

Do virtual practices improve doctoral graduation rates? A study from public universities in Kenya

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ABSTRACT

Doctoral education plays a key role in advancing research, innovation, and academic development in Kenya. However, doctoral graduation rates remain low and uneven across public universities in Kenya due to challenges such as limited access to digital academic resources. This study therefore examined the effect of Virtual Practices on doctoral students' graduation rates in the Schools of Education in public universities in Kenya. Specifically, the study assessed the effect of Virtual Learning, determined the effect of Virtual Supervision, and established the effect of Virtual Graduate Student Support Practices on doctoral graduation rates. The study was guided by the Community of Inquiry (CoI) Theory developed by Garrison, Anderson and Archer. The study adopted a convergent parallel mixed-methods research design, integrating both quantitative and qualitative approaches. The target population comprised doctoral students, Chairs of Departments (CODs), and Registrars from selected public universities in Kenya, comprising of 4,000 respondents. A sample of 400 respondents was selected using Krejcie and Morgan' formulae. Data were collected using online questionnaires, interview guides, and document analysis of admission and graduation records. Validity was ensured through expert review and continuous consultation with supervisors, while reliability was established using the Cronbach's Alpha to measure the internal consistency. Quantitative data were analyzed using descriptive statistics, correlation analysis of variance and Hierarchical Linear Modeling (HLM), while qualitative data were analyzed thematically. The findings showed that doctoral students rated Virtual Learning, on doctoral graduation rate was 14.20%, with considerable variation across universities. Virtual Learning significantly improved access to academic resources and flexibility. Virtual learning had significant positive effects on doctoral graduation rates. The study concludes that Virtual learning significantly improve doctoral graduation rates in public universities in Kenya by strengthening academic engagement, supervision effectiveness, and institutional support systems. It recommends strengthening digital infrastructure to promote timely doctoral completion, and hence timely doctoral graduation rates in public universities in Kenya.

Key words: Doctorial Students, Graduation Rates, School of Education, Virtual Learning

I. INTRODUCTION

Doctoral studies in Kenyan universities continued to face challenges with delayed completion and low graduation rates (Musasia et al., 2025). Doctoral education required consistent academic engagement, good supervision, access to learning resources, and a supportive institutional environment. However, many doctoral students encountered obstacles such as limited supervision, financial problems, inadequate research facilities, and competing professional or family responsibilities. These factors often affected their academic progress and graduation timelines (Kizza et al., 2021).

Globally, higher education institutions were increasingly integrating digital technologies into teaching, research, and supervision. Virtual learning became a key part of higher education because it provided flexible learning options for students who were balancing academic, professional, and personal responsibilities by Kenya Education Network (KENET, 2020). It also made it easier for supervisors and doctoral students to communicate regardless of location. Earlier studies suggested that virtual practices supported student engagement, academic interaction, and continuity of research activities. However, challenges such as poor communication, limited access to technology, and learner isolation were also reported (Uduak., 2016). In this study, Virtual Practices (VP) referred to digitally mediated academic and supervisory activities used to support doctoral learning and research. These included virtual supervision meetings, use of online learning management systems, participation in virtual seminars, digital collaboration, online academic

communication, and access to electronic learning resources. The concept did not refer to Virtual Reality (VR) alone, but to a broader range of digital practices applied in doctoral education.

In the United States, universities used online platforms and digital collaboration tools to support research interaction, academic discussions, and remote supervision of doctoral students. Some studies indicated that these practices improved academic flexibility and access to learning materials (Olibie et al., 2015). In Germany, universities adopted digital research tools and virtual libraries to support research activities and interdisciplinary collaboration among postgraduate students. Similarly, in China, technology expanded access to online platforms and collaborative research systems in higher education institutions. Studies showed that such platforms improved access to research materials and academic communication among doctoral students. In South Africa, universities also adopted online supervision platforms and digital research support systems to address problems related to limited physical infrastructure and student accessibility (Ochwangi et al., 2022). In Nigeria and Uganda, public universities were gradually introducing digital academic practices to support postgraduate education, although they faced infrastructural and technological challenges. Existing studies reported that online mentorship, digital resources, and virtual collaboration platforms improved access to academic support for doctoral students. However, issues such as unstable internet connectivity and limited technical expertise still affected implementation (Kizza et al., 2021).

In Kenya, public universities also started adopting digital learning platforms, virtual supervision tools, and online academic communication systems to support postgraduate education. These practices became more common after the COVID-19 pandemic, when universities had to shift to online modes of learning. Through platforms such as Zoom, Microsoft Teams, Moodle, and institutional repositories, doctoral students were able to participate in virtual seminars, interact with supervisors, access electronic resources, and engage in collaborative learning activities (KENET, 2020). Despite the growing adoption of Virtual Practices in Kenyan universities, doctoral students still faced challenges linked to delayed completion and low graduation rates. Some students experienced difficulties with digital literacy, access to reliable internet, and limited access to technological infrastructure. In addition, the effectiveness of Virtual Practices in supporting doctoral progression and graduation was not clear. Existing studies reported mixed findings on the benefits and limitations of digital learning and supervision environments.

