learning capacity to a greater extent.

According to Leithwood and Jantzi (2009), elementary schools should be limited to 500 pupils or, if serving a high proportion of disadvantaged pupils, then a maximum of 300 pupils. Their equivalent figures for secondary schools were 1,000 and 600 pupils. To address the challenge of large school size that may hamper provision of quality education in Siaya County by 2030, some sub-county schools will need to be adequately equipped with teachers and physical facilities to accommodate both junior and senior secondary schools. This is a common practice in the United States where in some districts, students attend a combined junior/senior high school or attend a middle school until 14 (grade 8) before transiting to a four year senior high school. Figure 4.4

shows the average school size for primary, junior secondary and senior secondary schools in Siaya County in the year 2030.
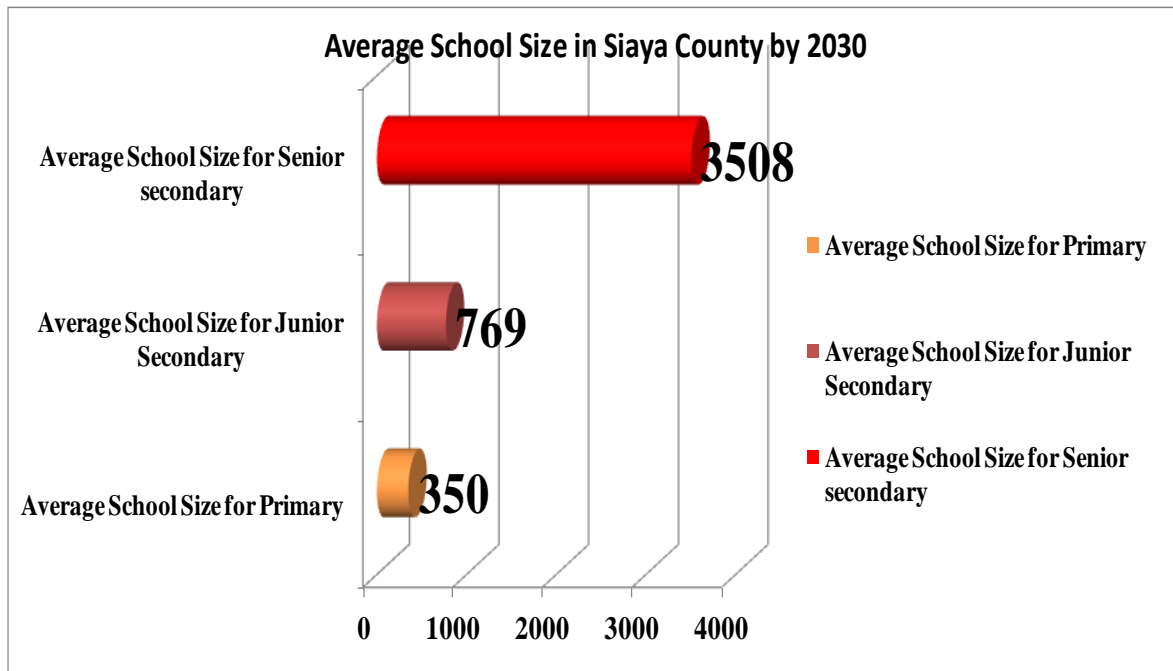
Figure Error! No text of specified style in document.**.8: Average school sizes for primary, junior and senior schools in Siaya County by 2030**

Figure 4.4 shows the average school sizes for primary schools, junior secondary schools and senior secondary schools in Siaya County by the year 2030. The average school size for primary schools in the county will be 350, the average school size for junior secondary schools will be 769 and the average school size for senior secondary schools will be 3,508. While large school size is likely to be more efficient due to economies of scale (Young & Green, 2005), Naz et al (2015) argue that small size school enhances class participation, increases attendance ratio and students confidence level, decreases drop out, remove fear and hesitation and enhances students learning capacity to a greater extent than large class sizes. An average school size of 3,508 if not well planned for in terms of key educational resources, may hamper provision of quality education envisaged in Kenya Vision 2030.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter contains a summary of the research findings, conclusions of the issues that the study focused on, recommendations for policy and recommendations for further research.

5.2 Summary of Research Findings

The study had four objectives namely to: project school age population and school enrolment for primary and secondary schools in Siaya County by 2030, determine teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030, establish physical infrastructure requirement (classrooms, toilets and desks) for provision of quality education in primary and secondary schools in Siaya County by 2030 and determine the

average school size for provision of quality education in primary and secondary schools in Siaya County by 2030.

5.2.1 School age population and enrolment in primary and secondary schools in Siaya County

Primary school age population in Siaya County is projected to decrease by 23.13% from 244,933 in 2021 to 188,270 in 2024. In the year 2024, the primary school age population in Kenya will comprise of 6-11 year old children. This population is projected to increase by 12.54% from 188, 270 in 2024 to 211,876 in 2030. There will be 105,084 males and 106,792 females aged 6-11 years in Siaya County by 2030.

The 8-4-4 secondary school age population is projected to decrease by 74.5% from 109,796 in 2021 to 27,997 in 2027. There will be 35,767 twelve year olds in Siaya County by 2023. This population forms the grade 7 in junior secondary school. This population is projected to increase by 252.74% from 35,767 in 2023 to 126,164 in 2030.

Senior secondary (15-17) will admit the first grade 10 in 2026. There will be 32,138 (15 year) population in Siaya County in the year 2026. Senior secondary school age population in Siaya County is projected to increase by 200.6% from 32,138 in 2026 to 96,607 in 2030.

Enrolment for primary schools in Siaya County is projected to increase by 1.85% from 259,864 in 2021 to 264,682 in 2022. Enrolment in primary schools in Siaya County under the 2-6-6-3 system of education is projected to increase by 9.81% from 208,929 in 2024 to 229, 432 in 2030. There will be 115,997 boys and 113,435 girls enrolled in primary schools in Siaya County by 2030. Amongst the 229,432 pupils who will be enrolled in primary schools in Siaya County by 2030, 17,556 will be out of the 6-11 primary school age limits (overage and underage population).

The enrolment in junior secondary schools in Siaya County is projected to increase by 33.44% from 112,355 in 2021 to 149,924 in 2030. Girls' enrolment in junior secondary schools in Siaya County will be 74,300 while enrolment for boys in junior secondary schools will stand at 75,624 by 2030. Due to double intakes in 2023, 2024 and 2025, junior secondary enrolment is projected to increase by 87.73% between 2021 and 2025 from 149,924 in 2021 to 210,927 in 2025. There will be 23,760 students enrolled in junior secondary schools in Siaya County by 2030 who will either be overage or underage.

Senior secondary school enrolment in Siaya County is projected to increase by 29.63% from 116,357 in 2026 to 150,835 in 2030. Out of the total enrolment of 150,835 students in senior secondary in Siaya County, 81,781 (54.22%) will be girls and 69,055 (45.78%) will be boys. More girls than boys will therefore be enrolled in senior secondary schools in Siaya County by 2030.There will be 54,229 students enrolled in senior secondary schools in Siaya County by 2030 who will either be overage or underage. There will also be 1,053 boys aged 15-17 years who will be out of school by 2030.

5.2.2 Teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030

Teacher requirement in primary schools in Siaya County is projected to increase by 9.81% from 5,354 in 2024 to 5,879 in 2030. There are currently 6,325 primary school teachers in the county. If this number of teachers remains constant till 2030, there will be an excess of 446 primary school teachers in Siaya County by 2030.

Teacher requirement in junior secondary schools in Siaya County is projected to increase by 33.44% from 4,682 in 2021 to 6,248 in 2030. Between the year 2021 and 2025, however,

teacher requirement in junior secondary schools in Siaya County will increase by 87.73% from 4,682 in 2021 to 8,790 in 2025 due to double intake.

As senior secondary schools start admitting Grade 10 in 2026, teacher requirement at this level will increase by 29.63% from 4,849 in 2026 to 6,286 in 2030. The county will need a total of 12,534 teachers in junior and secondary schools by the year 2030. There are currently 2,920 secondary school teachers in the county. A total of 9,816 teachers need to be hired by 2030 for both junior and senior secondary schools to achieve a PTR of 40:1 which is an indicator of quality education. Junior secondary schools will take 34% of the teaching force in Siaya County. Senior secondary schools will also take 34% while primary schools will take 32% of the teaching force.

5.2.3 Physical infrastructure requirement for provision of quality education in primary and secondary schools in Siaya County by 2030

Classroom requirement in primary schools in Siaya County will increase by 1.85% from 5,775 in 2021 to 5,882 in 2022. Under the 2-6-6-3 system of education, classroom requirement at this level of education is projected to increase by 9.81% from 4,643 in 2024 to 5,098 in 2030. There are currently 5,820 classrooms in primary schools in Siaya County. This implies that 722 classrooms in primary schools in Siaya County will be vacant by 2030 as primary schooling years are reduced from eight to six.

Desk requirement in primary schools in Siaya County is projected to increase by 1.85% from 86,621 in 2021 to 88,227 in 2022. Under the 2-6-6-3 system of education, desk requirement in primary schools in Siaya County will increase by 9.81% from 69,643 in 2024 to 76,477 in 2030. There are currently 50,550 desks in primary schools. This means that the county will have a

shortage of 36,071 by 2021. Under the 2-6-6-3 system of education, 25,927 more desks will be required by primary schools in Siaya County by 2030 to meet the recommended Pupil Desk Ratio of 3:1 that is an indicator of quality education.

The recommended pupil toilet ratio for girls is 25:1 and 30:1 for boys. The toilet requirement for girls in primary schools in Siaya County is projected to increase by 1.71% from 5,181 in 2021 to 5,269 in 2022. Under the 2-6-6-3 system of education, toilet requirement for girls in primary schools in Siaya County is projected to increase by 9.48% from 4,144 in 2024 to 4,537 in 2030. The boys' toilet requirement in primary schools in Siaya County is projected to increase by 1.99% from 4,345 in 2021 to 4,432 in 2022. Under the 2-6-6-3 system of education, the toilet requirement for boys in primary schools in Siaya County is projected to increase by 10.14% from 3,511 in 2024 to 3,867 in 2030. There are currently 2,544 and 2,623 toilets for girls and boys respectively in Siaya County. An additional 1,993 toilets for girls and 1,244 toilets for boys need to be constructed in primary schools in Siaya to meet the recommended pupil toilet ratio of 25:1 for girls and 30:1 for boys by 2030.

The classroom requirement for junior secondary schools in Siaya County is projected to increase by 33.34 % from 2,497 in 2021 to 3,332 in 2030. However, due to double intake expected at this level of education between 2023 and 2025, classroom requirement in junior secondary schools in Siaya County will increase by 87.73% from 2,497 in 2021 to 4,687 in 2025 before decreasing by 13.32% between 2026 and 2028. Classroom requirement at junior secondary level will again increase by 10.23% from 3,023 in 2028 to 3,332 in 2030.

Classroom requirement in senior secondary schools in the county is projected to increase by 29.63% from 2,586 in 2026 to 3,352 in 2030. There are currently 2,037 classrooms in secondary

schools in Siaya County against a classroom requirement of 6,684 by 2030. There is therefore need to construct 4,647 more classrooms for the projected enrolment in junior and senior secondary schools in Siaya County by 2030 in order to achieve the recommended Pupil Classroom Ratio of 45:1 which is an indicator of quality education.

A Pupil Desk Ratio of 1:1 is recommended for students in secondary schools. The number of desks in junior secondary schools in Siaya County will increase by 33.44% from 112,355 in 2021 to 149,924 in 2030. Between 2021 and 2025, the desk requirement in junior secondary schools in Siaya County will increase by 87.73% from 112,355 in 2021 to 210,927 in 2025 due to double in take at junior secondary school level between 2023 and 2025. Enrolment in senior secondary schools in Siaya County is projected to increase by 29.63% from 116,357 in 2026 to 150,835 in 2030. Since pupil/desk ratio in secondary schools is 1:1, the number of desks at this level of education is also projected to increase by 29.63% from 116,357 in 2026 to 150,835 in 2030. There are currently 102,235 desks in secondary schools in Siaya County against a desk requirement of 300,759 for junior and senior secondary schools by 2030. An addition of 198,524 desks is required to meet the recommended secondary schools' pupil desk ratio of 1:1 by 2030.

