

**Effect Of School Infrastructure On Management Of Teaching-Learning At UCE Level In Government Aided
Secondary Schools In Kisoro District, Uganda.**

Tumwehitysye Yosam¹, Dr. Wabuna Muhammad (PhD)²

1, 2 Metropolitan International University

Abstract

The study examined the effect of school infrastructure on management of teaching-learning at Uganda Certificate of Education (UCE) level in government aided secondary schools in Kisoro District. A cross-sectional survey design was employed with a sample of 175 respondents comprising teachers, head teachers, and students. Data were collected using structured questionnaires and analyzed through correlation and regression analysis. Results revealed that school infrastructure significantly affected teaching-learning management ($r=0.694$, $p<0.01$). Classroom facilities ($\beta=0.412$, $p<0.01$), laboratory and library resources ($\beta=0.336$, $p<0.01$), and sanitation facilities ($\beta=0.247$, $p<0.05$) significantly predicted teaching-learning effectiveness. The study concluded that adequate school infrastructure enhanced instructional delivery, student engagement, and learning outcomes. Recommendations included increasing government budgetary allocation for infrastructure development, establishing school infrastructure maintenance funds, implementing infrastructure standards compliance monitoring, and encouraging community-school partnerships for infrastructure improvement.

Keywords: School infrastructure, teaching-learning management, classroom facilities, laboratory resources, government aided schools, Kisoro District

1.0 Background of the Study

School infrastructure constituted the physical foundation upon which effective teaching and learning processes were built, encompassing classrooms, laboratories, libraries, sanitation facilities, furniture, and other physical resources essential for educational delivery (Barrett et al., 2019). Globally, research consistently demonstrated that adequate school infrastructure significantly influenced educational quality, teacher effectiveness, student attendance, and academic achievement (Earthman, 2004; Uline & Tschannen-Moran, 2008). The physical learning environment affected not only instructional delivery but also student motivation, concentration, health, and overall learning experiences. In developed countries, minimum infrastructure standards were enforced to ensure conducive learning environments, while in many developing nations, inadequate infrastructure remained a persistent challenge undermining educational quality despite policy commitments to universal secondary education.

In Uganda, the introduction of Universal Secondary Education (USE) in 2007 led to dramatic enrollment increases in government aided secondary schools, with student numbers rising from approximately 600,000 in 2006 to over 1.4 million by 2020 (Ministry of Education and Sports, 2021). While this expansion represented progress toward education access goals, it occurred without commensurate infrastructure development, resulting in severe overcrowding, inadequate classroom space, insufficient laboratories and libraries, poor sanitation facilities, and

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

shortages of instructional materials in many schools. The Education Sector Strategic Plan (2017-2020) acknowledged infrastructure deficits as critical constraints on secondary education quality, particularly in rural and mountainous districts where construction costs were high and accessibility challenges complicated infrastructure development (Ministry of Education and Sports, 2017).

Kisoro District, located in Uganda's southwestern highlands bordering Rwanda and the Democratic Republic of Congo, exemplified these infrastructure challenges. The district's rugged terrain, limited road networks, and relative remoteness increased construction and material transportation costs, while high population density and growing demand for secondary education strained existing facilities. Government aided secondary schools in the district, which enrolled the majority of UCE-level students, faced particularly acute infrastructure challenges as they depended heavily on limited government capitation grants supplemented by modest community contributions. Teachers and school administrators frequently reported difficulties managing effective teaching-learning processes in contexts of overcrowded classrooms, absent or poorly equipped science laboratories, minimal library resources, and inadequate sanitation facilities, all of which potentially compromised instructional quality and student learning outcomes (Bakaira, 2020). Despite these widely acknowledged challenges, limited empirical research had systematically examined how school infrastructure affected teaching-learning management in Kisoro's government aided secondary schools, leaving policymakers and education planners without evidence-based insights to guide infrastructure investment priorities and improvement strategies.

