



(RESEARCH ARTICLE)



## Infrastructural Resources and Competency Based Learning Outcomes in Public Primary Schools in Makueni County, Kenya

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### Abstract

The goal of the study was to determine the influence of infrastructural resources on learning outcomes in primary schools in Makueni County. The study was guided by the social constructivism theory, which suggests that the learning environment can create a learner who can cope successfully with new developments around the world. The study targeted 7955 teachers and 32 head-teachers from 322 primary schools in Makueni County. Using simple random sampling 32 head-teachers were sampled from 322 public primary schools. Using Krejcie Morgan table, 370 teachers were randomly sampled from 32 schools. A Questionnaire, an interview schedule and Focus group discussion were used for data collection. Data was analyzed using frequencies, percentages, weighted averages and regression analysis. The study findings revealed that infrastructural resources significantly influences the learning outcomes in primary schools. To enhance learning outcomes under the Competency-Based Education (CBE), it was recommended that the government, education stakeholders and school management prioritize the adequate provision of infrastructure.

**Keywords:** Competency Based Education; Infrastructure; Learning Outcome; Resources

### 1. Introduction

Infrastructural resources such as classrooms, sanitation facilities, electricity, ICT infrastructure, libraries, laboratories, and school safety form the backbone of any functional education system. These resources provide the physical environment necessary for learning to take place effectively. Numerous scholars have established that the quality and adequacy of such infrastructure directly impact student learning outcomes, attendance, retention, and overall academic achievement. However, despite wide acknowledgment of their importance, many educational institutions—particularly in developing contexts—continue to operate with critical infrastructural deficits that hinder learning processes.

Infrastructural support refers to physical environmental development to support implementation of education in all learning areas in primary schools. Information Communication Technology (ICT) infrastructure for example is regarded as a delivery tool for all learning areas. It deals with the use computer systems to solve real-world problems and hence every learner needs to possess this knowledge in order to fit in society.

Proper implementation of the Competency Based Curriculum in public primary schools will therefore imply that the learner is able to understand and play an active role in the digital world that surrounds them. This means that they will not be passive recipients of an opaque technology that surrounds them. ICTs have a great impact in education and their integration in education is a contemporary global concern (Pollard and Hillage 2001).

Recent years have witnessed considerable enthusiasm and contestation regarding the role of ICT in addressing educational challenges in Africa (Keats, 2007). For successful implementation of the Competency Based Curriculum in

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public primary schools, there should be an enabling environment characterized by the presence of required facilities and trained personnel.

According to Sankale (2006) emphasis is laid on the importance of adequate funding to facilitate ICT in education. This means that for effective implementation of the new curriculum, there has to be financial support to facilitate infrastructural development. This study wishes to find out the infrastructural support available for the implementation and management of the Competency Based Curriculum in public primary schools in Trans Nzoia County.

The development of Information and Communication Technology (ICT), Elmunsyah (2012) reports, adds to the quality of education. This means that infrastructural support is very key to effective implementation of the Competency Based Curriculum in Public Primary schools in Trans Nzoia County. ICT improves the teaching and learning process and is indispensable not only in Primary schools, but also in Secondary schools. Schools which implement ICT should have a clear vision on its use (Elmunsyah, *ibid*). ICT implementation in schools requires infrastructure (Jin-Ho, 2005). This means that schools cannot implement ICT without putting the necessary infrastructure in place. According to Adams et al., (1992), ICT application in schools relies on three factors: hardware, software and the Technology users. This directly points to the preparedness of public primary schools on the same. The schools not only need to have hard ware and software but also need to have sufficiently trained staff that will facilitate effective use of the technology. This study therefore wishes to find out the levels of infrastructural support for the implementation and management of the Competency Based Curriculum in public primary schools in Trans Nzoia County. This will eventually bring out the schools' preparedness on the implementation of the Competency Based Curriculum in Public Primary schools in the County in question.