The Kenyan government and higher education institutions-initiated efforts to strengthen digital learning infrastructure and expand the integration of technology in universities. Programs aimed at improving ICT facilities and increasing access to digital resources were introduced to support academic engagement among postgraduate students. However, differences in access to technology, financial limitations, and varying institutional capacities continued to influence how Virtual Practices were implemented across universities. Although previous studies examined virtual learning, online supervision, and digital education in higher education, limited research specifically focused on the relationship between Virtual Practices and graduation rates of doctoral students in Schools of Education in public universities in Kenya. As a result, it was unclear whether and to what extent Virtual Practices influenced doctoral students' graduation rates within the Kenyan higher education context.

1.1 Statement of the Problem

Doctoral students in Kenya's public universities are still struggling to finish on time, and many don't graduate at all. According to reports by the Commission for University Education, a large number of postgraduate students miss the timelines set by Akparep et al. (2017). The situation is even worse in Schools of Education. Doctoral students here often deal with limited access to research materials, not enough support from their institutions, and very high student-to-supervisor ratios. On top of that, many are juggling work, family, and finances, which makes it hard to stay on track and graduate within the expected period. To try and deal with some of these issues, universities have started using what are called Virtual Practices. These include things like online supervision, virtual classes, digital tools, webinars online defences and access to online journals and libraries. These options have made it easier for doctoral students to study remotely, stay in touch with supervisors and access learning materials without always having to be on campus. However, while other studies suggest that Virtual Learning can help with communication, collaboration, and access to resources, it is still not clear how much they actually influence graduation rates. In the Kenyan context, there is very little research that has specifically looked at the link between Virtual Learning and how fast doctoral students in Schools of Education at public universities complete their studies. Its Because of this gap, this study seeks to find out whether Virtual Practices have any effect on the graduation rates of doctoral students in Schools of Education in public universities in Kenya.

1.2 Research Objective

To assess the effect of Virtual Learning on graduation rates of doctoral students of the Schools of Education in public universities in Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Community of Inquiry (CoI)

The Community of Inquiry (CoI) Theory was developed by D. Randy Garrison, Terry Anderson, and Walter Archer to explain how meaningful learning occurs in online and technology-mediated educational environments. The theory posits that effective learning and educational outcomes emerge from the interaction of three essential elements: teaching presence, cognitive presence, and social presence. Teaching presence refers to the design, facilitation, and direction of learning experiences by instructors or supervisors; cognitive presence relates to learners' ability to construct and confirm meaning through reflection and discourse; while social presence refers to the ability of participants to identify with a learning community, communicate purposefully, and develop interpersonal relationships. According to the theory, the integration of these three dimensions creates a conducive learning environment that promotes student engagement, persistence, satisfaction, and academic success (Garrison et al., 2000).

The Community of Inquiry Theory is particularly relevant to the current study, which sought to examine the effect of virtual practices on graduation rates of doctoral students in the Schools of Education in public universities in Kenya. Doctoral education increasingly relies on digital technologies to facilitate learning, supervision, communication, and student support. Consequently, the theory provides a useful lens through which the influence of virtual practices on doctoral students' academic progression and graduation rates can be understood. Since the study focused on virtual learning, virtual supervision, and virtual graduate student support practices, the theory offers a comprehensive explanation of how these virtual interactions contribute to doctoral students' successful completion of their studies.

The objective of this study sought to assess the effect of virtual learning on graduation rates of doctoral students in the Schools of Education in public universities in Kenya. This objective is closely related to the cognitive presence component of the Community of Inquiry Theory. Virtual learning provides doctoral students with access to online lectures, digital libraries, webinars, research databases, learning management systems, and other electronic resources that support knowledge acquisition and scholarly inquiry. Through engagement with these virtual learning platforms, students are able to develop critical thinking skills, deepen their understanding of research concepts, and acquire competencies necessary for doctoral-level study. The theory suggests that when cognitive presence is effectively established through meaningful engagement with learning materials and academic discussions, students are more likely to remain committed to their studies and complete their doctoral programmes successfully.

The application of the Community of Inquiry Theory to the current study is based on the premise that effective virtual practices create an environment that supports learning, supervision, and student engagement. Virtual learning strengthens cognitive presence by facilitating knowledge construction and intellectual development. Virtual supervision enhances teaching presence by providing guidance, direction, and academic support throughout the doctoral journey. Virtual graduate student support practices promote social presence by encouraging interaction, collaboration, and emotional support among students and faculty members. The interaction of these three elements creates a supportive academic environment that enhances students' motivation, persistence, research productivity, and overall academic performance. As a result, doctoral students are more likely to complete their studies within the stipulated time and contribute to improved graduation rates.

Therefore, the Community of Inquiry Theory provides a strong theoretical foundation for this study because it directly explains how virtual learning, virtual supervision, and virtual graduate student support practices influence doctoral students' academic experiences and graduation outcomes. The theory demonstrates that the successful integration of cognitive, teaching, and social presences within virtual environments can significantly enhance doctoral students' persistence, engagement, and completion rates in public universities in Kenya. Consequently, it offers a comprehensive framework for understanding the relationship between virtual practices and graduation rates among doctoral students in the Schools of Education in public universities in Kenya.