2.0 Problem Statement

Government aided secondary schools in Kisoro District faced persistent infrastructure inadequacies that potentially undermined effective teaching-learning management at UCE level. Teachers struggled to deliver quality instruction in overcrowded classrooms lacking basic teaching aids, science subjects suffered from absent or poorly equipped laboratories, students had minimal access to library resources for independent study, and inadequate sanitation facilities affected school attendance particularly among female students (Muheebwa, 2019). These infrastructure deficits potentially constrained teachers' pedagogical choices, limited practical learning opportunities, reduced instructional time, and negatively affected student engagement and achievement. While school administrators and teachers attributed various instructional challenges to infrastructure inadequacies, empirical evidence quantifying the relationship between specific infrastructure dimensions and teaching-learning management effectiveness remained limited. Without such evidence, resource allocation decisions, infrastructure development planning, and school improvement interventions lacked empirical grounding, potentially resulting in inefficient investments and missed opportunities for enhancing educational quality in the district's government aided secondary schools.

3.0 Objective of the Study

To examine the effect of school infrastructure on teaching-learning management at UCE level in Kisoro District.

4.0 Methodology

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

This study employed a cross-sectional survey research design, enabling examination of relationships between school infrastructure and teaching-learning management variables at a single point in time across multiple schools (Amin, 2005). The study was conducted in Kisoro District, specifically targeting government aided secondary schools offering Uganda Certificate of Education (UCE) level instruction.

The target population comprised 18 government aided secondary schools in Kisoro District, with a total of 324 teachers, 18 head teachers, and approximately 4,800 UCE-level students (Senior 1-4). Using Krejcie and Morgan's (1970) sample size determination table, a sample of 175 respondents was selected, comprising 96 teachers, 15 head teachers, and 64 students. Multi-stage sampling was employed: first, 10 schools were purposively selected based on geographic distribution across the district and willingness to participate; second, teachers were selected through stratified random sampling ensuring representation across subject departments (sciences, humanities, languages), with proportionate allocation yielding the desired sample size from each school; third, head teachers from selected schools were included through census sampling; fourth, students were selected through systematic random sampling from class registers, with 6-7 students selected per school ensuring gender balance and representation across Senior 2-4 levels.

Data were collected using three validated questionnaires: a Teacher Questionnaire (TQ) with 32 items assessing infrastructure availability, quality, and effects on teaching practices; a Head Teacher Questionnaire (HTQ) with 28 items examining infrastructure management, resource allocation, and perceived effects on school performance; and a Student Questionnaire (SQ) with 24 items measuring infrastructure adequacy and effects on learning experiences. All instruments employed five-point Likert scales. School infrastructure was measured through four dimensions: classroom facilities (adequacy, furniture, ventilation, lighting), laboratory and library resources (availability, equipment, materials), ICT infrastructure (computers, internet, teaching aids), and sanitation facilities (toilets, water supply, hygiene). Teaching-learning management was measured through instructional delivery effectiveness, student engagement, practical learning opportunities, and learning outcomes indicators.

The instruments were validated through expert review by three education management specialists and two secondary school inspectors. Pilot testing was conducted with 20 respondents (12 teachers, 3 head teachers, 5 students) from government aided schools in neighboring Kabale District. Reliability analysis yielded Cronbach's alpha coefficients of 0.88 for school infrastructure, 0.85 for teaching-learning management (teacher version), and 0.82 for student learning experiences. Data collection occurred over eight weeks from September to November 2023. Research assistants trained in ethical research practices administered questionnaires at participating schools during non-instructional periods. All participants provided informed consent (parental consent for students below 18 years), and confidentiality was assured. The response rate was 96.6% (169 out of 175), comprising 93 teachers, 15 head teachers, and 61 students.

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

Data were entered into SPSS version 26 for analysis. Descriptive statistics including frequencies, percentages, means, and standard deviations were computed. Infrastructure adequacy was categorized as inadequate (mean scores 1.00-2.49), moderate (2.50-3.49), or adequate (3.50-5.00). Pearson correlation analysis examined relationships between infrastructure dimensions and teaching-learning management. Hierarchical multiple regression analysis determined the predictive power of infrastructure dimensions on teaching-learning effectiveness, controlling for school characteristics. Analysis of Variance (ANOVA) compared teaching-learning management across schools with different infrastructure levels. Statistical significance was set at $p < 0.05$.

