

Effects of Technology Innovation Learning Strategy on Performance of Students in Kenyan Public Universities

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ABSTRACT: Objective: Students' academic performance is a major concern in every university. It is the core business of universities to see that students perform according to required standards. The study's objective was to determine the effect of technology innovation learning strategy on academic performance of university students.

Design: The study adopted an explanatory research design. 4343 teaching staff from 9 public universities in Kenya were targeted. The sample size was 366 lecturers.

Findings: The correlation results showed that technology innovation positively and significantly influenced student performance ($r=0.498$, $p=0.00$). The linear regression results revealed a significant positive association between technology innovation and performance of students ($\beta_3=.358$ and $p<0.05$), indicating that technology innovation has an impact on the performance of students.

Policy Implications: This study enlightens universities to enhance technology innovation strategy to improve students' performance.

Originality: The paper comprehensively analyzes the role of technology innovation strategy in improving students' performance in Kenyan universities.

Keywords: Technology innovation, learning strategy, student performance, public universities

1.0 Introduction

Social and economic development of any country has a direct correlation to student' performance in their academics. Students' performance and academic achievement has a great significance to graduates' quality, ensuring that graduates have a higher capacity to become invaluable to the country in providing leadership and manpower for socio-economic development (Kumar, Agarwal, & Agarwal, 2021). Much focus has been extended to how performance is measured, with previous researches indicating that students' performance in academics is hampered by environmental, economic, social, personal and psychological variable (Hayat, Yaqub, Aslam, & Shabbir, 2022). Essentially, these factors strongly influence students' performance. Nonetheless, previous researches have also identified that there are variations in these variables respective to different contexts, be it difference in countries and individuals.

In Kenya's public universities, the performance of students is alarming, which is witnessed by the fact that failure rates have consistently been on the rise. Conditions in Kenya's public universities leave a lot to be desired (Odhiambo, 2018). For example, Kenyan public universities are marred by resource inadequacies, lacking research and teaching facilities, books, journals and teaching staff receive poor remunerations which have a significant effect on optimal operation and overall performance. Further, the adverse conditions experienced in Kenya's public universities are attributed to the poor quality of graduates and low standards of higher education. Despite there being government efforts aimed at ensuring that education quality and standards are satisfactory in line with the Millennium Development Goals, nonetheless Kenya is significantly challenged in terms of implementing appropriate strategies, which leads to negative outcomes for universities and students (Fountain & Fountain, 2013).

Education is contended to be a challenging field across the globe, more so taking into consideration the rapid expansion of knowledge and modern technology, necessitating the adoption of different forms of technology in the regular classroom (Bryson, Edwards, & Van Slyke, 2018), Subsequently, the global

economy's growth as well as growth of the information based society forces education systems across the globe to initiate and implement technology innovation strategies so as to achieve educational outcomes and equip students with necessary skills (Joyce, 2015). In essence, technology innovation is instrumental in providing teachers with appropriate tools with which teaching can be improved and students' skill and knowledge acquisition can lead to better academic achievement (Walker, 2013).

The last couple of decades have witnessed educational institutions making heavy investments in technology innovation, basically influencing the education sector's learning and teaching approaches (Mitchell, 2014). However, despite these improvements across the educational sector such as in institutions of higher learning, the question still remains on the scope of influence that technology innovation has not only on education returns but also on educational achievement and performance of university students. Considering that technology innovation is embedded in contextual environment, understanding the influence on students' academic performance requires its integration in learning and teaching processes to be evaluated (Mitchell, 2014). Overall, whereas standardized approaches on performance of students puts more focus on curricula and achievement, with regard to technology innovation, it is necessary for performance to be extensively defined in terms of integration of technology in the educational experience.

Efforts to integrate technology innovation have in the past decade been enhanced in various aspects of educational practice, receiving a significant amount of attention in different countries such as Norway (Mitchell, 2014). The motive for focusing on technology innovation in the educational environment is considered to be twofold (Hayat, Yaqub, Aslam, & Shabbir, 2022). Foremost, it is acknowledged that competence in technology innovation plays a significant role in the society. Secondly, it is surmised that technology innovation significantly enhances learning, competence and literacy, which are core components of educational curricula. It is therefore pertinent for technology innovation to be given a position as an appropriate strategy in the achievement of educational outcomes (Odhiambo, 2018).