The number of toilets for girls in junior secondary schools in Siaya County is projected to increase by 32.05% from 2,251 in 2021 to 2,972 in 2030. Between 2021 and 2025, the toilet requirement for girls in junior secondary schools in Siaya will increase by 85.24% from 2,251 in 2021 to 4,169 in 2025. The toilet requirement for girls at this level will decrease by 13.45% from 3,674 in 2026 to 3,180 in 2027 as girls under 8-4-4 system of education exit. This requirement is again projected to increase by 10.06% from 2,700 in 2028 to 2,972 in 2030. The Toilet requirement for girls in senior secondary schools in Siaya County is projected to increase by 32.89% from 2,462 in 2026 to 3,271 in 2030. There are currently 2,045 toilets for girls in

secondary schools in Siaya County. A total of 6,243 toilets will be required in both junior and senior secondary schools. An additional of 4,198 toilets for girls needs to be provided in Siaya County by 2030 to meet the recommended pupil toilet ratio of 25:1 which is an indicator of quality education.

Toilet requirement for boys in junior secondary schools in Siaya County will increase by 34.83% from 1,870 in 2021 to 2,521 in 2030. Due to double intake anticipated at junior secondary level from 2023 to 2025, toilet requirement for boys at junior secondary school level in Siaya County will increase by 90.24% from 1,870 in 2021 to 3,557 in 2025. As the 8-4-4 enrolment for boys exit secondary schools in 2027, the toilet requirement will decrease by 13.19% from 3,129 in 2026 to 2,716 in 2027. The toilet requirement for boys in junior secondary schools will again increase by 10.39% from 2,284 in 2028 to 2,521 in 2030. Toilet requirement for boys in senior secondary schools in Siaya County is projected to increase by 25.98% from 1,827 in 2026 to 2,302 in 2030. There are 1,731 toilets for boys in secondary schools in Siaya County. A total of 4,823 toilets for boys will be required by both junior and senior secondary schools in the county by 2030. An addition of 3,092 toilets for boys will be needed by both junior and senior secondary schools in Siaya County by 2030 to meet the recommended pupil toilet ratio of 30:1 for boys.

5.2.4 Average school size for provision of quality education in primary and secondary schools in Siaya County

Primary schools in Siaya County will have an average school size of 350 pupils in 2030. Between 2021 and 2022, the average school size in Siaya County will increase by 1.85% from 396 in 2021 to 403 in 2022. Under the 2-6-6-3 system of education, average school size for primary schools in Siaya County is projected to increase by 9.81% from 318 in 2024 to 350 in

2030. This means that most primary schools in Siaya County will need to be double streamed with an average school size of 540 to optimally utilize the projected educational resources for provision of quality education.

As junior secondary schools admit the grade 7 students between 2023 and 2025, the average school size for junior secondary schools in Siaya County is projected to increase by 87.73% from 579 in 2021 to 1,082 in 2025. Overall, the average school size at junior secondary school level in Siaya County is projected to increase by 33.44 % from 576 in 2021 to 769 in 2030. An average school size of 769 is equivalent to six streams per class in junior secondary school in the county. This implies that most of the junior secondary schools in Siaya County will be six streamed with an average school size of 810 students to optimally utilize the projected educational resources for provision of quality education.

The average school size for senior secondary schools in Siaya County is projected to increase by 29.63% from 2,706 in 2026 to 3,508 in 2030. On average, each senior secondary school in Siaya County will need to have 26 streams per class by 2030 to accommodate the projected enrolment at this level. The high average school size at senior secondary school level in Siaya County is as a result of few county, extra county and national schools which are earmarked to host senior secondary school age population from 2026. Out of 238 regular secondary schools in Siaya County, only 43 schools fall under the categories of county, extra- county and national schools that will host senior secondary in the county. The average school size of 3,508 is too large and will hamper provision of quality education at senior secondary school level in Siaya County by 2030.

5.3 Conclusion

From the research findings, the following conclusions and generalizations emerged in view of the objectives that were set and from the summary of findings given on projection of school age population and school enrolment in primary and secondary schools in Siaya County by 2030, determining of teacher requirement for provision of quality education in primary and secondary schools in Siaya County by 2030, establishment of physical infrastructure requirement (classrooms, toilets and desks) for provision of quality education in primary and secondary schools in Siaya County by 2030 and determining the average school size for provision of quality education in primary and secondary schools in Siaya County by 2030.

5.3.1 Projection of school age population and enrolment in primary and secondary schools in Siaya County by 2030

a) There will be more pupils enrolled in primary schools in Siaya County (229,432) as compared to the corresponding 6-11 school age population (211,876). Planning for provision of educational resources at the primary school level in Siaya County should not be limited to the primary school age population (6-11) alone. There should be provision for under age and over age pupils who will be enrolled in primary schools by 2030.

Enrolment in junior secondary schools in Siaya County will increase by 87.73% from 149,924 in 2021 to 210,927 in 2025. Planning for educational resources should therefore be guided by the projected enrolment for the year 2025 as it is the year that will require the highest educational resource requirement in junior secondary level. Senior secondary school enrolment will increase by 29.63% from 116,357 in 2026 to 150,835 in 2030. Planning for provision of educational resources at this level of education should be gradual to avoid wastage of educational resources.

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5.3.2 Projection of teacher requirement in primary and secondary schools in Siaya County by 2030

a) Primary schools in Siaya County will need 5,879 teachers by 2030 to enhance provision of quality education in the county. If the current number of teachers is retained (6,325), there will be an excess of 446 teachers in primary schools in Siaya County by 2030.

b) Junior secondary schools in Siaya County will require 6,248 teachers to achieve the recommended PTR of 40:1 and enhance provision of quality education by 2030. Senior secondary schools in the county will require 6,286 teachers to achieve the PTR of 40:1 to handle the various pathways under the 2-6-6-3 system of education. There are currently 2,920 teachers employed by TSC in secondary schools in Siaya County. If the current number of teachers is retained, there will be a shortage of 9, 614 teachers in junior and senior secondary schools in Siaya County by 2030.

5.3.3 Projection of physical infrastructure requirement for provision of quality education in primary and secondary schools in Siaya County by 2030

a) Primary schools in Siaya County will require 5,098 classrooms to attain the pupil classroom ratio of 45:1, 76,477 desks to attain pupil desk ratio of 3:1, 4,537 toilets for girls to attain pupil toilet ratio of 25:1 and 3,867 toilets for boys to attain pupil toilet ratio of 30:1 by 2030.

b) Junior secondary schools in Siaya County will require 3,332 classrooms, 149,924 desks, 2,972 toilets for girls and 2,521 toilets for boys by 2030 to meet the standards of Ministry of Education of 45:1 pupil/classroom ratio, 1:1 pupil/desk ratio, 25:1 girls/toilet ratio and 30:1 boys/toilet ratio respectively.

c) Senior secondary schools in Siaya County will require 3,352 classrooms, 150,835 desks, 3,271 toilets for girls and 2,302 toilets for boys by 2030 to meet the standards of Ministry of Education of 45:1 pupil/classroom ratio, 1:1 pupil/desk ratio, 25:1 girls/toilet ratio and 30:1 boys/toilet ratio respectively.

5.3.4 Projection of average school size for provision of quality education in primary and secondary schools in Siaya County

a) Primary schools in Siaya County need be double streamed and have an average school size of 540 pupils to optimally utilize the projected educational resources and enhance provision of quality education.

b) Junior secondary schools in Siaya County need to be six streamed with an average school size of 810 students by 2030 to optimally utilize the projected educational resources and ensure provision of quality education.

c) Senior secondary schools in Siaya County will have large school sizes (3,508) by 2030 that will hamper provision of quality of education at this level.

5.4 Recommendations

5.4.1 Recommendations for policy

From the research findings, the following recommendations were made for policy:

1. It was evident from the study that secondary schools in the county will need more classrooms, sanitation facilities and desks to accommodate the increasing students' enrolment by 2030. More Constituency Development Funds should be allocated to existing day secondary schools in Siaya County to expand the educational facilities as they anticipate the double in-take from the year 2023 to 2025. This study also recommends that Boards of Management should mobilize for funds to put up more physical facilities and expand the

existing ones to enable secondary schools offer quality education envisioned in Kenya Vision 2030.

2. Teachers' Service Commission should gradually deploy primary school teachers who have acquired Bachelors of Education degrees to teach in junior secondary to avoid under-utilization of teachers in primary schools in Siaya County by 2030. TSC should also have a plan of employing an additional 9,614 teachers to teach in junior and senior secondary schools in Siaya County by 2030.

3. It is evident from the study that Siaya County has many primary schools which are economically non viable. The study also established that there are very few schools to host the senior secondary level of education in Siaya County. This study recommends that an assessment of the existing boarding primary and some day primary schools to be done by the Ministry of Education so as to upgrade these schools to junior secondary schools. School mapping should also be done by the Ministry of Education on the existing sub-county and secondary schools so as to upgrade those schools that have adequate facilities to senior secondary schools. This study also recommends that day school wings should be created in every senior secondary school to allow these schools to enroll more students without exerting pressure on boarding facilities.

5.4.2 Recommendations for further research

1. The findings of this study indicate that educational resource requirements in existing secondary schools will need to be expanded in order to accommodate the increasing students' enrolment. Expansion of educational resources is also paramount as it will enable secondary schools to implement the 2-6-6-3 system of education effectively. Since the 2-6-6-3 system of education is an educational reform affecting all schools in Kenya, this study recommends

that a similar study be replicated in other counties in the country to establish the educational resource requirements that will enable the counties to provide quality education under the 2-6-6-3 system of education.

2. The findings of this study also indicated that enrolment in both junior and senior secondary schools in Siaya County was on an upward trend. However, the Ministry of Education has banned establishment of more public primary and secondary schools. A study should therefore be conducted in Siaya County to establish how existing secondary schools can be expanded to accommodate the projected increase in enrolment by the year 2030.

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APPENDICES

APPENDIX A: CONSENT FORM

I, Norich Muindi Munyasia, a post graduate student at Maseno University in the Department of Educational Management and Foundations would like to carry out a research on **Projection of educational resource requirement for provision of quality education in primary and secondary schools in Siaya County, Kenya by 2030.**

Siaya County was ranked amongst the lowest performing counties nationally in numeracy and literacy assessment done in 2018 by class three pupils. A preliminary survey conducted in Siaya County in 2018 established that most primary and secondary schools had overcrowded classrooms, inadequate desks and sanitation facilities. Inadequacy of these educational resources is hampering provision of quality education envisaged in Kenya Vision 2030. There is therefore need to project educational resource requirement for provision of quality education in primary and secondary schools in Siaya County by 2030. Data Analysis Proforma and Key Informant Interview Guide will be used to collect data from the Ministry of Education, Kenya National Bureau of Statistics and Teachers service commission on school age population, pupils' enrolment, status of physical infrastructure and staffing of teachers in primary and secondary

schools in Siaya County. This data will be used to project the educational resources required in Siaya County by 2030 to enhance provision of quality education. Findings of this study would inform policy makers including TSC and Ministry of Education to come up with proactive policy reforms that would enhance provision of quality education amidst the on-going education reforms in Kenya. Participation or any other involvement in this research is voluntary. The participant has a right to withdraw himself or herself from this research as he/ she wishes. I assure the participants that the information shared will be highly confidential and will not be displayed to any other party whatsoever. No information that reveals identity of any study participant will be released or published without consent.

PARTICIPANT'S CONSENT

I have read and understood the information regarding the research study and the research study has been explained to me by the researcher. I also understand that my participation in this study is entirely voluntary and I can withdraw at any time. I voluntarily give my consent to participate in this study.

Participant's signature: _____ Date: _____

Researcher's signature: _____ Date: _____

For any questions or concerns about this study, please contact me through:

Email: munyasianorich@yahoo.com, Tel no: +254 722 298 100

For any questions pertaining to rights as a research participant, contact:

The secretary, Maseno University Ethics Review Committtee, Private Bag, Maseno

Telephone numbers: 057-51622, 0722 203 411, 0721 543 976, 0733 230 878

Email address: muerc-secretariate@maseno.ac.ke; muerc-secretariate@gmail.comNDICE

APPENDIX B: DATA ANALYSIS PROFORMA FOR KENYA NATIONAL BUREAU OF STATISTICS (DAPKNBS)

YEAR	2009			2019		
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
AGES						
6						
7						
8						
9						
10						
11						
12						

13					
14					
15					
16					
17					
TOTAL					

APPENDIX C: DATA ANALYSIS PROFORMA FOR MINISTRY OF EDUCATION (DAPMOE): ENROLMENT DATA FOR PRIMARY SCHOOLS 2016-2020

YEA	STD 1		STD 2		STD 3		STD 4		STD 5		STD 6		STD7		STD 8		TOTAL	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
2016																		
2017																		

2018																			
2019																			
2020																			
Number of primary schools in 2020:																			

APPENDIX D: DATA ANALYSIS PROFORMA FOR MINISTRY OF EDUCATION (DAPMOE): ENROLMENT DATA FOR SECONDARY SCHOOLS 2016-2019

YEAR	FORM 1		FORM 2		FORM 3		FORM 4	
	B	G	B	G	B	G	B	G
2016								

2017							
2018							
2019							
2020							

Number of secondary schools in 2020:

Number of sub-county schools_____

Number of county school_____

Number of extra county schools_____

Number of national schools_____

APPENDIX E: DATA ANALYSIS PROFORMA FOR TEACHERS SERVICE COMMMISSION

Sub-county	Total number of teachers in the sub-county/ County in 2020				Total number of schools	
	No of Primary school teachers	CBE in primary	No of Secondary school teachers	CBE in secondary	No of primary schools	No of sec schools

Siaya						
Bondo						
Gem						
Rarieda						
Ugenya						
Ugunja						
Siaya County						

APPENDIX F: KEY INFORMANT INTERVIEW (KII) GUIDE FOR TSC COUNTY HUMAN RESOURCE OFFICER

1. What are the major causes of teacher shortage in your county?

2. What measures have you put in place to retain teachers in your county?

3. As a county, what are you doing to ensure that the current shortage of teachers in the county does not affect provision of quality education?