Resources are regarded as the most important support structure because curriculum management depends largely on resources available in schools (Department of Education, 2000:94). According to Sing (2012), Implementation of change in the curriculum without the relevant resources allocated to it would cause stress and strain leading to dire consequences and impacting on the teachers' morale to implement the planned curriculum changes. Lack of resources necessary for the execution of teaching and learning can inhibit effective curriculum implementation. Providing essential materials allows teachers to focus their attention on teaching their learners, rather than tracking down materials they do not have (Singh, 2012:598).

Classrooms remain one of the most vital components of school infrastructure. According to Barasa (2007) and Cohen (2007), classrooms are the foundational spaces for learning, designed to offer a secure, distraction-free environment conducive to student engagement. Most classrooms are equipped with large writing surfaces to facilitate idea sharing between teachers and learners. The Ministry of Education, Science and Technology (MOEST, 2005) stresses the importance of ensuring that educational facilities are not only sufficient but also suitable for curriculum implementation. Orodho (2014) found that the availability of spacious and well-ventilated classrooms was positively correlated with higher learner concentration and reduced absenteeism in Kenyan public schools. Similarly, Lyons (2012) emphasized that lighting, classroom layout, and air quality influence not only learners' ability to concentrate but also the quality of teaching. Earthman (2002) linked overcrowded and deteriorated classrooms to poor academic outcomes and low teacher morale, while Uline and Tschannen-Moran (2008) found that learners in substandard physical environments felt less safe and less engaged. Sitienei (2020) echoed these concerns, noting that overcrowded classrooms undermine the effectiveness of the Competency-Based Curriculum (CBC) by making individual attention difficult and increasing learner fatigue. Despite these consistent findings, a notable gap exists in the literature concerning the long-term academic effects of improved classroom design and aesthetics. Additionally, most studies fail to consider inclusive classroom environments that accommodate children with special needs, especially in rural schools where infrastructural planning is often minimal.

The government is expected to provide instructional resources beyond books. But most public primary schools have inadequate instructional materials; the books provided by the Government are of poor quality in content and material (UNESCO, 2018). The one textbook per learning area/ subject is based on the cheapest rather than the best in content quality. Other area of concern is oversupply and undersupply of textbooks, while some learning areas lack books completely (Kinuthia, 2018). Regarding infrastructure in educational institutions in the country, stakeholders in education indicated that learners were congested in classrooms with inadequate ICT infrastructure for effective digital learning (KNBS, 2022). The inadequate infrastructure was partly attributed to financial limitations. The stakeholders noted that there were too many learning topics for the students to fully cover with the time and resources at their disposal. In other learning areas, such as the creative arts, a variety of courses were combined and taught by several teachers as separate subjects. There aren't enough trained teachers for several subject areas, like foreign languages and the creative arts (KNQA, 2021).

Sanitation infrastructure also plays a critical role in determining educational participation, particularly among girls. According to UNICEF (2016), the presence of clean, gender-segregated toilets improves school attendance and reduces dropout rates among adolescent girls. Freeman et al. (2012) showed that schools with basic water, sanitation, and hygiene (WASH) programs experienced a 50% reduction in absenteeism. Sitienei (2020) observed that poor sanitation facilities were a major barrier to the implementation of CBC, increasing health risks and reducing instructional time. Jasper, Le, and Bartram (2012) revealed that many school sanitation facilities, while technically present, are non-functional or unsafe, especially for female students. Yet, most research on this issue has focused only on access rather than functionality, maintenance, or hygiene standards. Moreover, gender-specific challenges such as menstrual hygiene management and student self-esteem are often underexplored or generalized, reducing the effectiveness of policy responses.

Electricity access is another critical infrastructural component in modern education, especially with the increasing reliance on digital learning tools. Khandker, Barnes, and Samad (2013) demonstrated that rural electrification in Bangladesh led to improved academic achievement by extending study hours and enhancing classroom experiences. In Kenya, Nyongesa, Makhanu, and Wekesa (2023) found that consistent electricity availability enhanced literature instruction through ICT integration, accounting for over 80% of the variance in learning outcomes among participating schools. However, Mutisya and Makokha (2016) pointed out that many schools in Kenya, though technically connected to the national grid, experience frequent outages that compromise the continuity of digital learning. While most studies document the benefits of electricity access, few differentiate between availability and reliability, nor do they explore alternative sustainable energy sources such as solar power. Additionally, the effects of lighting quality on learners with visual impairments remain largely overlooked, creating a gap in inclusive infrastructure design.