Kenya's educational sector has initiated and implemented a variety of steps to ensure that technology innovation is embraced by institutions of higher learning for purposes of improving students' performance and academic achievement. The steps comprise recognizing the significance of technology in the academic environment. It is pivotal for tutors to contextually understand students' performance. Operational efficacy and strategy are equally instrumental to the achievement of optimal execution of implementation and desired performance. Formulation and implementation of a strategy is not only a continuous but systematic process for making decisions with regard to the trajectory of the organization, development of appropriate procedures and operations for achieving projected future of the organization can determine the measures of success of the organization (Simiyu, 2013). This means that strategy formulation and implementation is systematic, which allows organizations to establish and enhance their commitment to stakeholders. Statistics reveal that 66% of organizational strategies go without being implemented (Lacka, Wong, & Haddoud, 2021). The prevailing gap between strategy and performance is surmised to be the result of the associated gap between formulation and implementation of strategies. As such, achievement of students' academic performance relies significantly on the implementation of an appropriate technology innovation strategy.

1.1 Statement of the Problem

Students' underperformance or failure in academics is a global concern especially in higher learning institutions, which has impacted the international community, calling for the necessity of critically looking into it (Siddiquah & Salim, 2017). The main focus of universities is providing quality education; thus, it is pertinent that they are constantly analyzed so as to find out if there are any prevailing problems and action taken to address them (Espinoza, Gonzalez, McGinn, Castillo, & Sandoval, 2019). Students' failure and

poor performance refers to circumstances where students do not reach projected or estimated standards of achievement respective their abilities, which leads to alterations in personality and affects other aspects of their lives. Currently, the education system recognizes academic failure of students as their inability to pass examinations. Poor performance is delineated as students not meeting desired academic standards (Musau & Abere, 2015). The same scope of underperformance and failure is experienced in public universities in Kenya. Despite efforts by the Kenya government to enhance the education sector, since 2010, performance of students has been declining (Peconcillo Jr, Peteros, Mamites, Sanchez, & Suson, 2020). Research indicates that most institutions of higher learning face problems in implementing a technology innovation strategy and in extension, delivery of educational service has suffered. In Kenyan universities, prevailing challenges continue to hamper their implementation of a technology innovation strategy, which ultimately affects overall performance (Alharthy, Rashid, Pagliari, & Khan, 2017).

1.2 Objective

To establish the effect of technology innovation strategy on academic performance of students in Kenyan public universities.

1.3 Hypothesis

H₀₁ There is no significant effect of technology innovation strategy on the academic performance of students in Kenyan public universities.

II: THEORETICAL FRAMEWORK

The study was guided by implementation theory (Maskin & Sjöström, 2002). Implementation theory is an aspect of game theory, and has a close association with mechanism design, where mechanisms are added to a game, resulting to a game's equilibrium following a concept of optimality, for instance Pareto optimality. Subsequently, if the mechanism has properties that, in their states, the outcome of the equilibrium matches the optimal outcome, indicated by rule of social choice, then the presumption is that the rule of social choice is implemented by the mechanism.

Implementation theory proposes that the extent that the rule of choice can be implemented or not depends on the applied concept of game theory (Maskin & Sjöström, 2002). The theory informs the study in that learning institutions are aimed at producing all round and competent graduates. Implementing appropriate strategies is also aimed at improvement of students' performance, thus the institution has to make sacrifices to ensure that the strategies are brought to fruition either by investing time of finances to acquire the necessary resources, staff, teaching and learning materials, enhancing the learning environment and embracing latest technologies to enhance the capacity of their students and improve their performance to meet set standards.