5.0 Results

5.1 Demographic Characteristics of Respondents

Table 1: Demographic Characteristics of Respondents (N=169)

Characteristic	Category	Frequency	Percentage
Respondent Type	Teachers	93	55.0
	Head Teachers	15	8.9
	Students	61	36.1
Gender (Teachers & Head Teachers)	Male	67	62.0
	Female	41	38.0
Teacher Experience	Less than 3 years	18	19.4
	3-5 years	29	31.2
	6-10 years	32	34.4
	Over 10 years	14	15.1
Teacher Qualification	Diploma	42	45.2
	Bachelor's Degree	47	50.5
	Master's Degree	4	4.3
Subject Area (Teachers)	Sciences	34	36.6
	Humanities	31	33.3
	Languages	28	30.1
Student Class Level	Senior 2	18	29.5
	Senior 3	24	39.3
	Senior 4	19	31.1

Source: Primary Data, 2025

The demographic analysis revealed a diverse respondent profile ensuring multiple perspectives on infrastructure-teaching-learning relationships. Teachers constituted the majority (55.0%), providing primary data on instructional

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

delivery challenges, while head teachers (8.9%) offered administrative and management perspectives, and students (36.1%) contributed learning experience insights. Among education staff, males predominated (62.0%), reflecting broader gender patterns in secondary school teaching in rural Uganda. Teacher experience distribution showed that most had 6-10 years of service (34.4%), indicating reasonable experience levels, though a substantial proportion (19.4%) were relatively new teachers with under three years' experience, potentially reflecting recent recruitment to address teacher shortages following USE expansion.

Regarding qualifications, approximately half of teachers (50.5%) possessed bachelor's degrees while 45.2% held diplomas, meeting minimum qualification requirements though the limited proportion with postgraduate degrees (4.3%) suggested limited opportunities for advanced professional development in the district. Subject area representation was fairly balanced across sciences (36.6%), humanities (33.3%), and languages (30.1%), ensuring that infrastructure challenges specific to different instructional areas were captured, particularly science subjects requiring specialized laboratory facilities. Student respondents were distributed across Senior 2-4 levels, with Senior 3 students comprising the largest group (39.3%), providing perspectives from learners at different UCE preparation stages.

5.2 School Infrastructure Status

Table 2: Status of School Infrastructure Dimensions (N=169)

Infrastructure Dimension	Mean	Std. Dev.	Status Category
Classroom Facilities			
- Adequate number of classrooms	2.34	1.08	Inadequate
- Classroom furniture availability	2.56	0.97	Moderate
- Classroom ventilation	2.89	0.84	Moderate
- Adequate lighting	2.72	0.91	Moderate
- Teaching aids availability	2.41	1.02	Inadequate
<i>Overall Classroom Facilities</i>	2.58	0.86	<i>Moderate</i>
Laboratory & Library Resources			
- Science laboratory availability	2.18	1.15	Inadequate
- Laboratory equipment adequacy	1.94	0.98	Inadequate
- Library space availability	2.45	1.06	Inadequate
- Library book collection	2.28	1.01	Inadequate
- Reading materials adequacy	2.31	0.95	Inadequate
<i>Overall Lab & Library Resources</i>	2.23	0.92	<i>Inadequate</i>
ICT Infrastructure			
- Computer availability	1.87	1.12	Inadequate

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

- Internet connectivity	1.65	1.08	Inadequate
- Projectors/teaching technology	1.78	1.05	Inadequate
<i>Overall ICT Infrastructure</i>	<i>1.77</i>	<i>1.04</i>	<i>Inadequate</i>
Sanitation Facilities			
- Toilet adequacy	2.67	0.98	Moderate
- Water supply reliability	2.52	1.03	Moderate
- Waste disposal facilities	2.71	0.89	Moderate
<i>Overall Sanitation Facilities</i>	<i>2.63</i>	<i>0.87</i>	<i>Moderate</i>
Overall School Infrastructure	2.38	0.82	Inadequate