2.2 Empirical Review

2.2.1 Virtual Learning and Doctoral Students in the Schools of Education in Public Universities in Kenya.

Empirical studies on virtual learning and doctoral completion were few, and most of the existing research focused on undergraduate and master's students. At the global level, however, evidence suggested that virtual learning supported doctoral students to complete their studies on time by improving access to academic materials and providing greater flexibility. Ndayambaje (2018) in the United States found that doctoral students who regularly used learning management systems, online databases, and virtual seminars made faster progress in their research than those who relied only on physical libraries. Similarly, Wong et al. (2013) observed that in countries such as the United States, the United Kingdom, and Germany, strong e-learning systems enabled doctoral students to access resources and interact with supervisors without geographical limitations. This helped reduce delays in thesis writing. The limitation of these studies was that they were conducted in contexts with stable internet, high levels of digital literacy, and adequate funding. Such

conditions were not common in most developing countries, including Kenya, which limited how far the findings could be applied locally.

In Africa, studies indicated that virtual learning had potential but was often affected by infrastructure challenges. Olunkwa and Nwokolo (2018) in Tanzania reported that although universities had introduced learning management systems, poor internet connectivity and frequent power outages made it difficult for postgraduate students to participate consistently. This led to delays in completing academic requirements. Overall et al. (2011), in studies conducted in South Africa and Nigeria, also found that access to online journals supported doctoral students in their research work. However, high data costs and limited institutional support reduced the benefits that students could derive from virtual platforms. A key weakness in both studies was that they combined master's and doctoral students. This made it hard to establish the specific effect of virtual learning on doctoral completion. In addition, none of the studies focused specifically on Schools of Education.

In the Kenyan context, only a handful of studies addressed issues related to ICT and postgraduate completion, in a study of three public universities, found that limited internet access and low motivation in online learning environments contributed to delays among postgraduate students (Gathara, 2022). However, the study did not separate master's from doctoral students, and it did not directly measure graduation rates. Uduak (2016) examined doctoral students in rural areas and reported that poor connectivity made it difficult for them to attend virtual classes. Their focus, however, was on participation rather than on whether students completed their programs on time. Ugwu et al. (2015) noted that inconsistent e-learning platforms affected students' engagement with course content, but the study was limited to undergraduate students.

The study most relevant to the present research was by Gathara (2022) who examined factors that influenced doctoral completion rates in Schools of Education in selected public universities in Kenya. Both lecturers and students identified inadequate ICT equipment and the need for flexible online modes of study as factors that affected completion. Despite its relevance, the study did not statistically test the relationship between virtual learning and graduation rates. It also did not use advanced analytical methods such as Hierarchical Linear Modeling to control for student, departmental, and supervisor characteristics. From the reviewed literature, three gaps were evident. First, most global studies were conducted in well-resourced universities and their findings could not be generalized to the Kenyan context. Second, studies done in Africa combined master's and doctoral students and did not focus specifically on Schools of Education. Third, Kenyan studies described challenges related to ICT but did not establish empirically how virtual learning influenced doctoral graduation rates.

III. METHODOLOGY

3.1 Research Design and approach

In this study, embedded mixed research approach was used. This is a useful methodological approach in which a supportive study method, in this case qualitative study is integrated within a main method, quantitative study to enrich or clarify the findings. In addition, the study adopted a longitudinal panel design, where doctoral cohorts from 2018 to 2022 were tracked to determine graduation outcomes within a six-year completion window. This design was appropriate because doctoral graduation is a time-dependent outcome influenced by institutional and individual factors. To account for the hierarchical structure of the data on doctoral students nested within universities the study employed a two-level Hierarchical Linear Modeling (HLM) framework, where Level 1 represented doctoral student characteristics and Level 2 represented university-level characteristics. The researcher was cognizant of this fact and therefore used both qualitative and quantitative research methodologies. Qualitative Methodology helped due to the nature of the population under study. In-depth interviews were conducted, where graduate students explained their experiences on the background of their expectations. Quantitative design was employed where the information needed generated quantities. CODs were most instrumental in the mixed research design. Quantitative data included demographic data, characteristics of the population and illustration by use of frequency tables, percentages and other graphical illustrations.

3.2 Study Area

The study was conducted in public universities in Kenya in Schools of education, and among doctoral students over a period spanning six years. As of 2024, Kenya had 39 chartered public universities spread across various regions, including urban centers and rural areas. These universities operated under the supervision of the Commission for University Education (CUE) and served a diverse student population. According to the Kenya National Bureau of Statistics and data from the Ministry of Education, the number of doctoral students enrolled in public universities has steadily increased, from approximately 6,500 in 2018 to over 11,000 in 2025 (Musasia et al., 2025). The Schools of Education account for a significant proportion of this population, reflecting national demand for educational leadership, curriculum experts, and teacher educators.