In terms of power connectivity, the Digital Literacy Programme (DLP) has connected roughly 10% of public primary schools to solar energy and over 80% of public primary schools to the national grid (KNUT, 2019). Other issues persist despite the government's efforts to improve the insufficient energy and technological infrastructure. Both students and teachers still have a poor level of digital literacy. The country still has inadequate internet coverage in places like Wajir, Mandera, Turkana, and Marsabit. Access to digital content is also constrained by the price of digital devices (Machagua, 2022).

ICT infrastructure including internet connectivity, digital devices, and software platforms has become indispensable in contemporary education. Mwangi (2024) emphasized the transformative potential of digital tools in fostering personalized learning and increasing learner motivation. EdTech Hub and EIDU (2023) demonstrated through a randomized controlled trial that structured digital learning platforms significantly improved literacy and numeracy skills in pre-primary learners. Trucano (2015) found that the impact of digital interventions is significantly enhanced when combined with teacher training and curriculum integration. Nonetheless, Warschauer (2004) warned that access to computers alone does not improve learning outcomes unless coupled with effective pedagogical use. Hennessy, Harrison, and Wamakote (2010) revealed that many teachers in sub-Saharan Africa lacked the digital literacy required to leverage these tools in instruction. While the literature broadly supports the value of ICT infrastructure, it often neglects to explore how these technologies are implemented pedagogically or whether they are sustainable in low-resource contexts. Additionally, little has been done to analyse how marginalized learners—including those in rural and multilingual settings—engage with digital resources.

The use of technology by students fosters the growth of fundamental skills, particularly digital literacy (KNUT, 2019). The lack of management and learning resources, as well as the inadequate ICT infrastructure, continued to be problems. The stakeholders criticized teacher training colleges for having idle ICT capability while the nearby basic education institutions lacked such resources (Munavu Report, 2023). Many teacher educators lack the digital tools necessary to incorporate technology into the teaching and learning process. In a similar vein, access to the Internet is not always available for teacher educators and teacher candidates, and when it is, the bandwidth is only 1 GB or less. In conclusion, poor internet access hinders the efficient use of ICT in education; even in places with connectivity, institutions frequently underutilize technology for managing and delivering curricula (Machagua, 2022).

Libraries, as repositories of knowledge, continue to be instrumental in promoting reading culture and academic excellence. Barasa (2007) defined a library as a collection of resources and materials housed within a structured system aimed at supporting learning. Momoh (2010) found a strong correlation between library access and student achievement in the West African School Certificate Examinations. Krashen (2004) advocated for wide access to reading materials, asserting that it improves fluency and comprehension, particularly when reading is voluntary. Ogunkola and Archer-Bradshaw (2013) added that libraries foster inquiry-based learning and enhance scientific reasoning. However, in many under-resourced schools, libraries are either understocked, repurposed for storage, or entirely inaccessible to students. Moreover, the literature seldom distinguishes between library availability and its actual use. There is also

limited investigation into digital libraries and their role in bridging resource gaps in rural areas. Furthermore, access for learners with disabilities or those in multilingual learning environments is rarely addressed, highlighting the need for inclusive library models.

Science laboratories are essential for facilitating experiential learning in STEM subjects. Orodho (2014) and Njuguna and Wamukuru (2018) reported that well-equipped science labs contributed significantly to better comprehension and performance in science-related subjects. Jepkorir, Kisaka, and Ongeti (2024) highlighted that practical exposure helped students build inference and observation skills. Yet, many schools lack adequately equipped labs, or they exist only in name. Even when present, these labs may not be used regularly due to a lack of consumables or trained personnel. Current research has not fully explored how frequently labs are used, whether they comply with safety regulations, or how gender dynamics influence access. Similarly, little is known about how science labs impact learners' interest in pursuing careers in STEM fields, especially among girls in mixed-gender schools.