Source: Primary Data, 2025

The infrastructure assessment revealed significant deficits across most dimensions in government aided secondary schools in Kisoro District. Overall school infrastructure scored a mean of 2.38 (SD=0.82), categorized as inadequate, confirming widespread infrastructure challenges that potentially constrained teaching-learning management. Classroom facilities showed moderate adequacy (M=2.58, SD=0.86), though specific deficits existed in classroom numbers (M=2.34) and teaching aids (M=2.41), indicating that while basic classroom structures existed, they were insufficient for student populations and lacked essential instructional materials. The moderate ratings for furniture (M=2.56), ventilation (M=2.89), and lighting (M=2.72) suggested that existing classrooms provided minimally acceptable learning environments but required improvements for optimal instructional conditions.

Laboratory and library resources demonstrated the most severe deficits (M=2.23, SD=0.92), representing a critical constraint particularly for science instruction. Laboratory equipment adequacy scored lowest across all infrastructure items (M=1.94), indicating that even schools possessing laboratory structures often lacked functional equipment, chemicals, and apparatus necessary for practical science teaching. Science laboratory availability (M=2.18) was also inadequate, with many schools lacking dedicated laboratory spaces altogether. Library infrastructure was similarly deficient, with inadequate space (M=2.45), limited book collections (M=2.28), and insufficient reading materials (M=2.31) severely constraining students' independent learning opportunities and research skills development essential for UCE-level academic work.

ICT infrastructure showed the most critical deficits (M=1.77, SD=1.04), with internet connectivity scoring exceptionally low (M=1.65), reflecting both limited infrastructure investment and Kisoro's challenging terrain and remoteness that complicated connectivity provision. Computer availability (M=1.87) and teaching technology such as projectors (M=1.78) were similarly inadequate, effectively excluding ICT integration from teaching-learning processes despite national policy emphasis on technology-enhanced education. These deficits placed Kisoro's

government aided schools at considerable disadvantage in preparing students for increasingly digital educational and economic environments.

Sanitation facilities achieved moderate adequacy (M=2.63, SD=0.87), representing one infrastructure area approaching acceptable standards, though even these ratings indicated room for improvement. Toilet adequacy (M=2.67), water supply (M=2.52), and waste disposal (M=2.71) all scored in the moderate range, suggesting basic provisions existed but were likely inadequate for school populations, particularly considering that poor sanitation disproportionately affected female students' school attendance and learning participation.

5.3 Teaching-Learning Management Status

Table 3: Teaching-Learning Management Effectiveness (N=169)

Teaching-Learning Dimension	Mean	Std. Dev.
Instructional Delivery (Teacher Responses, n=108)		
- Ability to use varied teaching methods	2.87	0.94
- Demonstration of concepts effectively	2.74	0.98
- Provision of practical learning experiences	2.31	1.06
- Use of teaching aids in lessons	2.56	0.91
- Completion of syllabus content	3.12	0.87
<i>Overall Instructional Delivery</i>	2.72	0.83
Student Engagement (All Responses)		
- Student attendance rates	3.34	0.89
- Student participation in lessons	2.95	0.92
- Student motivation to learn	2.78	0.96
- Group work opportunities	2.54	0.88
<i>Overall Student Engagement</i>	2.90	0.82
Learning Environment Quality		
- Conducive learning atmosphere	2.68	0.94
- Safety and comfort	2.81	0.87
- Access to learning resources	2.42	0.99
<i>Overall Learning Environment</i>	2.64	0.85
Learning Outcomes (Teacher & Student Perspectives)		
- Student understanding of concepts	2.91	0.88
- Academic performance levels	2.76	0.93
- Skill development adequacy	2.58	0.97

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026



<i>Overall Learning Outcomes</i>	2.75	0.87
Overall Teaching-Learning Management	2.75	0.79

Source: Primary Data, 2025

Teaching-learning management effectiveness showed moderate levels (M=2.75, SD=0.79), indicating functional but suboptimal teaching-learning processes in government aided secondary schools. Instructional delivery scored a mean of 2.72 (SD=0.83), with teachers reporting particular challenges in providing practical learning experiences (M=2.31) due to limited laboratory equipment and teaching materials. The ability to use varied teaching methods (M=2.87) and effectively demonstrate concepts (M=2.74) were constrained by inadequate teaching aids and overcrowded classrooms that limited pedagogical flexibility. Interestingly, syllabus completion scored relatively higher (M=3.12), suggesting teachers prioritized content coverage, possibly through lecture-heavy approaches, even when infrastructure constraints prevented more effective, student-centered pedagogies.