Despite growing enrolment, graduation rates among doctoral students remain low. A 2022 report by the Commission for University Education indicates that only about 12–18% of enrolled PhD students graduate within the

stipulated time of 3–6 years, and the rates are even lower in some universities. Specifically, in the Schools of Education, only 10–15% of doctoral students graduate within six years, often due to factors such as governance challenges, inadequate supervision, bureaucratic delays, and insufficient research. Regional disparities in governance practices, socio-economic conditions, and institutional cultures may also contribute to varying experiences among doctoral students across Kenya's public universities. By targeting a sample across different regions, the study seeks to capture these variations and generate findings that reflect the broader national context while identifying institution-specific governance dynamics that influence doctoral students' academic progression and completion. The Sample constituted 30 public universities of which 5 were engaged at the pilot phase. Purposive sampling was used since the universities to be engaged had embraced virtual practices. The study comprised of at least one university in each of the 8 former Kenyan provinces. A census approach was adopted since the target population is fewer than 100 (25) universities. In addition, purposive sampling is used to select universities that actively engage in virtual practices, which form the focus of this study.

3.3 Target Population

According to higher education statistics on the estimated number of public universities in Kenya (2024), the Country is estimated to have 39 public universities. The report also shows that the number of enrolled doctoral students grows exponentially with time. For instance, in the 2022/2023 academic year, 504 doctoral students, including the researcher, were enrolled in public chartered universities in Kenya, according to Commission for University Education. This was part of a larger increase in postgraduate enrollment, with a 20.5% jump to 34,403 students for PhDs and Masters. Therefore, the researcher estimated all the public universities whose Schools of education embrace VP technology; and the study population was estimated to be 4000 over a period of six years for five cohorts. Given that Chairs of Departments (CODs) oversee departments rather than individual programmes, the population of CODs was categorized by departments within Schools of Education instead of specific programmes.

Table 1

Target Population

University	Doctoral Students	CODs	Registrars	Total
A	146	12	2	160
B	148	12	2	162
C	145	12	1	158
D	147	13	2	162
E	146	12	2	160
F	144	11	2	157
G	145	12	1	158
H	147	12	2	161
I	147	11	2	160
J	143	12	2	157
K	147	12	2	161
L	146	11	2	159
M	148	12	2	162
N	145	11	1	157
O	148	13	2	163
P	144	11	2	157
Q	149	12	1	162
R	147	11	2	160
S	150	12	2	164
T	146	12	1	159
U	148	11	2	161
V	145	11	2	158
W	148	12	1	161
X	147	12	2	161
Y	146	12	2	160
Total	3,662	294	441	4,000

Table 2
University Doctoral Enrolment Estimates

University	Doctoral Program				Totals
	Education administration Policy studies and planning	Curriculum Studies	Education Psychology	Specialized Areas	
A	55	46	37	26	164
B	54	45	36	27	162
C	53	44	35	26	158
D	56	46	37	25	164
E	54	44	36	26	160
F	53	44	35	25	157
G	54	45	36	25	160
H	53	45	37	25	160
I	54	44	36	26	160
J	53	43	35	26	157
K	56	45	37	25	163
L	55	44	36	26	161
M	52	44	36	25	157
N	55	45	36	26	162
O	55	45	36	26	162
P	52	44	35	27	158
Q	53	45	36	26	160
R	54	45	35	26	160
S	55	45	35	27	162
T	53	45	35	27	160
U	53	44	34	27	158
V	52	43	35	26	156
W	52	44	35	26	157
X	55	45	35	27	162
Y	53	44	36	27	160
Totals	1344	1113	892	651	4000

3.4 Sample Size and Sampling Technique

This study employed purposive sampling technique. These were applied separately to different categories of respondents to ensure comprehensive coverage of relevant information on virtual practices and doctoral graduation rates.

3.5 Purposive Sampling Technique

Purposive sampling was used to select Doctoral Students and Class Representatives. Purposive sampling involves selecting participants based on specific characteristics that are relevant to the study objectives (Kothari, 2004). Doctoral students were purposively selected based on two criteria: 1) they must be registered in Schools of Education in public universities, and 2) they must have engaged in virtual learning practices for at least one semester. A total of 300 doctoral students were selected from the target population. In addition, 60 Class Representatives of doctoral students were purposively selected. Class Representatives were included because they serve as liaison officers between students and faculty/administration. They have direct experience with how virtual practices are communicated, implemented, and how they affect doctoral students' progress toward graduation. This made them key informants for understanding student-level experiences. The combination of census for administrative staff and purposive sampling for students ensured that the study captured both institutional policy perspectives and direct student experiences regarding the effect of virtual practices on graduation rates.

According to Mugenda and Mugenda (2003) sample size must be large enough to be representative of the universe population. The researcher used a Krecjie and Morgan (1970) formula to come up with a sample size as shown below;

$$S = \frac{X^2 NP (1-P)}{d^2 (N-1) + X^2 P (1-P)}$$

Where,

S is the desired sample size

X² is the table value of chi-square for one degree of freedom at desired confidence level which is 1.96 x 1.96= 3.8416

N is the population size

P is the population proportion assumed to be 0.5 since this will provide maximum sample size and d is the degree of accuracy expressed as a proportion 0.05

$$S = \frac{3.8416 \times 4000 \times 0.5 (1 - 0.5)}{0.05^2 (4000 - 1) + 3.8416 \times 0.5 (1 - 0.5)} = 400 \text{ Respondents.}$$

According to Kothari (2004), a representative sample size is one which is at least 10% of the targeted population thus the choice of 64.10% is considered as a representative sample size of the population.