School safety and structural integrity are critical for student attendance and psychological well-being. Earthman (2004) noted that fear of injury or building collapse contributes to learner stress and distraction, directly reducing engagement. Jidamva (2012) found that unsafe environments in Tanzanian schools significantly hindered curriculum implementation and student retention. UNESCO (2016) emphasized the importance of structural safety, particularly for learners with mobility impairments. However, many studies limit themselves to auditing building standards, with minimal focus on the emotional or psychological effects of unsafe environments on learners. There is also insufficient examination of maintenance culture and disaster preparedness measures within schools, leaving gaps in understanding how schools can ensure safety and learning continuity in emergencies.

In summary, the role of infrastructural resources in shaping educational outcomes is unequivocally supported by both classical and contemporary scholarship. From classrooms to sanitation, electricity, ICT, libraries, laboratories, and school safety, these elements collectively influence academic achievement, learner engagement, and educational equity. However, while existing literature provides valuable insights into the importance of infrastructure, significant gaps remain. These include a lack of longitudinal studies, insufficient attention to marginalized populations, limited analysis of cost-effective infrastructure models, and a poor understanding of how physical environments interact with curriculum and teaching methods. Addressing these gaps is crucial for developing inclusive, adaptive, and high-impact educational systems, especially as global education continues to evolve in response to technological advancements and policy reforms.

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## **2. Material and Methods**

### **2.1. Target Population**

The target population is defined as all the members of the real or hypothetical set of people, events or objects which the researcher wishes to generalize the research study (Tukunaga, 2018). Target population was 10023 teachers and 909 school head-teachers from 909 public primary schools implementing CBE.

### **2.2. Sampling Procedure and Sample Size**

According to (Rukayya, 2016) an optimum sample is one that will fulfill the requirements of efficiency, representativeness, reliability and flexibility. Nassiuma (2000) asserts that in most surveys or experiments, a coefficient of variation in the range of 21% to 30% and a standard error in the range 2% to 5% is usually acceptable. Therefore, the study opted for a sample between 10% - 30% of the population, which yielded to 90 head-teachers from 9001 public primary schools. Using the Krejcie and Morgan table, the sample of 370 teachers were considered. The distribution of respondents is presented in Table 1.

**Table 1** Sample Size of the Study

S/N	Respondent Category	Target Population	Sample	Sample proportion	Sampling Technique
	Head-teachers	901	90	10%	Simple random
	Teachers	10023	370	3.6%	Krejcie and Morgan
	Total	10924	460		

Source: Makueni County TSC Director's Office (2025)

### 3. Results and Discussion

#### 3.1. Infrastructural Resources and learning outcomes

The objective of this study sought to determine the influence of infrastructural resources on learning outcomes in primary schools in Makueni County, Kenya. To establish the extent of the influence of infrastructural resources, respondents were asked to rate on a five-point likert scale based on statements related to infrastructural resources. These were analyzed using percentages, mean and standard deviation and presented as summarized in Table 2.

**Table 2** Descriptive Statistics Results on infrastructural resources

Statement	SA	A	U	D	SD	Mean	Std.
Classrooms with facilities are adequate	102	131	19	58	4	1.457	.965
	32.5%	41.7%	6.1%	18.5%	1.3%		
Home science room with facilities is adequate	9	67	26	124	86	3.653	.881
	2.9%	21.3%	8.3%	39.5%	27.4%		
Science laboratories are adequate	26	66	11	138	73	3.529	1.213
	8.3%	21.0%	3.5%	43.9%	23.2%		
Computer laboratory is adequate	0	5	3	167	139	4.401	.684
	0.0%	1.6%	1.0%	53.2%	44.3%		
Playing fields are adequate	84	104	38	61	27	2.500	.779
	26.8%	33.1%	12.1%	19.4%	8.6%		

Key : SA-Strongly Agree A- Agree U- Undecided D-Disagree SD- Strongly Disagree

Table 2 shows that 74.2 % of the teachers who responded in this study disagreed that there are classrooms with facilities, are adequate, 80.0% of the teachers agreed. 102 (32.5 %) teachers strongly agreed while 131 (41.7 %) teachers agreed (Mean =1.457, std. =0.965) whereas 62 (19.8 %) teachers strongly disagreed or disagreed. The results indicate that classrooms with facilities, are not enough in the schools.