APPENDIX G: KEY INFORMANT INTERVIEW GUIDE (KII) FOR COUNTY QUALITY ASSURANCE AND STANDARDS OFFICER

1. What are the factors affecting pupils' enrolment in primary and secondary schools in your county?

2. What measures have you put in place as a county to ensure that all the school going age children are enrolled in schools?

3. What are the reasons for inadequacy of physical facilities in primary and secondary schools in Siaya County?

4. What mechanisms have you put in place as a county to ensure that schools have adequate physical infrastructure for provision of quality education in the county?

APPENDIX H: WORKOUT FOR COMPOUNDED GROWTH RATE (R) AND PROJECTION FOR SCHOOL AGE POPULATION IN SIAYA COUNTY

YEAR	2009 CENSUS	2019 CENSUS	$R = [(P_n / P_o)^{1/10} - 1] \times 100$	$R = [(P_n / P_o)^{1/10} - 1] \times 100$

AGE	M (p_0)	F (p_0)	T	M (p_n)	F (p_n)	T		R		R
6	12,538	12,339	24,877	14046	14050	28096	1.01	1.14	1.01	1.31
7	11,733	11,555	23,288	13619	13886	27505	1.02	1.50	1.02	1.85
8	11,096	11,629	22,725	12870	13462	26332	1.01	1.49	1.01	1.47
9	12,222	12,053	24,275	14658	14649	29307	1.02	1.83	1.02	1.97
10	13,050	12,670	25,720	15661	15172	30833	1.02	1.84	1.02	1.82
11	10,120	10,301	20,421	14304	14500	28804	1.04	3.52	1.03	3.48
12	12,756	11,795	24,551	16218	15898	32116	1.02	2.43	1.03	3.03
13	11,710	11,184	22,894	15736	15653	31389	1.03	3.00	1.03	3.42
14	10,660	10,298	20,958	14130	13876	28006	1.03	2.86	1.03	3.03
15	11,202	10,691	21,893	13959	13480	27439	1.02	2.22	1.02	2.35
16	9,811	9,732	19,543	12378	12366	24744	1.02	2.35	1.02	2.42
17	10,825	10,256	21,081	12639	12041	24680	1.02	1.56	1.02	1.62
TOTAL	137723	134503	272226	170218	169033	339251				

Population Projection formula

$$P_n = P_o (1+R/100)^n$$

Where;

$P_{n=}$ Population for 2021, 2022, 2023............2030

P_0= Population for 2020

$$R = [(P_n / P_o)^{1/n} - 1] \times 100$$

$_n$= 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

APPENDIX I: SIAYA COUNTY SCHOOL AGE POPULATION 2016-2020

Year	2016			2017			2018		
	M	F	T	M	F	T	M	F	T
6	13575	13513	27089	13731	13690	27420	13887	13869	27756
7	13023	13141	26165	13219	13385	26604	13418	13633	27051
8	12310	12884	25194	12494	13074	25567	12681	13266	25947
9	13880	13816	27697	14135	14089	28223	14394	14366	28760

10	14827	14374	29201	15100	14635	29735	15378	14901	30279
11	12894	13086	25980	13348	13542	26889	13818	14013	27830
12	15091	14536	29627	15458	14977	30434	15833	15430	31264
13	14401	14151	28552	14833	14635	29468	15278	15136	30413
14	12985	12689	25673	13356	13073	26428	13737	13468	27206
15	13067	12574	25642	13358	12869	26227	13655	13171	26826
16	11544	11509	23053	11816	11788	23603	12094	12073	24167
17	12065	11475	23540	12253	11661	23914	12445	11849	24294

Year	2019			2020		
	M	F	T	M	F	T
6	14046	14050	28096	14206	14234	28440
7	13619	13886	27505	13824	14144	27967
8	12870	13462	26332	13062	13660	26723
9	14658	14649	29307	14927	14938	29864
10	15661	15172	30833	15949	15448	31397
11	14304	14500	28804	14808	15004	29812
12	16218	15898	32116	16612	16380	32992
13	15736	15653	31389	16208	16188	32396
14	14130	13876	28006	14534	14296	28830
15	13959	13480	27439	14270	13796	28066
16	12378	12366	24744	12669	12666	25335
17	12639	12041	24680	12836	12236	25072

APPENDIX J: SIAYA SUB-COUNTY SCHOOL AGE POPULATION 2016-2030

Year	2016			2017			2018		
	M	F	T	M	F	T	M	F	T
6	2926	2938	5864	2959	2977	5936	2993	3016	6009
7	2807	2857	5664	2849	2910	5760	2892	2964	5856
8	2653	2801	5455	2693	2843	5536	2733	2885	5618
9	2992	3004	5996	3046	3063	6110	3102	3124	6226

Age	M	F	T	M	F	T	M	F	T
10	3318	3182	6500	3379	3240	6618	3441	3299	6740
11	2885	2897	5782	2987	2998	5984	3092	3102	6194
12	3377	3218	6595	3459	3315	6774	3543	3416	6959
13	3222	3133	6355	3319	3240	6559	3418	3351	6769
14	2905	2809	5714	2988	2894	5882	3074	2982	6055
15	2864	2838	5702	2928	2904	5832	2993	2972	5965
16	2530	2597	5127	2590	2660	5250	2650	2725	5375
17	2644	2590	5234	2685	2632	5317	2727	2674	5401

Year	2019			2020		
	M	F	T	M	F	T
6	3109	3123	6232	3,151	3,170	6,321
7	3088	3160	6248	3,147	3,231	6,378
8	2972	3090	6062	3,034	3,149	6,183
9	3335	3459	6794	3,411	3,551	6,962
10	3496	3431	6927	3,559	3,499	7,058
11	3075	3214	6289	3,172	3,326	6,498
12	3626	3504	7130	3,714	3,608	7,322
13	3547	3510	7057	3,655	3,633	7,288
14	3011	3048	6059	3,084	3,138	6,222
15	3063	2931	5994	3,131	2,990	6,121
16	2683	2734	5417	2,743	2,795	5,538
17	2771	2754	5525	2,814	2,802	5,616

Year	2021			2022			2023			Deviation
Age	M	F	T	M	F	T	M	F	T	%
6	3,195	3,218	6,413	3,239	3,266	6,505	3,284	3,316	6,600	2.92
7	3,210	3,305	6,515	3,273	3,381	6,654	3,338	3,458	6,796	4.31
8	3,100	3,212	6,312	3,167	3,275	6,442	3,235	3,340	6,575	4.17
9	3,492	3,650	7,142	3,575	3,751	7,326	3,659	3,855	7,514	5.21
10	3,624	3,570	7,194	3,689	3,642	7,331	3,755	3,715	7,470	3.84
11	3,270	3,442	6,712	3,372	3,561	6,933	3,476	3,685	7,161	6.69
12	3,803	3,715	7,518	3,895	3,825	7,720	*	*	*	*
13	3,768	3,762	7,530	3,883	3,894	7,777	4,002	4,031	8,033	6.68
Total (6-13)	27,462	27,874	55,336	28,093	28,595	56,688	24,749	25,400	50,149	-9.37
12	*	*	*	*	*	*	3,989	3,939	7,928	*
14	3,156	3,230	6,386	3,230	3,324	6,554	3,305	3,422	6,727	5.34
15	3,201	3,048	6,249	3,273	3,108	6,381	3,346	3,168	6,514	4.24
16	2,805	2,857	5,662	2,867	2,920	5,787	2,931	2,984	5,915	4.47
17	2,858	2,850	5,708	2,902	2,900	5,802	2,947	2,951	5,898	3.33
Total (12-17)	12,020	11,985	24,005	12,272	12,252	24,524	16,518	16,464	32,982	37.40

Year	2024			2025			2026		
Age	M	F	T	M	F	T	M	F	T
6	3329	3366	6695	3375	3417	6792	3421	3469	6890
7	3404	3537	6941	3471	3618	7089	3539	3700	7239
8	3305	3406	6711	3376	3473	6849	3449	3541	6990
9	3746	3962	7708	3834	4071	7905	3924	4184	8108
10	3823	3790	7613	3892	3866	7758	3962	3943	7905
11	3583	3813	7396	3694	3945	7639	3808	4082	7890
Total (6-11)	21190	21874	43064	21642	22390	44032	22103	22919	45022

Junior Secondary school age population

Age	M	F	T	M	F	T	M	F	T
12	4085	4055	8140	4184	4175	8359	4284	4298	8582
13	4125	4173	8298	4251	4320	8571	4381	4471	8852
14	*	*	*	3461	3625	7086	3542	3730	7272
Total (12-14)	8210	8228	16438	11896	12120	24016	12207	12499	24706

8-4-4 secondary school age population

Age	M	F	T	M	F	T	M	F	T
14	3383	3522	6905	*	*	*	*	*	*
15	3420	3230	6650	3497	3293	6790	*	*	*
16	2996	3050	6046	3063	3117	6180	3131	3186	6317
17	2993	3002	5995	3039	3054	6093	3085	3108	6193
Total (14-17)	12792	12804	25596	9599	9464	19063	6216	6294	12510

Senior secondary school age population

Age	M	F	T	M	F	T	M	F	T
15	*	*	*	*	*	*	3575	3357	6932
16	*	*	*	*	*	*	*	*	*
17	*	*	*	*	*	*	*	*	*
Total (15-17)	*	*	*	*	*	*	3575	3357	6932

Year	2027			2028		
Age	M	F	T	M	F	T
6	3,468	3,521	6,989	3,516	3,574	7,090
7	3,608	3,785	7,393	3,679	3,871	7,550
8	3,523	3,610	7,133	3,599	3,680	7,279
9	4,016	4,299	8,315	4,111	4,417	8,528
10	4,033	4,022	8,055	4,105	4,103	8,208
11	3,925	4,223	8,148	4,046	4,370	8,416
Total (6-11)	22,573	23,460	46,033	23,056	24,015	47,071

Junior secondary school age population

Age	M	F	T	M	F	T
12	4387	4425	8812	4493	4555	9048
13	4515	4628	9143	4653	4790	9443
14	3624	3839	7463	3709	3951	7660
Total (12-14)	12526	12892	25418	12855	13296	26151

8-4-4 secondary School age population

Age	M	F	T	M	F	T
14	*	*	*			
15	*	*	*			
16	*	*	*			
17	3133	3162	6295			
Total (14-17)	3133	3162	6295			

Senior secondary school age population

Age	M	F	T	M	F	T
15	3654	3422	7076	3736	3488	7224
16	3201	3256	6457	3272	3328	6600
17	*	*	*	3181	3217	6398
Total (15-17)	6855	6678	13533	10189	10033	20222

Year	2029			2030			Deviation
Age	M	F	T	M	F	T	%
6	3,564	3,628	7,192	3,612	3,682	7,294	
7	3,751	3,959	7,710	3,823	4,048	7,871	
8	3,676	3,751	7,427	3,754	3,824	7,578	
9	4,207	4,538	8,745	4,306	4,662	8,968	
10	4,179	4,184	8,363	4,253	4,268	8,521	
11	4,171	4,521	8,692	4,299	4,677	8,976	
Total (6-11)	**23,548**	**24,581**	**48,129**	**24,047**	**25,161**	**49,208**	**14.27**
12	4,601	4,689	9,290	4,712	4,826	9,538	
13	4,796	4,958	9,754	4,942	5,131	10,073	
14	3,795	4,066	7,861	3,883	4,185	8,068	
Total (12-14)	**13192**	**13713**	**26905**	**13537**	**14142**	**27679**	**249.13**
15	3,819	3,556	7,375	3,904	3,624	7,528	
16	3,345	3,401	6,746	3,419	3,476	6,895	
17	3,230	3,273	6,503	3,279	3,329	6,608	
Total (15-17)	**10394**	**10230**	**20624**	**10602**	**10429**	**21031**	**203.39**