Student engagement demonstrated moderate levels (M=2.90, SD=0.82), with attendance rates relatively strong (M=3.34) but participation (M=2.95) and motivation (M=2.78) lower, potentially reflecting inadequate infrastructure's negative effects on learning experiences. Limited opportunities for group work (M=2.54) suggested that overcrowded classrooms and insufficient furniture restricted collaborative learning approaches. Learning environment quality scored 2.64 (SD=0.85), with particularly low ratings for access to learning resources (M=2.42), directly linking infrastructure deficits to constrained learning opportunities. Learning outcomes showed moderate levels (M=2.75, SD=0.87), with student understanding (M=2.91) rated somewhat higher than academic performance (M=2.76) and skill development (M=2.58), indicating that while basic knowledge transmission occurred, higher-order learning outcomes requiring practical application, critical thinking, and problem-solving all dependent on adequate infrastructure remained insufficiently developed.

5.4 Correlation Analysis

Table 4: Correlation Between School Infrastructure and Teaching-Learning Management (N=169)

Infrastructure Dimension	Instructional Delivery	Student Engagement	Learning Environment	Learning Outcomes	Overall T-L Management
Classroom Facilities	.612**	.578**	.634**	.587**	.658**
Lab & Library Resources	.689**	.543**	.598**	.671**	.687**
ICT Infrastructure	.534**	.489**	.512**	.548**	.567**
Sanitation Facilities	.478**	.556**	.534**	.467**	.542**

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026





Overall	.673**	.612**	.647**	.634**	.694**
Infrastructure					

Note: ** Correlation is significant at the 0.01 level (2-tailed)

Source: Primary Data, 2025

The correlation analysis revealed strong positive relationships between all school infrastructure dimensions and teaching-learning management components. Overall infrastructure demonstrated a strong correlation with overall teaching-learning management ($r=.694, p<.01$), providing compelling evidence that infrastructure quality significantly affected educational processes in government aided secondary schools. This relationship was substantial enough to suggest that infrastructure improvements could yield meaningful enhancements in teaching-learning effectiveness.

Laboratory and library resources showed the strongest correlations with instructional delivery ($r=.689, p<.01$) and learning outcomes ($r=.671, p<.01$), underscoring these facilities' critical importance for effective teaching and meaningful learning, particularly at UCE level where curriculum requirements emphasized practical work, research skills, and independent study. The strong relationship with instructional delivery indicated that teachers' pedagogical effectiveness was heavily constrained by laboratory and library inadequacies—without functional laboratories, science teaching remained theoretical and demonstration-based rather than student-centered and experimental; without adequate libraries, humanities and languages instruction lacked essential reference materials for deep content engagement.

Classroom facilities demonstrated strong associations with all teaching-learning dimensions, particularly learning environment quality ($r=.634, p<.01$) and overall management effectiveness ($r=.658, p<.01$). This finding highlighted that basic infrastructure adequate classrooms, furniture, ventilation, lighting, and teaching aids formed the foundation for all other educational processes. Even excellent teachers struggled to deliver quality instruction in severely overcrowded, poorly ventilated, or inadequately furnished classrooms. ICT infrastructure, despite being the most deficient area, still showed significant moderate correlations with teaching-learning dimensions (r ranging from .489 to .567, all $p<.01$), suggesting that even limited technology integration enhanced instructional variety and student engagement where available.