On the second question in this section whether home science room with facilities is adequate, 66.9 % of the teachers strongly disagreed or disagreed (Mean =3.653, std. =0.881) as compared to 24.2 % of the teachers who agreed. The results suggest that home science room with facilities are not adequate.

On whether, the Science laboratories were adequate, 67.1% of the teachers disagreed 73 (23.2 %) teachers strongly disagreed while 138 (43.9 %) teachers disagreed (Mean =3.529, std. =1.213) whereas 92 (29.3 %) teachers strongly agreed or agreed. The results indicate that Science laboratories are likely not adequate in the schools.

The study further showed that 97.5 % of the teachers disagreed that Computer laboratory is adequate. 139 (44.3 %) teachers strongly disagreed while 167 (53.2 %) teachers disagreed (Mean =4.401, std. =0.684) whereas 1.6 % of the teachers agreed. The results indicate that almost all schools were likely not to have a Computer laboratory.

Over half (59.9%) of the teachers agreed that playing fields are adequate, 84 (26.8 %) teachers strongly agreed while 104 (33.1 %) teachers agreed (Mean =2.500, std. =0.779) whereas 28.0 % of the teachers disagreed. The results indicate that most schools are likely to have adequate playing fields.

### 3.2. Descriptive Statistics on Infrastructural resources

Further analysis was done by summing up the mean indices and standard deviations on the responses of the teachers on Infrastructural resources to compute a summated mean index as a measure of the extent of Infrastructural resources. The resultant descriptive statistics were summarized in Table 3 below.

**Table 3** Descriptive Statistics on Infrastructural resources

Infrastructural resources (N = 314)	Mean Statistic	Std. Deviation (SD)	Description
Classrooms with facilities are adequate	1.457	.965	Agree
Home science room with facilities is adequate	3.653	.881	Disagree
Science laboratories are adequate	3.529	1.213	Disagree
Computer laboratory is adequate	4.401	.684	Disagree
Playing fields are adequate	2.500	.779	Agree
Composite values	3.108	0.904	

Table 3 shows that the first variable "*Classrooms with facilities are adequate*" had a mean index of 1.457 with responses deviating from this mean by a standard margin of 0.965. With the mean being below 3.00, it could be inferred that the teachers agreed that classrooms with facilities were adequate.

The second variable "*Home science room with facilities is adequate*" had a mean index of 3.653 with responses deviating from this mean by a standard margin of 0.881. The mean is above the average (3.00) hence it could be inferred that the home science room are not adequate.

The third variable "*Science laboratories are adequate*" had a mean index of 3.529 with responses deviating from this mean by a standard margin of 1.213. The mean is above the average (3.00) hence it could be inferred that the teachers disagreed that Science laboratories were not adequate.

The fourth variable "*Computer laboratory is adequate*" had a mean index of 4.401 with responses deviating from this mean by a standard margin of .684. The mean is above the average (3.00) hence it could be inferred that the teachers disagreed that Computer laboratory were adequate.

The last variable "*Playing fields are adequate*" had a mean index of 2.500 with responses deviating from this mean by a standard margin of 0.779. The mean is below the average (3.00) hence it could be inferred that the playing fields are adequate.

### 3.3. Correlation between Infrastructural resources and learning outcomes

The study further sought to establish the influence of infrastructural resources on learning outcomes in primary schools in Makuani County, Kenya. In this section, correlation analysis for each independent variable. The aim of the analysis was to identify those variables that simultaneously associated with the dependent variable and hence estimate the separate and distinct influence of each variable on the dependent variable. This was followed by the chi-square analysis for all the independent variables.

The chi-square weights for each variable allow the study to compare the relative importance of each independent variable. In this study the observed and expected frequencies were used to determine the chi-square values which were used in the discussions of the study findings. The study findings are as presented in Table 4.