* School age population excluded

APPENDIX K: BONDO SUB-COUNTY SCHOOL AGE POPULATION 2016-2030

Year	2016			2017			2018		
	M	F	T	M	F	T	M	F	T
6	2499	2514	5013	2528	2547	5075	2557	2581	5137
7	2397	2445	4843	2433	2490	4924	2470	2537	5007
8	2266	2397	4663	2300	2433	4733	2334	2468	4803
9	2555	2571	5126	2602	2621	5223	2650	2673	5323
10	2585	2521	5106	2633	2567	5200	2681	2614	5295

11	2248	2295	4543	2327	2375	4702	2409	2458	4867
12	2631	2550	5181	2695	2627	5322	2761	2706	5467
13	2511	2482	4993	2586	2567	5153	2664	2655	5318
14	2264	2226	4489	2329	2293	4621	2395	2362	4757
15	2369	2313	4682	2422	2367	4789	2476	2423	4899
16	2093	2117	4210	2142	2168	4311	2193	2221	4413
17	2187	2111	4298	2222	2145	4367	2256	2180	4436

Year	2019			2020		
	M	F	T	M	F	T
6	2805	2751	5556	2,857	2,790	5,647
7	2725	2740	5465	2,788	2,805	5,593
8	2443	2635	5078	2,482	2,695	5,177
9	2753	2675	5428	2,815	2,727	5,542
10	3019	2931	5950	3,100	2,999	6,099
11	2788	2741	5529	2,906	2,860	5,766
12	3003	3145	6148	3,085	3,272	6,357
13	2897	3055	5952	3,004	3,193	6,197
14	2618	2647	5265	2,714	2,747	5,461
15	2490	2560	5050	2,542	2,636	5,178
16	2282	2304	4586	2,346	2,370	4,716
17	2323	2286	4609	2,371	2,331	4,702

Year	2021			2022			2023	Deviation		
Age	M	F	T	M	F	T	M	F	T	%
6	2,912	2,830	5,742	2,969	2,871	5,840	3,027	2,912	5,939	3.43
7	2,856	2,874	5,730	2,927	2,944	5,871	2,998	3,017	6,015	4.97
8	2,523	2,760	5,283	2,565	2,826	5,391	2,607	2,894	5,501	4.13
9	2,880	2,780	5,660	2,945	2,834	5,779	3,014	2,889	5,903	4.29
10	3,186	3,071	6,257	3,275	3,145	6,420	3,367	3,220	6,587	5.27
11	3,034	2,988	6,022	3,165	3,123	6,288	3,303	3,262	6,565	9.02
12	3,172	3,409	6,581	3,261	3,552	6,813	*	*	*	*
13	3,117	3,342	6,459	3,235	3,499	6,734	3,358	3,662	7,020	8.69
Total (6-13)	23,680	24,054	47,734	24,342	24,794	49,136	21,674	21,856	43,530	-8.81
12	*	*	*	*	*	*	3,352	3,700	7,052	*
14	2,818	2,855	5,673	2,926	2,967	5,893	3,038	3,083	6,121	7.90
15	2,595	2,718	5,313	2,648	2,801	5,449	2,702	2,888	5,590	5.21
16	2,413	2,440	4,853	2,482	2,512	4,994	2,553	2,586	5,139	5.89
17	2,422	2,380	4,802	2,475	2,429	4,904	2,528	2,479	5,007	4.27
Total (12-17)	10,248	10,393	20,641	10,531	10,709	21,240	14,173	14,736	28,909	40.06

Year	2024			2025			2026		
Age	M	F	T	M	F	T	M	F	T
6	3,086	2,954	6,040	3,145	2,996	6,141	3,206	3,039	6,245
7	3,070	3,091	6,161	3,145	3,166	6,311	3,221	3,244	6,465
8	2,650	2,962	5,612	2,694	3,033	5,727	2,737	3,105	5,842
9	3,082	2,944	6,026	3,153	3,001	6,154	3,225	3,058	6,283
10	3,460	3,297	6,757	3,557	3,376	6,933	3,655	3,457	7,112

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	M	F	T	M	F	T	M	F	T
11	3,447	3,408	6,855	3,597	3,561	7,158	3,753	3,720	7,473
Total (6-11)	**18,795**	**18,656**	**37,451**	**19,291**	**19,133**	**38,424**	**19,797**	**19,623**	**39,420**

Junior secondary school age population

	M	F	T	M	F	T	M	F	T
12	3446	3855	7301	3541	4015	7556	3641	4182	7823
13	3485	3833	7318	3617	4011	7628	3753	4198	7951
14	*	*	*	3274	3329	6603	3399	3459	6858
Total (12-14)	**6931**	**7688**	**14619**	**10432**	**11355**	**21787**	**10793**	**11839**	**22632**

8-4-4 Secondary school age population

	M	F	T	M	F	T	M	F	T
14	3153	3204	6357	*	*	*	*	*	*
15	2759	2977	5736	2815	3068	5883	*	*	*
16	2627	2662	5289	2701	2740	5441	2779	2820	5599
17	2582	2530	5112	2638	2583	5221	2695	2635	5330
Total (14-17)	**11121**	**11373**	**22494**	**8154**	**8391**	**16545**	**5474**	**5455**	**10929**

Senior secondary school age population

	M	F	T	M	F	T	M	F	T
15							2873	3163	6036
16							*	*	*
17							*	*	*
Total (15-17)							2873	3163	6036

Year		2027			2028	
Age	M	F	T	M	F	T
6	3,268	3,083	6,351	3,330	3,127	6,457
7	3,299	3,323	6,622	3,377	3,404	6,781
8	2,782	3,178	5,960	2,827	3,253	6,080
9	3,299	3,117	6,416	3,374	3,177	6,551
10	3,757	3,540	7,297	3,861	3,623	7,484
11	3,917	3,886	7,803	4,087	4,058	8,145
Total (6-11)	**20,322**	**20,127**	**40,449**	**20,856**	**20,642**	**41,498**

Junior secondary school age population

	M	F	T	M	F	T
12	3743	4356	8099	3847	4537	8384
13	3895	4392	8287	4042	4596	8638
14	3528	3594	7122	3661	3734	7395
Total (12-14)	**11166**	**12342**	**23508**	**11550**	**12867**	**24417**

8-4-4 Secondary school age population

	M	F	T	M	F	T
14	*	*	*			
15	*	*	*			
16	*	*	*			
17	2752	2689	5441			
Total (14-17)	**2752**	**2689**	**5441**			

Senior secondary school age population

	M	F	T	M	F	T
15	2933	3260	6193	2992	3361	6353
16	2858	2903	5761	2940	2988	5928
17	*	*	*	2811	2744	5555
Total (15-17)	**5791**	**6163**	**11954**	**8743**	**9093**	**17836**

Year		2029			2030		Deviation

Age	M	F	T	M	F	T	%
6	3,394	3,171	6,565	3,459	3,217	6,676	
7	3,458	3,486	6,944	3,542	3,572	7,114	
8	2,873	3,330	6,203	2,920	3,408	6,328	
9	3,451	3,237	6,688	3,530	3,300	6,830	
10	3,968	3,710	7,678	4,078	3,798	7,876	
11	4,264	4,239	8,503	4,449	4,428	8,877	
Total (6-11)	**21,408**	**21,173**	**42,581**	**21,978**	**21,723**	**43,701**	**16.69**
12	3,954	4,725	8,679	4,063	4,921	8,984	
13	4,193	4,808	9,001	4,352	5,030	9,382	
14	3,800	3,879	7,679	3,944	4,029	7,973	
Total (12-14)	**11947**	**13412**	**25359**	**12359**	**13980**	**26339**	**273.5**
15	3,054	3,463	6,517	3,117	3,570	6,687	
16	3,023	3,076	6,099	3,110	3,165	6,275	
17	2,871	2,801	5,672	2,933	2,859	5,792	
Total (15-17)	**8948**	**9340**	**18288**	**9160**	**9594**	**18754**	**210.7**

APPENDIX L: GEM SUB-COUNTY SCHOOL AGE POPULATION 2016-2030

Year	2016			2017			2018		
	M	F	T	M	F	T	M	F	T
6	2621	2617	5238	2651	2652	5302	2681	2686	5367
7	2514	2545	5059	2552	2593	5144	2590	2641	5231
8	2376	2495	4872	2412	2532	4944	2448	2570	5017
9	2679	2676	5356	2729	2729	5457	2779	2783	5561
10	2852	2814	5666	2905	2865	5770	2958	2917	5875
11	2480	2562	5042	2568	2651	5219	2658	2743	5401
12	2903	2846	5749	2973	2932	5906	3046	3021	6067
13	2770	2770	5541	2853	2865	5719	2939	2963	5902

14	2498	2484	4982	2569	2559	5128	2643	2637	5279
15	2525	2338	4863	2581	2392	4974	2639	2449	5088
16	2231	2140	4370	2283	2191	4475	2337	2245	4582
17	2332	2133	4465	2368	2168	4536	2405	2203	4608

Year	2019			2020		
	M	F	T	M	F	T
6	2567	2524	5091	2,584	2,540	5,124
7	2433	2413	4846	2,453	2,434	4,887
8	2405	2424	4829	2,434	2,444	4,878
9	2642	2634	5276	2,674	2,669	5,343
10	2925	2698	5623	2,971	2,724	5,695
11	2729	2743	5472	2,823	2,830	5,653
12	2944	2877	5821	3,001	2,944	5,945
13	2961	2877	5838	3,044	2,959	6,003
14	2669	2522	5191	2,741	2,582	5,323
15	2580	2491	5071	2,628	2,548	5,176
16	2323	2226	4549	2,372	2,274	4,646
17	2247	2195	4442	2,266	2,227	4,493

Year	2021			2022			2023			Deviation
Age	M	F	T	M	F	T	M	F	T	%
6	2,599	2,554	5,153	2,613	2,568	5,181	2,628	2,581	5,209	1.09
7	2,470	2,452	4,922	2,486	2,470	4,956	2,502	2,487	4,989	1.36
8	2,462	2,460	4,922	2,490	2,478	4,968	2,519	2,495	5,014	1.87
9	2,704	2,700	5,404	2,735	2,732	5,467	2,765	2,764	5,529	2.31
10	3,016	2,746	5,762	3,063	2,768	5,831	3,109	2,791	5,900	2.40
11	2,919	2,918	5,837	3,019	3,008	6,027	3,123	3,102	6,225	6.65
12	3,055	3,009	6,064	3,110	3,074	6,184	*	*	*	*
13	3,128	3,040	6,168	3,215	3,123	6,338	3,303	3,209	6,512	5.58
Total (6-13)	**22,353**	**21,879**	**44,232**	**22,731**	**22,221**	**44,952**	**19,949**	**19,429**	**39,378**	**-10.97**
12	*	*	*	*	*	*	3,167	3,141	6,308	*
14	2,814	2,639	5,453	2,888	2,699	5,587	2,965	2,759	5,724	4.97
15	2,673	2,606	5,279	2,720	2,665	5,385	2,769	2,726	5,495	4.09
16	2,420	2,321	4,741	2,470	2,369	4,839	2,520	2,419	4,939	4.18
17	2,281	2,258	4,539	2,297	2,290	4,587	2,313	2,322	4,635	2.12
Total (12-17)	**10,188**	**9,824**	**20,012**	**10,375**	**10,023**	**20,398**	**13,734**	**13,367**	**27,101**	**35.42**

Year	2024			2025			2026		
Age	M	F	T	M	F	T	M	F	T
6	2,642	2,594	5,236	2,657	2,608	5,265	2,672	2,621	5,293
7	2,520	2,505	5,025	2,536	2,523	5,059	2,553	2,540	5,093
8	2,547	2,513	5,060	2,576	2,529	5,105	2,606	2,546	5,152
9	2,796	2,796	5,592	2,827	2,829	5,656	2,858	2,862	5,720
10	3,157	2,814	5,971	3,204	2,836	6,040	3,254	2,859	6,113
11	3,230	3,198	6,428	3,340	3,296	6,636	3,454	3,398	6,852

	M	F	T	M	F	T	M	F	T
Total (6-11)	**16,892**	**16,420**	**33,312**	**17,140**	**16,621**	**33,761**	**17,397**	**16,826**	**34,223**

Junior secondary school age population

	M	F	T	M	F	T	M	F	T
12	3225	3210	6435	3284	3280	6564	3343	3351	6694
13	3394	3296	6690	3488	3386	6874	3585	3478	7063
14	*	*	*	3124	2883	6007	3206	2948	6154
Total (12-14)	**6619**	**6506**	**13125**	**9896**	**9549**	**19445**	**10134**	**9777**	**19911**