Sanitation facilities demonstrated noteworthy relationships with student engagement ($r=.556, p<.01$) and learning environment ($r=.534, p<.01$), indicating that adequate toilets, water supply, and hygiene facilities affected students' willingness to attend school regularly and remain in school throughout the day, particularly important for female students whose attendance and participation were disproportionately affected by inadequate sanitation. The significant correlations across all infrastructure-teaching-learning pairings confirmed that infrastructure effects were pervasive rather than isolated, influencing multiple educational dimensions simultaneously.

5.5 Regression Analysis and Infrastructure Impact

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026



Table 5: Hierarchical Multiple Regression - Infrastructure Predicting Teaching-Learning Management (N=169)

Model	B	Std. Error	Beta	t	Sig.
(Constant)	0.745	0.287		2.596	.010
Classroom Facilities	0.378	0.082	.412	4.610	.000
Lab & Library Resources	0.289	0.076	.336	3.803	.000
ICT Infrastructure	0.147	0.068	.193	2.162	.032
Sanitation Facilities	0.224	0.081	.247	2.765	.006

Model Summary: R = .747, R² = .558, Adjusted R² = .547, F(4,164) = 51.836, p < .001

Source: Primary Data, 2025

The hierarchical multiple regression analysis demonstrated that school infrastructure dimensions collectively explained 55.8% of variance in teaching-learning management effectiveness (R²=.558, F(4,164)=51.836, p<.001), representing a substantial and highly significant relationship. This finding provided strong empirical evidence that infrastructure quality was a major determinant of teaching-learning processes in government aided secondary schools, with infrastructure factors accounting for more than half of the variation in educational effectiveness.

Classroom facilities emerged as the strongest predictor (β=.412, p<.001), confirming that adequate, well-equipped classrooms formed the essential foundation for effective instruction. Without sufficient classroom space, appropriate furniture, and basic teaching aids, even well-trained, motivated teachers struggled to implement effective pedagogies. The practical implication was that classroom infrastructure investments expansion to reduce overcrowding, furniture provision, and teaching aids procurement would yield substantial improvements in teaching-learning management.

Table 6: Comparison of Teaching-Learning Management by Infrastructure Adequacy Level

Infrastructure Level	n	Mean T-L Management Score	Std. Dev.	F	Sig.
Inadequate (1.00-2.49)	68	2.34	0.71	42.187	<.001
Moderate (2.50-3.49)	87	2.89	0.68		
Adequate (3.50-5.00)	14	3.56	0.62		

Source: Primary Data, 2025

Laboratory and library resources also strongly predicted teaching-learning effectiveness (β=.336, p<.001), underscoring these facilities' importance for UCE-level education quality. The significant predictive power indicated that schools with functional laboratories and stocked libraries enabled qualitatively different and superior teaching-learning processes compared to schools lacking these resources. Science subjects particularly suffered from laboratory deficits, as conceptual understanding in physics, chemistry, and biology required hands-on experimentation that

theoretical instruction alone could not provide. Similarly, library resources enabled independent learning, research skills development, and supplementary reading essential for deep subject mastery.

Sanitation facilities significantly predicted teaching-learning management ($\beta=.247$, $p<.01$), validating their importance beyond health considerations. Adequate sanitation affected daily school operations, student attendance patterns (particularly for female students), and overall school climate. Schools with good sanitation maintained higher attendance rates and enabled longer, uninterrupted instructional time, directly enhancing teaching-learning effectiveness. ICT infrastructure, despite severe deficits, still showed significant predictive power ($\beta=.193$, $p<.05$), suggesting that even minimal technology integration a few computers for student use or occasional projector-based instruction enhanced teaching-learning processes, making future ICT infrastructure investments potentially high-impact interventions.

Table 6's ANOVA results revealed significant differences in teaching-learning management across infrastructure adequacy levels ($F=42.187$, $p<.001$). Schools with adequate infrastructure achieved teaching-learning management scores ($M=3.56$) 52% higher than schools with inadequate infrastructure ($M=2.34$), representing dramatic differences in educational quality. Even the moderate infrastructure category showed substantial advantages ($M=2.89$) over inadequate schools, indicating that infrastructure improvements yielded progressive benefits. These findings demonstrated infrastructure's powerful effect on educational processes and outcomes, justifying prioritization of infrastructure development in education sector planning and resource allocation.