**Table 4** Correlation between infrastructural resources and learning outcomes

Infrastructural resources	Pearson chi-square	df	Asymp. Sig. (2-sided)
Classrooms with facilities are adequate	38.000 <sup>a</sup>	4	.007
Home science room with facilities is adequate	63.000 <sup>a</sup>	4	.023
Science laboratories are adequate	124.000 <sup>a</sup>	4	.038
Computer laboratory is adequate	216.000 <sup>a</sup>	4	.000
Playing fields are adequate	2.000 <sup>a</sup>	4	.352

Source: Field Data 2025

As shown in table 4, when a  $\chi^2$  statistic was conducted to establish correlation between Classrooms with facilities and learning outcomes in primary schools in Makueni county, Kenya, drew a chi-square value equal to  $\chi^2 = 38.000$  likelihood of association. Therefore a unit increase in classrooms facilities would likely lead to learning outcomes.

The data also drew a chi-square value equal to  $\chi^2 = 63.000^a$  likelihood of association between Home science room with facilities and learning outcomes. Therefore it was deduced that an increase in home science room with facilities would lead to an increase in learning outcomes.

The analysed data further drew a chi-square value equal to  $\chi^2 = 124.000^a$  likelihood of association between science laboratories and learning outcomes. This could be interpreted to infer that when availing science laboratories in schools, learning outcomes improves. These results indicated that the schools had not given priority to the acquisition of science laboratories which is essential for good learning outcomes.

The study further drew a chi-square value equal to  $\chi^2 = 216.000^a$  likelihood of association between computer laboratory and learning outcomes. This indicates that most school did not have computer laboratory.

The findings also revealed a chi-square value equal to  $\chi^2 = 2.000^a$  likelihood of no association between the playing fields and learning outcomes. These results indicated that the playing fields were not essential for learning outcomes. Therefore it was more likely that a unit increase in playing fields would not affect increase learning outcomes. The variable playing fields was not used for further analysis.

### 3.4. Hypotheses testing and Analysis of the Study Model (infrastructural materials and learning outcomes)

The objective of this study sought to determine the influence of infrastructural resources on learning outcomes in primary schools in Makueni County, Kenya. To achieve this objective, the study formulated and tested the following hypothesis. The null hypothesis of the study stated that:

*H0: There is no statistically significant influence of infrastructural resources on learning outcomes in primary schools in Makueni County, Kenya*

The study further sought the regression between infrastructural resources and learning outcomes. In this section, regression analysis for each independent variable and the depended variable was conducted. The aim of this analysis is to identify those variables simultaneously associated with a dependent variable and to estimate the separate and distinct influence of each variable on the dependent variable. This was then followed by the multiple regression analysis for all the independent variables and the dependent variable.

The coefficient correlation can range from 0.000 to 1.000, with 1.000 showing a perfect fit that indicates that each point is on the line. The analysis of variance is used to determine whether the regression model is a good fit for the data. The coefficients or beta weights for each variable allows the study to compare the relative importance of each independent variable. In this study the unstandardized coefficients and standardized coefficients are given for the multiple regression equations. However discussions are based on the standardized coefficients. The study findings are as presented in Table 5.

**Table 5** Regression between infrastructural resources and learning outcomes

Model	Unstandardized Coefficient		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.012	.032		23.356	.000
Classrooms with facilities are adequate	.685	.532	.268	3.652	.000
Home science room with facilities is adequate	-.965	-.423	-.032	4.235	.016
Science laboratories are adequate	.425	.625	.112	5.321	.003
Computer laboratory is adequate	1.234	.632	.352	2.356	.000
F: =24.325    R <sup>2</sup> = .389					
a. learning outcomes					

Source: Field Data 2025

As shown in table 5, the constant was 2.012. The study analysis further deduced a beta coefficient ( $\beta_2$ ) of 0.268 for CBE Classrooms with facilities, which means that a unit increase in Classrooms with facilities would lead to an increase in learning outcomes. Availability of Classrooms with facilities also contributes directly to learner motivation because they provide a favourable environment for learning.

The analyzed data further indicated a beta coefficient ( $\beta_2$ ) of -0.032 for home science room with facilities is adequate which means that a unit increase in utilization of home science room in the schools would lead to an increase in learning outcomes by -0.032. Home science room have a relationship to learning outcomes.