8-4-4 Secondary school age population

	M	F	T	M	F	T	M	F	T
14	3044	2820	5864	*	*	*	*	*	*
15	2817	2787	5604	2866	2851	5717	*	*	*
16	2571	2469	5040	2624	2521	5145	2677	2573	5250
17	2328	2355	4683	2344	2388	4732	2360	2421	4781
Total (14-17)	**10760**	**10431**	**21191**	**7834**	**7760**	**15594**	**5037**	**4994**	**10031**

Senior secondary school age population

	M	F	T	M	F	T	M	F	T
15							2917	2915	5832
16							*	*	*
17							*	*	*
Total (15-17)							**2917**	**2915**	**5832**

Year		2027			2028	
Age	M	F	T	M	F	T
6	2,685	2,634	5,319	2,700	2,647	5,347
7	2,569	2,557	5,126	2,587	2,575	5,162
8	2,635	2,563	5,198	2,665	2,580	5,245
9	2,890	2,895	5,785	2,921	2,929	5,850
10	3,303	2,880	6,183	3,353	2,904	6,257
11	3,571	3,504	7,075	3,693	3,612	7,305
Total (6-11)	**17,653**	**17,033**	**34,686**	**17,919**	**17,247**	**35,166**

Junior secondary school age population

	M	F	T	M	F	T
12	3403	3424	6827	3465	3498	6963
13	3684	3573	7257	3785	3669	7454
14	3292	3013	6305	3379	3079	6458
Total (12-14)	**10379**	**10010**	**20389**	**10629**	**10246**	**20875**

8-4-4 Secondary school age population

	M	F	T	M	F	T
14	*	*	*			
15	*	*	*			
16	*	*	*			
17	2376	2456	4832			
Total (14-17)	**2376**	**2456**	**4832**			

Senior secondary school age population

15	2968	2981	5949	3021	3048	6069
16	2731	2627	5358	2786	2681	5467
17	*	*	*	2392	2490	4882
Total (15-17)	**5699**	**5608**	**11307**	**8199**	**8219**	**16418**

Year	2029			2030			Deviation
Age	M	F	T	M	F	T	%
6	2,714	2,661	5,375	2,728	2,674	5,402	
7	2,603	2,593	5,196	2,619	2,610	5,229	
8	2,695	2,597	5,292	2,726	2,613	5,339	
9	2,953	2,963	5,916	2,985	2,996	5,981	
10	3,403	2,926	6,329	3,455	2,949	6,404	
11	3,819	3,724	7,543	3,949	3,838	7,787	
Total (6-11)	**18,187**	**17,464**	**35,651**	**18,462**	**17,680**	**36,142**	**8.50**
12	3,527	3,573	7,100	3,592	3,650	7,242	
13	3,890	3,769	7,659	3,997	3,871	7,868	
14	3,468	3,148	6,616	3,560	3,217	6,777	
Total (12-14)	**10885**	**10490**	**21375**	**11149**	**10738**	**21887**	**246.97**
15	3,073	3,117	6,190	3,127	3,187	6,314	
16	2,844	2,737	5,581	2,901	2,794	5,695	
17	2,408	2,524	4,932	2,423	2,560	4,983	
Total (15-17)	**8325**	**8378**	**16703**	**8451**	**8541**	**16992**	**191.36**

APPENDIX N: RARIEDA SUB-COUNTY SCHOOL AGE POPULATION 2016-2030

Year	2016			2017			2018		
	M	F	T	M	F	T	M	F	T
6	2242	2203	4445	2268	2232	4500	2294	2261	4555
7	2151	2143	4294	2183	2182	4366	2216	2223	4439
8	2033	2101	4134	2064	2132	4195	2094	2163	4257
9	2293	2253	4545	2335	2297	4632	2378	2342	4720
10	2408	2320	4728	2452	2363	4815	2497	2405	4903

Age	M	F	T	M	F	T	M	F	T
11	2094	2113	4206	2168	2186	4354	2244	2262	4506
12	2451	2347	4797	2510	2418	4928	2571	2491	5062
13	2339	2284	4623	2409	2363	4771	2481	2443	4924
14	2109	2048	4157	2169	2110	4279	2231	2174	4405
15	2138	2027	4165	2186	2074	4260	2234	2123	4358
16	1889	1855	3744	1933	1900	3834	1979	1946	3925
17	1974	1850	3824	2005	1880	3885	2036	1910	3946

Year	2019			2020		
	M	F	T	M	F	T
6	2153	2200	4353	2,162	2,222	4,384
7	2079	2217	4296	2,094	2,256	4,350
8	1922	2008	3930	1,935	2,015	3,950
9	2289	2238	4527	2,318	2,266	4,584
10	2465	2371	4836	2,501	2,404	4,905
11	2191	2256	4447	2,259	2,321	4,580
12	2562	2469	5031	2,616	2,535	5,151
13	2486	2395	4881	2,553	2,474	5,027
14	2209	2162	4371	2,267	2,222	4,489
15	2261	2096	4357	2,312	2,135	4,447
16	1886	1975	3861	1,925	2,016	3,941
17	1999	1816	3815	2,023	1,835	3,858

Year	2021			2022			2023			Deviation
Age	M	F	T	M	F	T	M	F	T	%
6	2,168	2,242	4,410	2,175	2,263	4,438	2,181	2,285	4,466	1.27
7	2,107	2,294	4,401	2,119	2,334	4,453	2,133	2,374	4,507	2.41
8	1,945	2,019	3,964	1,955	2,023	3,978	1,965	2,025	3,990	0.66
9	2,344	2,293	4,637	2,371	2,320	4,691	2,397	2,347	4,744	2.31
10	2,537	2,435	4,972	2,573	2,467	5,040	2,610	2,499	5,109	2.76
11	2,328	2,385	4,713	2,399	2,452	4,851	2,471	2,519	4,990	5.88
12	2,671	2,601	5,272	2,726	2,669	5,395	*	*	*	*
13	2,622	2,554	5,176	2,692	2,638	5,330	2,764	2,724	5,488	6.03
Total (6-13)	18,722	18,823	37,545	19,010	19,166	38,176	16,521	16,773	33,294	-11.32
12	*	*	*	*	*	*	2,783	2,738	5,521	*
14	2,325	2,283	4,608	2,384	2,344	4,728	2,445	2,407	4,852	5.30
15	2,365	2,172	4,537	2,418	2,211	4,629	2,473	2,249	4,722	4.08
16	1,965	2,057	4,022	2,005	2,099	4,104	2,047	2,141	4,188	4.13
17	2,047	1,854	3,901	2,069	1,871	3,940	2,093	1,889	3,982	2.08
Total (12-17)	**8,702**	**8,366**	**17,068**	**8,876**	**8,525**	**17,401**	**11,841**	**11,424**	**23,265**	**36.31**

Year	2024			2025			2026		
Age	M	F	T	M	F	T	M	F	T
6	2,187	2,307	4,494	2,193	2,328	4,521	2,199	2,349	4,548
7	2,145	2,414	4,559	2,157	2,455	4,612	2,169	2,497	4,666
8	1,975	2,028	4,003	1,985	2,031	4,016	1,995	2,034	4,029
9	2,425	2,375	4,800	2,452	2,402	4,854	2,480	2,430	4,910
10	2,647	2,531	5,178	2,684	2,564	5,248	2,721	2,596	5,317

	M	F	T	M	F	T	M	F	T
11	2,546	2,589	5,135	2,623	2,661	5,284	2,703	2,735	5,438
Total (6-11)	**13,925**	**14,244**	**28,169**	**14,094**	**14,441**	**28,535**	**14,267**	**14,641**	**28,908**
Junior secondary school age population									
12	2839	2809	5648	2898	2882	5780	2958	2957	5915
13	2837	2812	5649	2912	2904	5816	2990	2998	5988
14	*	*	*	2572	2540	5112	2638	2608	5246
Total (12-14)	**5676**	**5621**	**11297**	**8382**	**8326**	**16708**	**8586**	**8563**	**17149**
8-4-4 secondary school population									
14	2507	2473	4980						
15	2529	2289	4818	2587	2329	4916			
16	2089	2184	4273	2132	2228	4360	2175	2274	4449
17	2117	1908	4025	2141	1925	4066	2165	1945	4110
Total (14-17)	**9242**	**8854**	**18096**	**6860**	**6482**	**13342**	**4340**	**4219**	**8559**
Senior secondary school age population									
15							2645	2369	5014
16							*	*	*
17							*	*	*
Total (15-17)							**2645**	**2369**	**5014**

Year	2027			2028		
Age	M	F	T	M	F	T
6	2,206	2,371	4,577	2,211	2,394	4,605
7	2,182	2,540	4,722	2,194	2,583	4,777
8	2,005	2,037	4,042	2,015	2,039	4,054
9	2,508	2,458	4,966	2,536	2,485	5,021
10	2,759	2,631	5,390	2,799	2,664	5,463
11	2,785	2,810	5,595	2,869	2,888	5,757
Total (6-11)	**14,445**	**14,847**	**29,292**	**14,624**	**15,053**	**29,677**
Junior secondary school age population						
12	3020	3032	6052	3081	3111	6192
13	3069	3095	6164	3151	3196	6347
14	2704	2679	5383	2774	2752	5526
Total (12-14)	**8793**	**8806**	**17599**	**9006**	**9059**	**18065**
8-4-4 Secondary school age population						
14	*	*	*			
15	*	*	*			
16	*	*	*			
17	2190	1963	4153			
Total (14-17)	**2190**	**1963**	**4153**			

		Senior secondary school age population				
15	2704	2411	5115	2765	2453	5218
16	2220	2319	4539	2266	2366	4632
17	*	*	*	2214	1982	4196
Total (15-17)	**4924**	**4730**	**9654**	**7245**	**6801**	**14046**

Year		2029			2030		Deviation
Age	M	F	T	M	F	T	%
6	2,217	2,416	4,633	2,223	2,438	4,661	
7	2,207	2,627	4,834	2,219	2,671	4,890	
8	2,025	2,041	4,066	2,034	2,044	4,078	
9	2,565	2,514	5,079	2,593	2,543	5,136	
10	2,838	2,698	5,536	2,878	2,732	5,610	
11	2,956	2,967	5,923	3,046	3,049	6,095	
Total (6-11)	**14,808**	**15,263**	**30,071**	**14,993**	**15,477**	**30,470**	**8.17**
12	3,145	3,191	6,336	3,210	3,273	6,483	
13	3,234	3,299	6,533	3,320	3,406	6,726	
14	2,844	2,826	5,670	2,916	2,902	5,818	
Total (12-14)	**9223**	**9316**	**18539**	**9446**	**9581**	**19027**	**244.63**
15	2,829	2,496	5,325	2,892	2,540	5,432	
16	2,312	2,413	4,725	2,359	2,463	4,822	
17	2,239	2,002	4,241	2,265	2,020	4,285	
Total (15-17)	**7380**	**6911**	**14291**	**7516**	**7023**	**14539**	**189.97**

APPENDIX M: UGENYA SUB-COUNTY SCHOOL AGE POPULATION 2016-2030

Year		2016			2017			2018	
	M	F	T	M	F	T	M	F	T
6	1848	1825	3673	1869	1849	3718	1891	1873	3763
7	1773	1774	3548	1800	1807	3607	1827	1841	3668
8	1676	1740	3416	1701	1765	3466	1726	1791	3518
9	1890	1866	3755	1924	1902	3827	1960	1940	3900
10	2060	1992	4052	2098	2028	4126	2137	2065	4201
11	1791	1813	3605	1855	1876	3731	1920	1942	3861
12	2097	2014	4111	2148	2075	4223	2200	2138	4338

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	M	F	T	M	F	T	M	F	T
13	2001	1961	3962	2061	2028	4089	2123	2097	4220
14	1804	1758	3562	1856	1811	3667	1909	1866	3775
15	1783	1723	3505	1822	1763	3586	1863	1805	3667
16	1575	1577	3152	1612	1615	3227	1650	1654	3304
17	1646	1572	3218	1672	1598	3269	1698	1624	3321

Year	2019			2020		
	M	F	T	M	F	T
6	2032	1967	3999	2,066	2,003	4,069
7	1921	1877	3798	1,955	1,910	3,865
8	1805	1796	3601	1,837	1,819	3,656
9	2065	2071	4136	2,106	2,119	4,225
10	2109	2112	4221	2,144	2,158	4,302
11	2009	1984	3993	2,084	2,051	4,135
12	2351	2211	4562	2,421	2,279	4,700
13	2169	2124	4293	2,230	2,185	4,415
14	2030	2008	4038	2,088	2,074	4,162
15	2019	1914	3933	2,072	1,962	4,034
16	1882	1782	3664	1,936	1,832	3,768
17	1904	1691	3595	1,945	1,720	3,665