6.0 Discussion

This study's findings provided robust evidence that school infrastructure significantly affected teaching-learning management at UCE level in Kisoro District's government aided secondary schools. The strong correlation ($r=.694$) and substantial variance explained (55.8%) aligned with extensive international research demonstrating physical learning environment's critical importance for educational quality (Earthman, 2004; Barrett et al., 2019). The findings resonated particularly strongly with research from other Sub-Saharan African contexts where rapid education expansion without corresponding infrastructure investment created significant quality challenges (Aturupane et al., 2013).

The identification of classroom facilities as the strongest predictor ($\beta=.412$) of teaching-learning effectiveness supported fundamental educational infrastructure principles adequate, appropriately furnished, and well-equipped classrooms formed the necessary foundation for all pedagogical activities. In Kisoro's context, where classroom inadequacy ($M=2.34$) was prevalent, many schools operated with severe overcrowding, with teacher-student ratios exceeding 1:60 in some cases, far above the recommended 1:40 ratio. Such conditions forced teachers into predominantly lecture-based instruction, precluded differentiated teaching, limited assessment variety, and constrained student participation opportunities. The finding validated persistent calls from teachers and school administrators for classroom expansion as the most urgent infrastructure priority.

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

The strong predictive power of laboratory and library resources ($\beta=.336$) highlighted specialized facilities' importance for secondary education quality. Unlike primary education where basic classrooms suffice for most instruction, UCE-level curriculum—particularly in sciences—required practical work that only properly equipped laboratories enabled. The severe laboratory deficits identified ($M=1.94$ for equipment, $M=2.18$ for laboratory availability) meant that many schools taught science subjects purely theoretically, fundamentally compromising learning quality and failing to develop practical skills, scientific inquiry abilities, and problem-solving competencies that UCE examinations assessed. Library inadequacies similarly constrained learning across all subjects, limiting students' ability to conduct research, access diverse information sources, and develop independent learning capabilities essential for lifelong education.

The significance of sanitation facilities ($\beta=.247$) aligned with growing recognition that water, sanitation, and hygiene (WASH) infrastructure affected multiple educational dimensions beyond health (Freeman et al., 2017). The relationship between sanitation and student engagement ($r=.556$) was particularly noteworthy, supporting evidence that inadequate sanitation disproportionately affected female students, contributing to absenteeism during menstruation and school dropout. For Kisoro's mountainous context with dispersed communities and limited water sources, ensuring adequate sanitation represented significant logistical and financial challenges but was essential for gender equity and inclusive education.

The ICT infrastructure deficits ($M=1.77$) represented missed opportunities for enhanced teaching-learning in an increasingly digital world. While ICT integration requires substantial investment, the significant predictive relationship ($\beta=.193$) suggested that even modest technology provision basic computer labs, occasional internet access, or simple teaching technologies like projectors could meaningfully enhance instructional effectiveness. However, Kisoro's challenging terrain and limited connectivity infrastructure complicated ICT deployment, requiring creative solutions such as offline educational resources, solar power for computer labs, and partnerships with technology providers.

The dramatic differences in teaching-learning management between schools with adequate versus inadequate infrastructure (3.56 versus 2.34, a 52% difference) provided compelling evidence for infrastructure investment prioritization. These differences exceeded those attributable to teacher quality, curriculum factors, or student characteristics alone, underscoring infrastructure's foundational importance. The findings supported education production function theories emphasizing that multiple inputs teachers, curricula, infrastructure must be adequate for effective educational outcomes, with deficiencies in any dimension constraining overall effectiveness (Hanushek, 1979).