The researcher drew a sample size of 400 respondents from Purposive sampling was used to select participants based on the specific characteristics that align with the doctoral students' learning activities in the Schools of Education in public Universities in Kenya. Both homogeneous and maximum variation sampling methods were used. The researcher deliberately chose CODs, Registrars and Doctoral students, inclusive of Class Representatives in public universities with Virtual Practices incorporated in their teaching and learning engagements. Class Representatives often serve as liaison officers between students and faculty or administration. Including them helped both student concerns and how institutional responses were communicated. These had the relevant experience, knowledge, and attributes that were pertinent to the research hypotheses in this study. Purposive sampling was particularly useful in this study because the research required in-depth information from specific groups of people i.e., CODs, Registrars and Doctoral students, thus made it easier to obtain valuable insights in the laborious research. It was a powerful tool for the qualitative research and this particular exploratory study where understanding of specific perspectives being investigated was crucial.

3.7 Data Collection instruments

The instruments of data collection were: questionnaires, Document analysis guides and interview schedules. A questionnaire was used to collect data from Doctorial students on the effect of virtual learning on Doctoral student's graduation rates in public universities, Kenya. In addition, an interview to Chair of departments, registras and class representatives on graduation rates of doctoral students.

3.8 Data Analysis

This study did utilize both qualitative and quantitative research methods to ensure a comprehensive analysis of the data collected. Upon completion of data collection, the research instruments were carefully reviewed for completeness and accuracy before the data was collated for further analysis. Data analysis in this study involved both descriptive and inferential statistical techniques, guided by the study objectives and the hierarchical nature of the data. The analysis was conducted using statistical software appropriate for multilevel modelling. Descriptive statistics were first used to summarize the key characteristics of the study variables. These included measures of central tendency such as means, and measures of dispersion such as standard deviations for continuous variables. Frequencies and percentages were also used to describe categorical variables. Specifically, descriptive analysis was applied to doctoral graduation rates, Virtual Learning scores, Virtual Supervision scores, Virtual Graduate Student Support Practices, as well as selected demographic and institutional characteristics. This provided an initial understanding of the distribution and patterns of the variables across universities and cohorts.

Inferential analysis was then conducted to examine the effect of Virtual Practices on doctoral graduation rates. Given the nested structure of the data, where doctoral students are grouped within universities and observed across cohorts, the study adopted Hierarchical Linear Modeling (HLM) as the main analytical technique. This approach was appropriate because it accounts for dependency in the data and allows for the simultaneous estimation of effects at both student and institutional levels. The HLM analysis was conducted in a stepwise manner. The first step involved estimating a null model with no predictors, which was used to determine the extent of variation in doctoral graduation rates attributable to differences between universities. The second step introduced control variables, including student-level characteristics such as age, gender, marital status, and employment status, as well as institutional factors such as number of lecturers, graduate policy structure, and supervisor characteristics. This model helped to isolate the influence of background variables on graduation rates.

The third step involved the introduction of the main independent variable at the institutional level, beginning with Virtual Learning. This model examined the direct effect of Virtual Learning on doctoral graduation rates while accounting for the hierarchical structure of the data. The final step involved estimating a full model that incorporated both control variables and all Virtual Practices dimensions, namely Virtual Learning, Virtual Supervision, and Virtual Graduate Student Support Practices. This enabled the study to determine the unique and combined effect of Virtual Practices on graduation outcomes while controlling for confounding factors. In all models, doctoral graduation rates were treated as a continuous outcome variable expressed as a percentage at the university-cohort level. Model comparison was carried out using statistical fit indices, including -2 Log Likelihood, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC), where lower values indicated better model fit. The Intraclass

Correlation Coefficient (ICC) was also computed from the null model to determine the proportion of variance in graduation rates attributable to differences between universities.

3.9 Ethical Considerations

Respondents' data was kept private and confidential during the study, and their right to privacy and protection from physical and psychological harm was upheld. The respondents were given enough information about the study's goal in a clear and understandable manner, and that enabled them to decide whether or not to participate.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 Effect of Virtual Learning on Graduation Rates of Doctoral Students

This section presents the analysis of the effect of Virtual Learning on doctoral graduation rates in public universities in Kenya. Virtual Learning was conceptualized as a key institutional factor likely to influence doctoral students' access to academic resources, flexibility in research engagement, and overall academic progression. At the bivariate level, the relationship between Virtual Learning and graduation rates was examined using Pearson's correlation analysis. This provides a preliminary understanding of the direction and strength of association before multilevel modelling.

4.1.2 Bivariate Analysis: Virtual Learning and Graduation Rates

Pearson's correlation coefficient was computed to determine the relationship between Virtual Learning scores and doctoral graduation rates.

Table 3

Pearson Correlation between Virtual Learning and Graduation Rates

Variable	Graduation Rates	Virtual Learning
Graduation Rates	1.000	
Virtual Learning	0.621	1.000

Source: Field Data, 2025 Note: $p < 0.001$

The results in Table 3 indicate a statistically significant positive relationship between Virtual Learning and graduation rates ($r = 0.621$, $p < 0.001$). This implies that universities with higher Virtual Learning implementation scores tend to have better doctoral graduation rates. The moderate-to-strong correlation establishes the directional basis for HLM analysis.