Year	2021			2022			2023			Deviation
Age	M	F	T	M	F	T	M	F	T	%
6	2,103	2,042	4,145	2,140	2,081	4,221	2,177	2,120	4,297	3.67
7	1,989	1,944	3,933	2,025	1,978	4,003	2,060	2,013	4,073	3.56
8	1,871	1,841	3,712	1,906	1,863	3,769	1,941	1,886	3,827	3.10
9	2,149	2,169	4,318	2,192	2,220	4,412	2,237	2,272	4,509	4.42
10	2,178	2,207	4,385	2,213	2,256	4,469	2,248	2,306	4,554	3.85
11	2,161	2,120	4,281	2,242	2,190	4,432	2,326	2,264	4,590	7.22
12	2,495	2,349	4,844	2,572	2,422	4,994	*	*	*	*
13	2,291	2,246	4,537	2,354	2,307	4,661	2,419	2,371	4,790	5.58
Total (6-13)	17,237	16,918	34,155	17,644	17,317	34,961	15,408	15,232	30,640	-10.29
12	*	*	*	*	*	*	2,650	2,496	5,146	*
14	2,148	2,145	4,293	2,211	2,217	4,428	2,274	2,293	4,567	6.38
15	2,128	2,012	4,140	2,187	2,062	4,249	2,245	2,114	4,359	5.29
16	1,991	1,883	3,874	2,050	1,937	3,987	2,109	1,992	4,101	5.86
17	1,988	1,750	3,738	2,033	1,781	3,814	2,078	1,812	3,890	4.07
Total (12-17)	8,255	7,790	16,045	8,481	7,997	16,478	11,356	10,707	22,063	37.51

Year	2024			2025			2026		
Age	M	F	T	M	F	T	M	F	T
6	2,215	2,161	4,376	2,254	2,202	4,456	2,293	2,245	4,538
7	2,096	2,049	4,145	2,134	2,085	4,219	2,172	2,122	4,294
8	1,977	1,908	3,885	2,013	1,931	3,944	2,050	1,954	4,004
9	2,282	2,326	4,608	2,328	2,381	4,709	2,376	2,437	4,813
10	2,284	2,358	4,642	2,320	2,410	4,730	2,358	2,464	4,822
11	2,413	2,340	4,753	2,503	2,418	4,921	2,597	2,498	5,095

Total (6-11)	13,267	13,142	26,409	13,552	13,427	26,979	13,846	13,720	27,566
Junior secondary school age population									
12	2732	2573	5305	2815	2652	5467	2901	2733	5634
13	2487	2437	4924	2555	2504	5059	2625	2573	5198
14	*	*	*	2406	2449	4855	2475	2532	5007
(Total 12-14)	**5219**	**5010**	**10229**	**7776**	**7605**	**15381**	**8001**	**7838**	**15839**
8-4-4 Secondary school age population									
14	2339	2369	4708	*	*	*	*	*	*
15	2306	2167	4473	2368	2222	4590	*	*	*
16	2170	2049	4219	2233	2107	4340	2299	2166	4465
17	2125	1843	3968	2172	1876	4048	2220	1908	4128
Total (14-17)	**8940**	**8428**	**17368**	**6773**	**6205**	**12978**	**4519**	**4074**	**8593**
Senior secondary school age population									
15							2432	2278	4710
16							*	*	*
17							*	*	*
Total (15-17)							**2432**	**2278**	**4710**

Year	2027			2028		
Age	M	F	T	M	F	T
6	2,333	2,287	4,620	2,373	2,330	4,703
7	2,210	2,158	4,368	2,248	2,196	4,444
8	2,087	1,977	4,064	2,125	2,001	4,126
9	2,423	2,494	4,917	2,472	2,553	5,025
10	2,395	2,519	4,914	2,433	2,574	5,007
11	2,694	2,582	5,276	2,794	2,668	5,462
Total (6-11)	**14,142**	**14,017**	**28,159**	**14,445**	**14,322**	**28,767**
Junior secondary school age population						
12	2989	2817	5806	3081	2903	5984
13	2698	2644	5342	2772	2716	5488
14	2546	2617	5163	2618	2705	5323
Total (12-14)	8233	8078	16311	8471	8324	16795
8-4-4 Secondary school age population						
14	*	*	*			
15	*	*	*			
16	*	*	*			
17	2269	1941	4210			
Total (14-17)	**2269**	**1941**	**4210**			
Senior secondary school age population						
15	2499	2335	4834	2567	2394	4961

16	2365	2227	4592	2434	2290	4724
17	*	*	*	2320	1975	4295
Total (15-17)	**4864**	**4562**	**9426**	**7321**	**6659**	**13980**

Year	2029			2030			Deviation
Age	M	F	T	M	F	T	%
6	2,414	2,375	4,789	2,456	2,420	4,876	
7	2,287	2,234	4,521	2,328	2,273	4,601	
8	2,164	2,025	4,189	2,204	2,048	4,252	
9	2,522	2,612	5,134	2,573	2,673	5,246	
10	2,472	2,632	5,104	2,510	2,690	5,200	
11	2,898	2,756	5,654	3,005	2,849	5,854	
Total (6-11)	**14,757**	**14,634**	**29,391**	**15,076**	**14,953**	**30,029**	**13.71**
12	3,175	2,992	6,167	3,271	3,083	6,354	
13	2,849	2,790	5,639	2,927	2,866	5,793	
14	2,694	2,795	5,489	2,771	2,890	5,661	
Total (12-14)	**8718**	**8577**	**17295**	**8969**	**8839**	**17808**	**246.06**
15	2,635	2,454	5,089	2,707	2,516	5,223	
16	2,504	2,355	4,859	2,577	2,421	4,998	
17	2,371	2,008	4,379	2,423	2,044	4,467	
Total (15-17)	**7510**	**6817**	**14327**	**7707**	**6981**	**14688**	**211.85**

APPENDIX O: UGUNJA SUB-COUNTY SCHOOL AGE POPULATION 2016-2030

Year	2016			2017			2018		
	M	F	T	M	F	T	M	F	T
6	1439	1415	2854	1456	1434	2889	1472	1452	2925
7	1381	1376	2757	1401	1402	2803	1423	1428	2850
8	1305	1349	2654	1325	1369	2694	1344	1389	2734
9	1472	1447	2919	1499	1475	2974	1526	1505	3031
10	1604	1545	3149	1634	1573	3206	1664	1601	3265

11	1395	1406	2801	1444	1455	2899	1495	1506	3001
12	1633	1562	3195	1672	1609	3282	1713	1658	3371
13	1558	1521	3079	1605	1573	3178	1653	1626	3280
14	1405	1364	2768	1445	1405	2850	1486	1447	2934
15	1388	1336	2724	1419	1368	2787	1451	1400	2850
16	1226	1223	2449	1255	1253	2508	1285	1283	2568
17	1282	1219	2501	1302	1239	2541	1322	1259	2581

Year	2019			2020		
	M	F	T	M	F	T
6	1380	1485	2865	1,386	1,509	2,895
7	1373	1479	2852	1,387	1,508	2,895
8	1323	1509	2832	1,340	1,538	2,878
9	1574	1572	3146	1,603	1,606	3,209
10	1647	1629	3276	1,674	1,664	3,338
11	1512	1562	3074	1,564	1,616	3,180
12	1732	1692	3424	1,775	1,742	3,517
13	1676	1692	3368	1,722	1,744	3,466
14	1593	1489	3082	1,640	1,533	3,173
15	1546	1488	3034	1,585	1,525	3,110
16	1322	1345	2667	1,347	1,379	2,726
17	1395	1299	2694	1,417	1,321	2,738

Year	2021			2022			2023			Deviation
Age	M	F	T	M	F	T	M	F	T	%
6	1,392	1,534	2,926	1,397	1,559	2,956	1,402	1,585	2,987	2.08
7	1,399	1,537	2,936	1,412	1,566	2,978	1,425	1,596	3,021	2.90
8	1,356	1,570	2,926	1,373	1,601	2,974	1,390	1,634	3,024	3.35
9	1,632	1,640	3,272	1,661	1,675	3,336	1,691	1,711	3,402	3.97
10	1,702	1,700	3,402	1,729	1,737	3,466	1,757	1,775	3,532	3.82
11	1,617	1,673	3,290	1,672	1,732	3,404	1,728	1,793	3,521	7.02
12	1,820	1,793	3,613	1,865	1,845	3,710	*	*	*	*
13	1,768	1,798	3,566	1,816	1,853	3,669	1,864	1,909	3,773	5.80
Total (6-13)	12,686	13,245	25,931	12,925	13,568	26,493	11,257	12,003	23,260	-10.30
12	*	*	*	*	*	*	1,912	1,900	3,812	*
14	1,688	1,577	3,265	1,738	1,624	3,362	1,789	1,670	3,459	5.94
15	1,625	1,564	3,189	1,666	1,604	3,270	1,708	1,645	3,353	5.14
16	1,373	1,415	2,788	1,398	1,450	2,848	1,424	1,487	2,911	4.41
17	1,441	1,342	2,783	1,464	1,364	2,828	1,488	1,386	2,874	3.27
Total (12-17)	6,127	5,898	12,025	6,266	6,042	12,308	8,321	8,088	16,409	36.46

Year	2024			2025			2026		
Age	M	F	T	M	F	T	M	F	T
6	1,408	1,611	3,019	1,413	1,637	3,050	1,417	1,664	3,081
7	1,438	1,626	3,064	1,450	1,658	3,108	1,463	1,689	3,152
8	1,407	1,667	3,074	1,424	1,701	3,125	1,441	1,734	3,175
9	1,721	1,747	3,468	1,753	1,784	3,537	1,784	1,821	3,605
10	1,785	1,813	3,598	1,815	1,853	3,668	1,844	1,893	3,737
11	1,787	1,855	3,642	1,847	1,921	3,768	1,909	1,988	3,897
Total (6-11)	9,546	10,319	19,865	9,702	10,554	20,256	9,858	10,789	20,647

Junior secondary school age population

Age	M	F	T	M	F	T	M	F	T
12	1960	1955	3915	2009	2012	4021	2059	2072	4131
13	1914	1967	3881	1966	2026	3992	2018	2088	4106
14	*	*	*	1896	1769	3665	1951	1820	3771
Total (12-14)	3874	3922	7796	5871	5807	11678	6028	5980	12008

8-4-4 Secondary school age population

Age	M	F	T	M	F	T	M	F	T
14	1842	1719	3561						
15	1751	1687	3438	1796	1728	3524	*	*	*
16	1450	1525	2975	1477	1564	3041	1504	1604	3108
17	1512	1409	2921	1536	1432	2968	1562	1455	3017
Total (14-17)	6555	6340	12895	4809	4724	9533	3066	3059	6125

Senior secondary school age population

Age	M	F	T	M	F	T	M	F	T
15							1841	1773	3614
16							*	*	*
17							*	*	*
Total (15-17)							1841	1773	3614

Year	2027			2028		
Age	M	F	T	M	F	T
6	1,422	1,692	3,114	1,428	1,720	3,148
7	1,476	1,722	3,198	1,489	1,754	3,243
8	1,459	1,769	3,228	1,477	1,804	3,281
9	1,816	1,860	3,676	1,849	1,899	3,748
10	1,874	1,933	3,807	1,904	1,976	3,880
11	1,974	2,057	4,031	2,041	2,129	4,170
Total (6-11)	**10,021**	**11,033**	**21,054**	**10,188**	**11,282**	**21,470**

Junior secondary school age population

Age	M	F	T	M	F	T
12	2111	2132	4243	2163	2194	4357
13	2072	2151	4223	2127	2217	4344
14	2009	1873	3882	2068	1927	3995
Total (12-14)	**6192**	**6156**	**12348**	**6358**	**6338**	**12696**

8-4-4 secondary school age population

Age	M	F	T	M	F	T
14	*	*	*			

15	*	*	*			
16	*	*	*			
17	1587	1479	3066			
Total (14-17)	**1587**	**1479**	**3066**			
		Senior secondary school age population				
15	1888	1818	3706	1935	1863	3798
16	1532	1646	3178	1560	1688	3248
17	*	*	*	1612	1504	3116
Total (15-17)	**3420**	**3464**	**6884**	**5107**	**5055**	**10162**

Year	2029			2030			Deviation
Age	M	F	T	M	F	T	%
6	1,432	1,747	3,179	1,437	1,776	3,213	
7	1,502	1,788	3,290	1,515	1,823	3,338	
8	1,495	1,840	3,335	1,513	1,877	3,390	
9	1,882	1,940	3,822	1,915	1,981	3,896	
10	1,934	2,018	3,952	1,966	2,061	4,027	
11	2,110	2,204	4,314	2,182	2,280	4,462	
Total (6-11)	**10,355**	**11,537**	**21,892**	**10,528**	**11,798**	**22,326**	**12.39**
12	2,218	2,258	4,476	2,273	2,325	4,598	
13	2,184	2,284	4,468	2,242	2,353	4,595	
14	2,129	1,983	4,112	2,191	2,040	4,231	
Total (12-14)	**6531**	**6525**	**13056**	**6706**	**6718**	**13424**	**252.15**
15	1,985	1,911	3,896	2,035	1,958	3,993	
16	1,589	1,731	3,320	1,618	1,775	3,393	
17	1,638	1,529	3,167	1,664	1,553	3,217	
Total (15-17)	**5212**	**5171**	**10383**	**5317**	**5286**	**10603**	**193.39**