7.0 Conclusions

Based on the study findings, it was concluded that school infrastructure exerted significant effects on teaching-learning management at UCE level in government aided secondary schools in Kisoro District. Adequate infrastructure—

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

including sufficient classrooms, functional laboratories, stocked libraries, and appropriate sanitation facilities—enhanced instructional delivery effectiveness, student engagement, learning environment quality, and educational outcomes. Conversely, infrastructure deficits severely constrained teaching-learning processes, forcing teachers into suboptimal pedagogical approaches, limiting practical learning opportunities, reducing student motivation, and ultimately compromising educational quality. Classroom facilities, laboratory and library resources, ICT infrastructure, and sanitation facilities all contributed significantly to teaching-learning effectiveness, with infrastructure factors collectively accounting for over half of the variation in educational management quality. The study therefore concluded that addressing infrastructure inadequacies represented a critical priority for improving secondary education quality in Kisoro District, requiring substantial, sustained investment from government, development partners, and communities. Without infrastructure improvements, other education quality enhancement efforts teacher training, curriculum reform, assessment improvements would achieve limited impact due to foundational physical constraints on teaching-learning processes.

8.0 Recommendations

Ministry of Education and Sports should substantially increase budgetary allocations for secondary school infrastructure development, establishing a dedicated infrastructure fund for government aided schools with prioritization criteria addressing the most severe deficits. For Kisoro District specifically, emergency classroom construction should address overcrowding, with targets of achieving 1:40 student-teacher ratios and adequate furniture for all students within three years.

Ministry of Education and District Education Office should develop and enforce minimum infrastructure standards for government aided secondary schools, including mandatory requirements for science laboratory provision, library space and book collections, sanitation facilities (separate toilets for girls and boys), and basic ICT equipment. Schools failing to meet standards should receive targeted infrastructure support with timelines for compliance.

School Management Committees and Head Teachers should establish dedicated infrastructure maintenance and development funds supported by modest parent contributions, community fundraising, and revenue from school income-generating activities. These funds should operate transparently with clear priorities established through participatory planning involving teachers, students, and parents.

District Local Government should facilitate community-school partnerships for infrastructure development, mobilizing local resources including labor, locally available materials, and technical expertise for construction projects. District technical staff should provide oversight ensuring construction quality and cost-effectiveness while communities contribute labor and local materials, reducing costs and fostering ownership.

References

Amin, M. E. (2005). *Social science research: Conception, methodology and analysis*. Kampala: Makerere University Printery.

Received: 20.01.2026

Accepted: 25.01.2026

Published on: 30.01.2026

Aturupane, H., Glewwe, P., & Wisniewski, S. (2013). The impact of school quality, socioeconomic factors, and child health on students' academic performance: Evidence from Sri Lankan primary schools. *Education Economics*, 21(1), 2–37.

Bakaira, G. G. (2020). *Educational management and administration in Uganda*. Kampala: Makerere University Press.

Barrett, P., Treves, A., Shmis, T., Ambasz, D., & Ustinova, M. (2019). *The impact of school infrastructure on learning: A synthesis of the evidence*. Washington, DC: World Bank Group.

Earthman, G. I. (2004). Prioritization of 31 criteria for school building adequacy. *American Civil Liberties Union Foundation of Maryland*.

Freeman, M. C., Garn, J. V., Sclar, G. D., Boisson, S., Medlicott, K., Alexander, K. T., ... Clasen, T. (2017). The impact of sanitation on infectious disease and nutritional status: A systematic review and meta-analysis. *International Journal of Hygiene and Environmental Health*, 220(6), 928–949.

Hanushek, E. A. (1979). Conceptual and empirical issues in the estimation of educational production functions. *Journal of Human Resources*, 14(3), 351–388.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610.

Ministry of Education and Sports. (2017). *Education Sector Strategic Plan 2017–2020*. Kampala: Government of Uganda.

Ministry of Education and Sports. (2021). *Education and Sports Sector Annual Performance Report*. Kampala: Government of Uganda.

Muhebwa, A. (2019). Sanitation facilities and girls' school attendance in rural secondary schools in Uganda. *African Educational Research Journal*, 7(2), 72–80.

Uline, C. L., & Tschannen-Moran, M. (2008). The walls speak: The interplay of quality facilities, school climate, and student achievement. *Journal of Educational Administration*, 46(1), 55–73.