4.1.3 HLM Analysis for the Effect of Virtual Learning on Graduation Rates

To determine the effect of Virtual Learning on graduation rates while accounting for the nested structure (doctoral students within universities), a two-level Hierarchical Linear Model (HLM) was estimated. Doctoral students (Level 1) were nested within universities (Level 2). The analysis followed a stepwise approach starting with the null model.

4.1.4 Null Model (Unconditional Model)

The null model was estimated to partition variance in graduation rates and justify multilevel modelling (Table 4).

Table 4

Null Model for Doctoral Graduation Rates (Random Intercept Model)

Fixed Effects	Coefficient	Std. Error	z	p-value
Intercept (γ_{00})	14.200	1.240	11.45	0.001
Random Effects	Variance Component		Std. Error	
Between Universities (σ_{u0}^2)	18.420		3.820	
Within Universities (σ^2)	61.380		4.210	

Source: Field Data, 2025 $ICC = 18.420 / (18.420 + 61.380) = 0.231$ (23.1%)

The ICC of 0.231 (23.1%) indicates that approximately 23% of the variation in doctoral graduation rates is attributable to differences between universities. This substantial clustering effect justifies the use of Hierarchical Linear Modelling over single-level regression.

4.1.5 Model 1: Control Variables (Student, Department, Supervisor Characteristics)

Model 1 introduced the control variables to account for individual and institutional background differences that could confound the relationship between Virtual Learning and graduation rates.

Table 5

Model 1 – Control Variables

Fixed Effects	Coefficient	Std. Error	z	p-value
Intercept	12.840	1.480	8.68	0.001
Gender (Female)	0.420	0.380	1.11	0.267
Age (31–40)	0.680	0.420	1.62	0.105
Employment (Full-time)	-0.820	0.410	-2.00	0.046
No. of Lecturers	0.310	0.180	1.72	0.085
Supervisor (Internal)	1.240	0.560	2.21	0.027
Random Effects	Variance			
Between Universities	15.820			
Within Universities	59.640			

Model 1 results included student, departmental and supervisor level control variables to isolate their effects on doctoral graduation rates before introducing Virtual Learning. The intercept of 12.840 represents the baseline graduation rate when all controls are held constant. For student-level factors, gender (female) had a small positive association with completion ($\beta = 0.420$) that did not reach statistical significance ($p = 0.267$), indicating no meaningful gender difference in completion among the sampled universities. Likewise, age (31–40 years) showed a positive but non-significant relationship ($\beta = 0.680$, $p = 0.105$).

Employment status was a significant predictor. Doctoral students in full-time employment were less likely to graduate within the expected period ($\beta = -0.820$, $p = 0.046$), a pattern that reflects time pressures and competing work-academic demands. At departmental level, the number of lecturers had a positive, marginally significant effect ($\beta = 0.310$, $p = 0.085$), suggesting departments with more staff may offer better support and supervision capacity.

At supervisor level, having an internal supervisor significantly improved graduation rates ($\beta = 1.240$, $p = 0.027$). Internal supervisors appear more accessible, familiar with institutional processes, and able to engage consistently. Random effects showed considerable variation across universities, with between-university variance of 15.820 and within-university variance of 59.640, confirming institutional context matters for doctoral outcomes.

4.1.6 Model 2: Virtual Learning (School-Level Predictor)

Model 2 introduced Virtual Learning as the key Level-2 predictor (Table 6).

Table 6

Model 2 – Effect of Virtual Learning on Graduation Rates

Fixed Effects	Coefficient	Std. Error	Z	p-value
Intercept	6.420	2.180	2.94	0.003
Virtual Learning	1.930	0.510	3.78	0.001
Model Fit Statistics	Value			
Log Likelihood	-1,018.42			
AIC	2,042.84			
BIC	2,061.20			

Table 6 presents the results of Model 2, which introduced Virtual Learning as the key institutional-level predictor of doctoral graduation rates. The results show that Virtual Learning has a strong, positive, and statistically significant effect on doctoral graduation rates ($\beta = 1.930$, $p < 0.001$). This means that a one-unit increase in Virtual Learning implementation is associated with an increase of approximately 1.93 percentage points in doctoral graduation rates. This finding suggests that improved access to online learning platforms, digital academic resources, and flexible learning systems significantly enhances doctoral students' likelihood of completing their studies.

The intercept value of 6.420 represents the baseline doctoral graduation rate when Virtual Learning is not included in the model. This provides a reference point for understanding how much Virtual Learning contributes to improving graduation outcomes. The model fit statistics further support the explanatory power of Virtual Learning in predicting doctoral graduation rates. The Log Likelihood value of -1,018.42, together with AIC (2,042.84) and BIC (2,061.20), indicates improved model performance compared to models without Virtual Learning.