APPENDIX P: ENROLMENT FOR CLASSES 1-8 FROM 2016-2020 (8-4-4 PRIMARY SCHOOL ENROLMENT)

Year	2016			2017			2018		
Sub-county	M	F	T	M	F	T	M	F	T
Siaya	27521	27842	55363	27889	28313	56202	28503	29270	57773

	M	F	T	M	F	T	M	F	T
Bondo	20996	21069	42065	21312	21245	42557	21946	21685	43631
Gem	22819	22337	45156	23019	22538	45557	23476	22834	46310
Rarieda	19142	18869	38011	19522	19129	38651	19865	19482	39347
Ugenya	15613	15784	31397	16717	16554	33271	17077	16975	34052
Ugunja	11457	11401	22858	11850	11539	23389	12805	12750	25555
Siaya County	117548	117302	234850	120309	119318	239627	123672	122996	246668

Year	2019			2020		
	M	F	T	M	F	T
Sub-county						
Siaya	28948	29211	58159	29212	29361	58573
Bondo	22219	21866	44085	22480	22392	44872
Gem	23778	23179	46957	24250	23689	47939
Rarieda	20074	19746	39820	20163	20379	40542
Ugenya	17304	17229	34533	18049	17929	35978
Ugunja	12972	13041	26013	13147	13428	26575
Siaya County	125295	124272	249567	127301	127178	254479

APPENDIX Q: ENROLMENT FOR CLASSES 1-6 FROM 2016-2020 (2-6-6-3) PRIMARY SCHOOL ENROLMENT)

Year	2016			2017			2018		
Sub-county	M	F	T	M	F	T	M	F	T
Siaya	21902	22086	43988	22208	22363	44571	22399	22414	44813

Sub-county	M	F	T	M	F	T	M	F	T
Bondo	16041	16023	32064	16485	16380	32865	16881	16506	33387
Gem	17532	17002	34534	17986	17325	35311	18153	17443	35596
Rarieda	14877	14109	28986	15022	14451	29473	15176	14689	29865
Ugenya	12662	12495	25157	12917	12783	25700	13006	12793	25799
Ugunja	8833	8670	17503	9182	8798	17980	9763	9677	19440
Siaya County	91847	90385	182232	93800	92100	185900	95378	93522	188900

Year	2019			2020		
Sub-county	M	F	T	M	F	T
Siaya	22750	22480	45230	23069	22768	45837
Bondo	16972	16596	33568	17351	16894	34245
Gem	18239	17589	35828	18555	17802	36357
Rarieda	15364	14907	30271	15683	15232	30915
Ugenya	13119	12947	26066	13358	13107	26465
Ugunja	9961	9796	19757	10248	9969	20217
Siaya County	96405	94315	190720	98264	95772	194036

APPENDIX R: ENROLMENT FOR FORMS 1- 4 FROM 2016-2020 (8-4-4 SECONDARY SCHOOL ENROLMENT)

Year	2016			2017			2018		
Sub-county	M	F	T	M	F	T	M	F	T
Siaya	6684	7539	14223	7175	8473	15648	7460	8675	16135
Bondo	6916	5305	12221	8040	6448	14488	8633	7023	15656

Gem	7524	5251	12775	8874	7186	16060	9345	7979	17324
Rarieda	7155	5432	12587	7630	5711	13341	8611	6554	15165
Ugenya	4107	3354	7461	4681	4437	9118	5401	5078	10479
Ugunja	3874	4281	8155	4537	5304	9841	4972	5978	10950
Siaya County	36260	31162	67422	40937	37559	78496	44422	41287	85709

Year	2019			2020		
Sub-county	M	F	T	M	F	T
Siaya	7974	10110	18084	8802	11236	20038
Bondo	9078	7799	16877	9818	8423	18241
Gem	10009	8928	18937	11069	9103	20172
Rarieda	8811	7414	16225	9584	8156	17740
Ugenya	5882	5915	11797	6703	6534	13237
Ugunja	5454	6397	11851	6061	6850	12911
Siaya County	47208	46563	93771	52037	50302	102339

APPENDIX S: ENROLMENT FOR CLASSES 7-8 AND FORM 1 FROM 2016-2020 (JUNIOR SECONDARY SCHOOL ENROLMENT)

Year	2016			2017			2018		
Sub-county	M	F	T	M	F	T	M	F	T

Sub-county	M	F	T	M	F	T	M	F	T
Siaya	7232	7636	14868	7583	8247	15830	8007	9283	17290
Bondo	6982	6712	13694	7052	6909	13961	7363	7300	14663
Gem	7535	7170	14705	7852	7233	15085	8011	7552	15563
Rarieda	6191	6318	12509	6602	6347	12949	6767	6807	13574
Ugenya	4116	4455	8571	5257	5086	10343	5768	5837	11605
Ugunja	3671	4044	7715	3863	4343	8206	4571	4601	9172
Siaya County	35727	36335	72062	38209	38165	76374	40487	41380	81867

Year	2019			2020		
Sub-county	M	F	T	M	F	T
Siaya	8486	9541	18027	8716	9923	18639
Bondo	7631	7501	15132	8584	8323	16907
Gem	8217	7761	15978	9003	7897	16900
Rarieda	7262	6984	14246	7124	7348	14472
Ugenya	5864	5990	11854	6628	6280	12908
Ugunja	4667	4931	9598	4758	5170	9928
Siaya County	42127	42708	84835	44813	44941	89754

APPENDIX T: ENROLMENT FOR FORMS 2-4 FROM 2016-2020 (SENIOR SECONDARY SCHOOL ENROLMENT)

Year	2016	2017	2018

Sub-county	M	F	T	M	F	T	M	F	T
Siaya	5071	5658	10729	5273	6166	11439	5557	6038	11595
Bondo	4889	3639	8528	5815	4603	10418	6227	4902	11129
Gem	5276	3416	8692	6555	5166	11721	6657	5518	12175
Rarieda	5229	3874	9103	5528	4042	9570	6166	4540	10706
Ugenya	2942	2188	5130	3224	3122	6346	3704	3423	7127
Ugunja	2827	2968	5795	3342	3597	6939	3443	3780	7223
Siaya County	26234	21743	47977	29737	26696	56433	31754	28201	59955

Year	2019			2020		
Sub-county	M	F	T	M	F	T
Siaya	5686	7300	12986	6229	7906	14135
Bondo	6494	5529	12023	7051	6134	13185
Gem	7331	6357	13688	7761	7093	14854
Rarieda	6259	5269	11528	6940	5955	12895
Ugenya	4194	4200	8394	4684	4716	9400
Ugunja	3774	4083	7857	4098	4344	8442
Siaya County	33738	32738	66476	36763	36148	72911

APPENDIX U: PROJECTED PRIMARY SCHOOL ENROLMENT (SIAYA AND BONDO SUB-COUNTIES)

Year	Projected Enrolment	Projected school age population	Overage & underage/ Out of school	Enrolment trend

			population					
	M	F	T	M	F	T	M	F	%
2021	29656	29827	59483	27462	27874	55336	2194	1953	
2022	29981	30013	59995	28093	28595	56688	1888	1418	0.86
2023	26099	26140	52240	24749	25400	50149	1350	740	-12.18
2024	23653	24116	47769	21190	21874	43064	2463	2242	
2025	23791	24216	48007	21642	22390	44032	2149	1826	
2026	23923	24309	48232	22103	22919	45022	1820	1390	
2027	24049	24392	48441	22573	23460	46033	1476	932	
2028	24172	24467	48639	23056	24015	47071	1116	452	
2029	24289	24529	48818	23548	24581	48129	741	-52	
2030	24396	24581	48977	24047	25161	49208	349	-580	2.53
Enrolment trend (%)	3.14	1.93	2.53						

BONDO SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	22668	22325	44992	23680	24054	47734	-1012	-1729	
2022	22692	22273	44965	24342	24794	49136	-1650	-2521	-0.06
2023	19662	18982	38645	21674	21856	43530	-2012	-2874	-14.11
2024	18172	17635	35807	18795	18656	37451	-623	-1021	
2025	18260	17696	35957	19291	19133	38424	-1031	-1437	
2026	18338	17750	36088	19797	19623	39420	-1459	-1873	
2027	18412	17797	36209	20322	20127	40449	-1910	-2330	
2028	18473	17832	36305	20856	20642	41498	-2383	-2810	
2029	18528	17860	36388	21408	21173	42581	-2880	-3313	
2030	18575	17882	36458	21978	21723	43701	-3403	-3841	1.82
Enrolment trend (%)	2.22	1.40	1.82						

APPENDIX V: PROJECTED PRIMARY SCHOOL ENROLMENT (GEM AND RARIEDA SUB-COUNTIES)

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	24772	24004	48776	22353	21879	44232	2419	2125	
2022	25395	24380	49775	22731	22221	44952	2664	2159	2.05
2023	22466	21317	43783	19949	19429	39378	2517	1888	-10.24
2024	20272	19765	40037	16892	16420	33312	3380	3345	
2025	20730	20290	41020	17140	16621	33761	3590	3669	
2026	21204	20826	42030	17397	16826	34223	3807	4000	
2027	21681	21372	43053	17653	17033	34686	4028	4339	
2028	22176	21934	44110	17919	17247	35166	4257	4687	
2029	22678	22507	45185	18187	17464	35651	4491	5043	
2030	23194	23086	46280	18462	17680	36142	4732	5406	15.59
Enrolment trend (%)	14.42	16.80	15.59						

RARIEDA SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend

	M	F	T	M	F	T	M	F	%
2021	20748	20797	41546	18722	18823	37545	2026	1974	
2022	21269	21396	42665	19010	19166	38176	2259	2230	2.69
2023	18659	18916	37576	16521	16773	33294	2138	2143	-9.56
2024	17306	16920	34227	13925	14244	28169	3381	2676	
2025	17757	17375	35133	14094	14441	28535	3663	2934	
2026	18219	17840	36059	14267	14641	28908	3952	3199	
2027	18694	18318	37011	14445	14847	29292	4249	3471	
2028	19175	18802	37978	14624	15053	29677	4551	3749	
2029	19670	19298	38968	14808	15263	30071	4862	4035	
2030	20172	19806	39977	14993	15477	30470	5179	4329	16.80
Enrolment trend (%)	16.56	17.05	16.80						

APPENDIX V: PROJECTED PRIMARY SCHOOL ENROLMENT (UGENYA AND UGUNJA SUB-COUNTIES

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	18590	18420	37011	17237	16918	34155	1353	1502	
2022	19117	18943	38060	17644	17317	34961	1473	1626	2.83
2023	16771	16739	33511	15408	15232	30640	1363	1507	-9.46
2024	13710	13561	27271	13267	13142	26409	443	419	
2025	13797	13669	27467	13552	13427	26979	245	242	
2026	13885	13778	27664	13846	13720	27566	39	58	
2027	13967	13883	27849	14142	14017	28159	-175	-134	
2028	14045	13987	28032	14445	14322	28767	-400	-335	
2029	14123	14089	28213	14757	14634	29391	-634	-545	
2030	14199	14190	28388	15076	14953	30029	-877	-763	4.10
Enrolment trend (%)	3.57	4.64	4.10						

UGUNJA SUB-COUNTY									
Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	13913	14143	28056	12686	13245	25931	1227	898	
2022	14492	14730	29222	12925	13568	26493	1567	1162	4.16
2023	12898	13245	26143	11257	12003	23260	1641	1242	-6.82
2024	12208	11611	23818	9546	10319	19865	2662	1292	
2025	12714	12014	24728	9702	10554	20256	3012	1460	
2026	13230	12423	25653	9858	10789	20647	3372	1634	
2027	13766	12291	26057	10021	10554	20575	3745	1737	
2028	14318	12994	27311	10188	11033	21221	4130	1961	
2029	14880	13435	28315	10355	11282	21637	4525	2153	
2030	15461	13890	29352	10528	11798	22326	4933	2092	23.23
Enrolment trend (%)	26.65	19.63	23.23						

APPENDIX W: PROJECTED JUNIOR SECONDARY SCHOOL ENROLMENT (SIAYA AND BONDO SUB- COUNTIES)