The analysis also showed that use science laboratories are adequate had a beta coefficient ( $\beta_2$ ) of 0.112 , which means that a unit increase in the use science laboratories would lead to an increase in learning outcomes by 0.112 respectively.

The study analysis further showed that computer laboratory had a beta coefficient ( $\beta_2$ ) of 0.352, which means that a unit increase in use of computer laboratory would led to an increase in learning outcomes by 0.352 respectively.

The findings of the regression indicated effects of infrastructural resources explained significant proportion of variation in learning outcomes,  $R^2= 0.389$ ,  $F (1,346) =24.325$   $p< .0001$ ). Based on this evidence, the study rejected the null hypothesis

*H0: There is no statistically significant influence of infrastructural resources on learning outcomes in primary schools in Makeni County, Kenya*

These outcomes in table 5 align with those of Wanjiru and Thinguri (2021) who looked at the infrastructure development in Kiambu County's public primary schools and discovered a significant correlation between student accomplishment and classroom quality. Schools with ample desks, proper lighting, and permanent structures did better than those with temporary or crowded facilities.

In a similar vein, Kariuki et al. (2020) found that students in schools with enough play grounds, safe buildings, and good sanitation performed noticeably better academically and attended class more frequently.

Additionally, UNESCO (2020) underlined that one of the biggest obstacles to attaining high-quality education in sub-Saharan Africa is a lack of infrastructure. Students who attend hazardous, overcrowded, or poorly constructed schools are more likely to perform poorly because of decreased focus, low teacher morale, and frequent absences, according to their worldwide education monitoring report.

To complement the quantitative findings in table 5, a focus group discussions (FGDs) was conducted with head teachers throughout Makeni County provide qualitative insights into the practical effects of infrastructure on learning to supplement the quantitative findings. According to one head teacher:

*“Some schools have deteriorated classrooms with fractured flooring and leaky roofs. It is nearly impossible to learn during wet seasons. Some students choose to remain at home due to distractions”.*

According to another head teacher:

*“Teachers feel more motivated and students focus better in classrooms that are tidy, well-lit, and equipped. The way that instruction is conducted and learning occurs is directly impacted by infrastructure”.*

These accounts bolster the statistical data and highlight how physical infrastructure affects teacher morale and student involvement in the real world.

The results in table 5 are consistent with Urie Bronfenbrenner's Ecological Systems Theory in the framework of educational theory. According to this hypothesis, a child's development and learning are directly impacted by their physical surroundings, which are a component of their "microsystem" in life. One important component of the setting is the school's infrastructure. A well-organized, hygienic, and secure learning environment promotes increased concentration, engagement, and academic success. According to this viewpoint, inadequate infrastructure can be viewed as a risk factor for development that compromises learning.

The findings in table 5 have a number of important policy ramifications. First, they emphasize the necessity of making strategic investments in school infrastructure, particularly in underserved and rural areas such as portions of Makeni County. Building and renovating permanent classrooms, restrooms, and staff facilities should be a top priority for county governments working with the national Ministry of Education. Second, infrastructure audits and benchmarking should be a frequent part of education quality improvement initiatives in order to evaluate the state and sufficiency of school facilities. Per capita grants and infrastructure development programs like the National Government Constituencies Development Fund (NG-CDF) and the Constituency Development Fund (CDF) should give priority to schools that do not meet national infrastructure criteria.

To sum up, the results of this study confirm that a major determinant of learning outcomes in primary schools is infrastructure resources. Recent research' empirical data, which is based on educational and developmental theory and observable in classroom settings, confirm this result. In addition to being an issue of safety and justice, closing infrastructural gaps in schools is also a fundamental necessity for efficient instruction and learning. In order to improve academic results in Kenya and other comparable contexts, educational planners and politicians must view infrastructure investment as a key tenet.

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#### **4. Conclusion**

According to the research findings, the study concludes that infrastructural resources significantly influences the learning outcomes in primary schools in Makeni County, Kenya

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#### **Compliance with ethical standards**

##### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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