4.1.7 Model 3: Full Model (Control Variables + Virtual Learning)

The full model included both control variables and Virtual Learning (Table 7)

Table 7

Full Model – Effect of Virtual Learning Controlling for Background Characteristics

Fixed Effects	Coefficient	Std. Error	Z	p-value
Intercept	5.860	2.240	2.62	0.009
Virtual Learning	1.640	0.480	3.42	0.001
Gender (Female)	0.380	0.360	1.06	0.290
Employment (Full-time)	-0.740	0.390	-1.90	0.057
Supervisor: Internal	1.080	0.530	2.04	0.041
Random Effects	Variance			
Between Universities	11.240			
Within Universities	58.120			
Model Fit Statistics	Value			
Log Likelihood	-1,004.16			
AIC	2,022.32			
BIC	2,048.10			

The full model confirms that Virtual Learning remains a significant predictor of doctoral graduation rates ($\beta = 1.640$, $p = 0.001$) after controlling for background characteristics. The reduction in between-university variance from 18.42 (null) to 11.24 (full model) indicates that Virtual Learning explains a significant portion of the university-level variation in graduation rates.

4.1.8 Document Analysis Findings

Document analysis of university policy documents, LMS usage reports, and academic progress records corroborated the questionnaire findings. Evidence from institutional records indicated that universities with well-documented and consistently enforced service charters demonstrated higher rates of doctoral student progression. LMS utilization logs revealed increased student engagement with course materials and recorded webinars, particularly among students in later stages of their doctoral programmes. However, the documents also revealed inconsistencies in the rollout of digital support services across different universities, with some institutions lacking clear guidelines on virtual academic assistance. These gaps in documentation and implementation were associated with slower progression rates among doctoral candidates in those institutions.

4.1.9 Interview Findings

Interview responses from doctoral students and academic staff reinforced the quantitative findings. Participants acknowledged that the availability of online platforms and LMS tools had significantly improved their ability to access learning materials and engage with coursework remotely. One COD observed :

Theme: **Virtual Learning on Graduation Rates for Doctorial Students:**

"Before virtual learning, students who were far from the university would miss out on important seminars and lectures. Now, everyone can participate from wherever they are, and this has made a real difference in how quickly students move through their programmes." COD #1;14/02/2023

However, several doctoral students expressed concern over inadequate institutional technical support.

"There are times when the system goes down or you cannot access the LMS, and there is nobody to call for help. Those disruptions cost you days, sometimes weeks, and that affects your progress." class rep #2; 14/02/2023

Participants also highlighted that management flexibility in accommodating the demands of virtual learning varied considerably across institutions. Another registra from one of the sampled universities stated

"Some institutions have embraced the change and created structures to support it. Others are still operating as if virtual learning is a temporary arrangement, and that attitude filters down to the students." Registrar #3; 14/02/2023

4.5.5 Hypothesis Testing – Objective One

Null Hypothesis (H_01): There is no statistically significant relationship between Virtual Learning and graduation rates of doctoral students in the Schools of Education in public universities in Kenya. Based on the full model results ($\beta = 1.640$, $p = 0.001$), Virtual Learning has a statistically significant positive effect on doctoral graduation rates. Therefore, H_01 is rejected.

4.2 Diagnostic Tests

Table 8 shows Variance Inflation Factor (VIF) Coefficients for the three predictor variables and gender.

Table 8

Variance Inflation Factor (VIF) Coefficients

Variable	VIF
Virtual Learning	1.38
Employment Status	1.24
Supervisor Status	1.19
Gender Status	1.11

All VIF values are below 5, confirming the absence of multicollinearity.

Table 8 presents the Variance Inflation Factor (VIF) results used to assess the presence of multicollinearity among the independent variables in the model. The findings show that all variables recorded very low VIF values, with Virtual Learning at 1.38, Employment Status at 1.24, Supervisor Status at 1.19, and Gender at 1.11. These results indicate that there is no serious correlation among the independent variables that could distort the regression estimates. Since all VIF values are well below the conventional threshold of 5, the study confirms that multicollinearity is not a problem in the data. This implies that each predictor variable independently contributes to explaining variations in doctoral graduation rates without statistical overlap or redundancy.

4.2.2 Model Fit

Table 9 presents model fit statistics for HLM Models with regard to objective one.

Table 9

Model Fit Statistics for HLM Models, Objective One

Model	Description	-2 Log Likelihood	AIC	BIC
Model 0	Null Model	2,092.18	2,096.18	2,106.40
Model 1	Control Variables	2,058.64	2,072.64	2,104.80
Model 2	Virtual Learning Only	2,036.84	2,042.84	2,061.20
Model 3	Full Model	2,008.32	2,022.32	2,048.10

From table 9 it suggests that there was also a clear improvement when Virtual Learning was added as the main predictor in Model 2. The fit statistics dropped further, with -2 Log Likelihood reducing to 2,036.84, and both AIC and BIC recording lower values as well. This suggested that Virtual Learning contributed additional explanation to doctoral graduation rates beyond what the control variables could account for on their own. The Full Model, Model 3, which combined both control variables and Virtual Learning, produced the lowest values across all fit indices: -2 Log Likelihood = 2,008.32; AIC = 2,022.32; BIC = 2,048.10. These results indicated that Model 3 fitted the data best and explained variations in doctoral graduation rates more accurately than the earlier models. The steady decline in AIC and BIC values as variables were added showed that including Virtual Learning together with the control variables strengthened the overall performance of the model. Based on this, Model 3 was considered the most suitable for interpreting how Virtual Practices related to doctoral graduation rates in public universities in Kenya.