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	9207	12051	21258	12020	11985	24005	-2813	66	
2022	9798	13107	22905	12272	12252	24524	-2474	855	7.75
2023	14895	17662	32557	16518	16464	32982	-1623	1198	42.14
2024	19364	23236	42600	21002	21032	42034	-1638	2204	
2025	20254	24537	44791	21495	21584	43079	-1241	2953	110.70
2026	17733	21966	39699	18423	18793	37216	-690	3173	
2027	15390	19279	34669	15659	16054	31713	-269	3225	-12.67
2028	12894	16393	29287	12855	13296	26151	39	3097	
2029	13500	17346	30846	13192	13713	26905	308	3633	
2030	14127	18342	32469	13537	14142	27679	590	4200	10.86
Enrolment trend (%)	53.44	52.20	52.73						

BONDO SUB-COUNTY									
Year	**Projected enrolment**			**Projected school age population**			**Overage & underage/out of school population**		**Enrolment trend**
	M	F	T	M	F	T	M	F	%
2021	10674	9408	20082	10248	10393	20641	426	-985	
2022	11463	10270	21734	10531	10709	21240	932	-439	8.22
2023	14349	12525	26874	14173	14736	28909	176	-2211	23.65
2024	18490	15977	34467	18052	19061	37113	438	-3084	
2025	19257	16318	35575	18586	19746	38332	671	-3428	77.15
2026	17047	14088	31135	16267	17294	33561	780	-3206	
2027	14750	12068	26817	13918	15031	28949	832	-2963	-24.62
2028	12377	10179	22556	11550	12867	24417	827	-2688	
2029	12943	10452	23396	11947	13412	25359	996	-2960	
2030	13536	10730	24266	12359	13980	26339	1177	-3250	7.58
Enrolment trend (%)	26.81	14.05	20.83						

APPENDIX X: PROJECTED JUNIOR SECONDARY SCHOOL ENROLMENT IN GEM AND RARIEDA SUB- COUNTIES BY 2030

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	11987	10694	22681	10188	9824	20012	1799	870	
2022	12991	11823	24815	10375	10023	20398	2616	1800	9.41
2023	14667	13109	27776	13734	13367	27101	933	-258	11.93
2024	18956	16886	35842	17379	16937	34316	1577	-51	
2025	19743	17540	37283	17730	17309	35039	2013	231	64.38
2026	17240	15209	32449	15171	14771	29942	2069	438	
2027	14786	13039	27825	12755	12466	25221	2031	573	-25.37
2028	12564	10885	23448	10629	10246	20875	1935	639	
2029	13115	11315	24430	10885	10490	21375	2230	825	
2030	13687	11758	25445	11149	10738	21887	2538	1020	8.52
Enrolment trend	14.19	9.95	12.19						

RARIEDA SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	10309	8860	19169	8702	8366	17068	1607	494	
2022	11063	9706	20769	8876	8525	17401	2187	1181	8.35
2023	12297	12266	24563	11841	11424	23265	456	842	18.27
2024	15777	15851	31627	14918	14475	29393	859	1376	
2025	16409	16531	32941	15242	14808	30050	1167	1723	71.85
2026	14162	14542	28704	12926	12782	25708	1236	1760	
2027	12242	12482	24724	10983	10769	21752	1259	1713	-24.94
2028	10210	10693	20903	9006	9059	18065	1204	1634	
2029	10632	11195	21827	9223	9316	18539	1409	1879	
2030	11068	11718	22787	9446	9581	19027	1622	2137	9.01
Enrolment trend (%)	7.37	32.26	18.88						

APPENDIX Y: PROJECTED JUNIOR SECONDARY SCHOOL ENROLMENT IN UGENYA AND UGUNJA SUB-COUNTIES BY 2030

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	7302	7535	14837	8255	7790	16045	-953	-255	
2022	7957	8420	16377	8481	7997	16478	-524	423	10.38
2023	13333	12049	25382	11356	10707	22063	1977	1342	54.98
2024	17474	15729	33203	14159	13438	27597	3315	2291	
2025	18829	16788	35617	14549	13810	28359	4280	2978	140.06
2026	16955	15018	31973	12520	11912	24432	4435	3106	
2027	14853	13084	27937	10502	10019	20521	4351	3065	-21.56
2028	12489	11246	23735	8471	8324	16795	4018	2922	
2029	13377	11975	25352	8718	8577	17295	4659	3398	
2030	14301	12739	27040	8969	8839	17808	5332	3900	13.93
Enrolment trend (%)	95.85	69.07	82.25						

UGUNJA SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2021	6609	7719	14328	6127	5898	12025	482	1821	
2022	7170	8418	15589	6266	6042	12308	904	2376	8.80
2023	8893	9117	18009	8321	8088	16409	572	1029	15.53
2024	11532	11881	23413	10429	10262	20691	1103	1619	
2025	12204	12515	24719	10680	10531	21211	1524	1984	72.52
2026	10729	11019	21747	9094	9039	18133	1635	1980	
2027	9465	9541	19006	7779	7635	15414	1686	1906	-23.11
2028	7971	8114	16086	6358	6338	12696	1613	1776	
2029	8430	8553	16983	6531	6525	13056	1899	2028	
2030	8904	9012	17916	6706	6718	13424	2198	2294	11.38
Enrolment trend (%)	34.73	16.74	25.04						

APPENDIX Z: PROJECTED SENIOR SECONDARY ENROLMENT FOR SIAYA, BONDO AND GEM SUB-COUNTIES

SIAYA SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	8048	11872	19920	9791	9651	19442	-1743	2221	
2027	8406	12642	21048	9988	9840	19828	-1582	2802	
2028	8776	13438	22214	10189	10033	20222	-1413	3405	
2029	9157	14260	23418	10394	10230	20624	-1237	4030	
2030	9549	15107	24656	10602	10429	21031	-1053	4678	23.78
Enrolment trend (%)	18.66	27.25	23.78						

BONDO SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	10852	10596	21448	8347	8618	16965	2505	1978	
2027	11561	11453	23014	8543	8852	17395	3018	2601	
2028	12295	12351	24646	8743	9093	17836	3552	3258	
2029	13058	13287	26346	8948	9340	18288	4110	3947	
2030	13854	14266	28120	9160	9594	18754	4694	4672	31.10
Enrolment trend (%)	27.66	34.63	31.10						

GEM SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	12269	13512	25781	7954	7909	15863	4315	5603	
2027	13074	14691	27765	8075	8064	16139	4999	6627	
2028	13904	15905	29808	8199	8219	16418	5705	7686	
2029	14756	17162	31918	8325	8378	16703	6431	8784	
2030	15627	18464	34091	8451	8541	16992	7176	9923	32.23
Enrolment trend (%)	27.37	36.65	32.23						

APPENDIX AA: PROJECTED SENIOR SECONDARY SCHOOL ENROLMENT IN RARIEDA, UGENYA AND UGUNJA SUB-COUNTIES BY 2030

RARIEDA SUB-COUNTY

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	10107	9731	19838	6985	6588	13573	3122	3143	
2027	10712	10450	21162	7114	6693	13807	3598	3757	
2028	11335	11192	22526	7245	6801	14046	4090	4391	
2029	11979	11955	23934	7380	6911	14291	4599	5044	
2030	12642	12740	25382	7516	7023	14539	5126	5717	27.95
Enrolment trend	25.08	30.92	27.95						

<div align="center">UGENYA SUB-COUNTY</div>

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	7499	9202	16701	6951	6352	13303	548	2850	
2027	8044	10048	18092	7133	6503	13636	911	3545	
2028	8614	10931	19545	7321	6659	13980	1293	4272	
2029	9203	11848	21051	7510	6817	14327	1693	5031	
2030	9821	12807	22628	7707	6981	14688	2114	5826	35.49
Enrolment trend (%)	30.96	39.17	35.49						

<div align="center">UGUNJA SUB-COUNTY</div>

Year	Projected enrolment			Projected school age population			Overage & underage/out of school population		Enrolment trend
	M	F	T	M	F	T	M	F	%
2026	6040	6629	12669	4907	4832	9739	1133	1797	
2027	6403	7049	13451	5007	4943	9950	1396	2106	
2028	6775	7482	14257	5107	5055	10162	1668	2427	
2029	7163	7934	15097	5212	5171	10383	1951	2763	
2030	7562	8396	15958	5317	5286	10603	2245	3110	25.96
Enrolment trend (%)	25.19	26.67	25.96						

APPENDIX AB: SUBNATIONAL PROJECTION TOOLKITS (MATHEMETICAL EXTRAPOLATION METHOD)

SETUP sheet

	A	B	C	D	E
3	Table		22		
4	Country	Republic of Demographica Region 1			
5	A. Projection specifications				
6	First date				
7	Year		1990		
8	Month		7		
9	Day		1		
10					
11	Second date				
12	Year		2000		
13	Month		7		
14	Day		1		
15					
16	Number of subareas		3		
17					
18	Subarea label	District			
19					
20	Projection dates				
21	Starting date		2000.50		
22	Ending date		2015.50		
23	Interval		5		
24					
25	Setup workbook				
26					
27					
28					
29					
30	Sources: 1990 and 2000 censuses of				

HELP **SETUP** INPUT LOGISTIC PROPORTION POP

INPUT sheet

	A	B	C	D	E	F	G	H
3	Table 22							
4	Republic of Demographica Region 1				Project			
5	B. Total Projected Population							
6	Area	2000.5	2005.5	2010.5	2015.5			
7	Total	17,493,729	19,520,094	21,355,078	23,166,043			
8								
9	C. Population by District							
10		Population		Proportion		Asymptotes		Logistic
11	District	1990.50	2000.50	1990.50	2000.50	Lower	Upper	growth rate
12								
13	Total	13,569,729	17,493,730	1.0000	1.0000	0	1	
14								
15	District 1	3,392,432	3,498,746	0.2500	0.2000	0	1	-0.0288
16	District 2	7,463,351	9,971,426	0.5500	0.5700	0	1	0.0081
17	District 3	2,713,946	4,023,558	0.2000	0.2300	0	1	0.0178
18								
19								

HELP SETUP **INPUT** LOGISTIC PROPORTION POP

POP sheet

	A	B	C	D	E
3	Table 22				
4					
5	F. Projected Population by District				
6					
7	Republic of Demographica Region 1	2000.5	2005.5	2010.5	2015.5
8					
9	Sum	17,493,729	19,520,094	21,355,078	23,166,043
10					
11	District 1	3,498,859	3,460,355	3,336,547	3,173,575
12	District 2	9,971,385	11,274,561	12,461,376	13,618,494
13	District 3	4,023,485	4,785,178	5,557,155	6,373,974
14					
15					

HELP SETUP INPUT LOGISTIC PROPORTION **POP**

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APPENDIX AC: MASENO UNIVERSITY ETHICS REVIEW COMMITTEE LETER

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622   Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 4th November, 2019

TO: Norich Muindi Munyasia
PHD/ED/00061/2017
Department of Educational Management and Foundations
School of Education
Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/00723/19

RE: **Educational Resource Requirement for Provision of Quality Education in Primary and Secondary Schools in Siaya County, Kenya by 2030. Proposal Reference Number MSU/DRPI/MUERC/00723/19**

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 4th day of November, 2019 for a period of one (1) year. This is subject to getting approvals from NACOSTI and other relevant authorities.

Please note that authorization to conduct this study will automatically expire on 3rd November, 2020. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 15th October, 2020.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 15th October, 2020.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Dr. Bernard Guyah
Ag. Secretary,
Maseno University Ethics Review Committee.
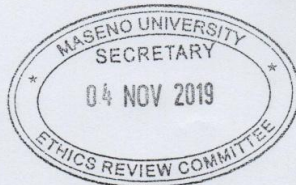
Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

APPENDIX AD: MAP OF SIAYA COUNTY ADMINISTRATIVE AND POLITICAL UNITS

ADMINISTRATIVE AND POLITICAL UNITS
IN SIAYA COUNTY

Busia

Kakamega

North Ugenya

East Ugenya

Ugenya

Sigomere

West Ugenya

Ukwala
Ukwala

Ugunja

Ugunja
Ugunja

Sidindi

West Alego

Central Alego

North Alego

North Gem

Yala

Usonga

Central Gem

Alego Usonga

Siaya
Siaya Township

Gem

West Gem

East Gem

South East Alego

Yala Swamp

Yimbo East

South Gem

Usenge
West Yimbo

North Sakwa

West Sakwa

Bondo

Kisumu

Mageta Islands

Bondo

Central Sakwa

East Asembo

West Asembo

Ndeda/Oyamo Islands

South Sakwa

Aram

West Uyoma

North Uyoma

LAKE VICTORIA

Rarieda

Homa Bay

South Uyoma

Legend

- Siaya County
- Sub County
- ■ Main Towns
- ● SubCounty HQs
- Ward
- Wetland

Kilometers

0   10   20   40

Siaya_County_cidp18

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