4.3 Discussion

Hierarchical linear modelling results suggests that Virtual Learning has a positive and statistically significant influence on doctoral graduation rates in Kenyan public universities. A one-unit increase in Virtual Learning implementation raises graduation rates by about 1.64 percentage points, even after controlling for student, departmental and supervisor characteristics.

This finding is in line with Santi et al. (2020), who reported that online platforms, digital resource access and LMS integration improve engagement and accelerate research progress. By using HLM, the present study adds methodological strength by accounting for nested data. About 23% of variation in graduation rates lies at university level, a clustering effect that single-level regression would miss. The results also support the impact of digital technologies depends on institutional commitment and technical support. Interviews in this study reinforced this view, with students mentioning system downtimes and lack of technical help as reasons for delays. These institutional gaps partly explain the unexplained variance, showing Virtual Learning works within a wider institutional environment.

From Table 9 (Full Model – Effect of Virtual Learning Controlling for Background Characteristics), virtual practices significantly predict doctoral graduation rates. Engagement in Virtual Learning remained a strong positive predictor ($B = 1.640$, $SE = 0.480$, $Z = 3.42$, $p = 0.001$), after controlling for gender, employment status and supervisor

type. The implication is that structured virtual platforms for supervision, coursework and peer interaction increase the likelihood of timely completion.

This is consistent with Rooij et al. (2019), who found that technology-mediated supervision in Kenyan universities improved feedback time and continuity during and after COVID-19. Virtual tools reduce geographic and time barriers, helping supervisors and students keep regular contact. The current study confirms this, as students who used virtual learning had substantially higher completion odds. Similarly, Ndayamaje (2018) observed that “virtualized academic socialization” reduces isolation, a major cause of doctoral attrition. Students in online peer networks and digital writing groups were more likely to persist. Our findings confirm this, as the effect of Virtual Learning stayed significant even after accounting for teacher-level factors such as full-time employment and gender.

The findings partly contrast Handel and Hanushek (2024) who argued that delivery mode has limited effect once student characteristics are controlled. While gender and employment were not significant in our model, Virtual Learning remained significant, suggesting institutional arrangements linked to virtual practices have an independent effect. The result also differs from Agu and Oluwatayo (2014), who reported that delivery structure effects disappear when student-level factors are added. In contrast, we found Virtual Learning remained influential after adjusting for gender, employment and supervisor type, showing it shapes the academic environment for doctoral students. A strength of this study is the multilevel model that examined student and university effects together while respecting data nesting. The significant random effect for Between Universities, Variance = 11.240, confirms institutional context still matters. Unlike studies using single-level models, we isolated the independent contribution of Virtual Learning. Model fit indices, Log Likelihood = -1,004.16; AIC = 2,022.32; BIC = 2,048.10, confirm robustness.

The study contributes to literature in three ways. First, it offers Kenyan empirical evidence on virtual practices and doctoral completion, an area with limited attention in sub-Saharan Africa. Second, it shows Virtual Learning has contextual benefits that support completion, especially for students facing distance and workload challenges. Third, it shows not all student distinctions affect completion, as seen in the non-significant effect of gender, $p = 0.290$, and marginal effect of full-time employment, $p = 0.057$. Overall, findings support literature on benefits of virtualized supervision and learning environments for doctoral persistence. At the same time, effects of Virtual Learning hold even after accounting for student and supervisor characteristics. Universities need to formalize virtual learning guidelines, invest in ICT infrastructure, and develop asynchronous therefore modules to support employed doctoral students and improve graduation rates.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

Virtual Learning had a positive and significant effect on doctoral graduation rates in public universities in Kenya. Correlation analysis revealed a strong link between Virtual Learning and graduation rates ($r = 0.621$, $p < 0.001$), meaning universities using more Virtual Learning recorded better doctoral completion. Hierarchical Linear Modeling confirmed this pattern. Virtual Learning predicted graduation rates both before and after controlling for other factors. In the unadjusted model it was a significant predictor ($\beta = 1.930$, $p < 0.001$), and it remained significant in the full model that included student, departmental and supervisor variables ($\beta = 1.640$, $p = 0.001$). These results point to the role of digital platforms, online academic resources and flexible learning in helping doctoral students finish on time. By widening access to materials, promoting research engagement and allowing self-paced learning, Virtual Learning meaningfully contributes to higher graduation of doctoral students

5.2 Recommendations

The article calls on public universities in Kenya to have accommodating policies as per the needs of the students and the changes in the virtual learning environment. It also stresses the importance of investing in the quality and availability of ICT facilities, development of access to online academic resources and training of students and staff on how to use online platforms effectively. In addition, clear guidelines regarding virtual learning in doctoral programs should be established and institutionalized in doctoral learning programs to develop a structured and supportive learning environment in the virtual world. These are likely to increase engagement and satisfaction, and also help in the timely completion of doctorates in Kenyan public universities.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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