2.1 Literature Review

Higher education institutions are said to be development and growth engines for any country because of the fact that they nurture innovativeness (Crosling, Mahendhiran, & Vaithilingam, 2014). Further, higher education institutions such as universities improve and create new products and services, are innovation centers, supply trained and expert human resource to the society and various organizations all across the country and in all sectors of industry (Al-Husseini & Ibrahim, 2014). Technological innovation refers to the process of successfully implementing creative ideas in organizations (Bigliardi, 2013). Considering that a paradigm shift is experienced globally with regard to technological innovation, higher educations are not

exempted, hence there is need for strategies to be developed and implemented so that the educational environment is improved, leading to improved performance of institutions and students (Graham, 2019).

Higher education institutions provide library services through the integration of technologies to widen students' reach, especially students who are in remote areas (Wharton, 2017). Integration of technology in provision of library services is thus convenient for students due to the fact that access to materials on the online resource is achieved by subscription for the period that the materials are needed (Wang & Wang, 2017). Further, open access resources allow students to access scholarly materials freely available to institutions and users (Ngwato, 2020). It is essential for education to be perceived as embracing technologies as a way of promoting equality, creativity and empowerment as well as producing efficacy in problem solving.

With the increased availability of technological resources such as computers both in home and school environments, researches have acknowledged the positively significant impact of technological adoption by educational institutions and academic performance of students (Jehanzeb & Bo, 2013). Subsequently, educational achievement is surmised to reflect performance on both standardized and non-standardized literacy and assessment tests. Technology is enormously important in the current world where there are varied dynamisms and information is transferrable from different points in short time frames. As such, educational institutions would benefit from embracing technology due to the fact that information exchange improves students' learning capacity and positively impacts overall performance.

Online learning platforms are integrated sets of interactive services that provide students, educators and other stakeholders in the educational sector with appropriate and necessary resources, information and tools to facilitate enhancement and support of delivery and management of educational services and products (Dobre, 2015). For example, Moodle cloud allows accessibility of applications and services at any time and from anywhere due to the fact that information can be accessed from the main servers of the service provider (Basha, Abdulreda, & Hatem, 2019). The development of technologies such as skype, webinars, google meetings and video conferencing means that "education in distance mode by broadcasting media is still most convenient and cost effective to expand and ensure education for all" (Dehtjare, Korjuhina, & Gehtmane-Hofmane, 2019)

Strategic innovation is a business development approach that focuses on the future of the business, identifies growth opportunities, accelerates decision making and creates measurable outcomes in the long term vision of the business in order to achieve sustainable competitiveness. Organizations' managers therefore need to utilize and implement information systems for growth and sustainability in the long term (Bigliardi, 2013). Additionally, managers need to acknowledge the significance of data in decision making processes, to enhance efficacy and effectiveness. In the context of the educational environment, higher education institutions need to make use of management information systems as a pivotal component of implementing educational reforms (Fernandes & Singh, 2022). Essentially, one core factor that plays a significant role in influencing the academic achievement of students is the adoption and use of technology both in the regular classroom and during examinations.

The implementation of multimedia technologies and internet to improve quality of learning by facilitating accessibility of resources and services, remote exchange and collaboration, plays a crucial role in enhancing academic performance and achievement of students (El-Khalili & El-Ghalayini, 2014). Technologies have a capacity of supporting effective learning strategies. Government initiatives by government for higher education learning and teaching were initiated in the 1990s, and were instrumental in improving higher education especially among universities in the UK as witnessed in the early 21st Century, which goes to cement the evidence that technology adoption, implementation and use by higher education institutions

inadvertently lead to improved academic performance and educational achievement by students (Wang & Wang, 2017).

Increasingly administrations in higher learning institutions are acknowledging the demands of the education sector and have opted to provide students with opportunities of learning online, which creates a rich teaching and learning environment (Chow & Croxton, 2017). Faculties in universities appreciate the advantages brought about by the adoption of technology which include supportive and convenient learning. Nonetheless, there is an inadequacy of resources that can satisfy the sector's immediate needs. At the level of university education, pivotal contributions for addressing innovation complexities are limited and scarce in most instances. Effectiveness and efficacy in use of resources is presently the trajectory that institutions of higher learning have shifted to and are looking towards with regard to integration of technology so as to enhance use of resources using technology. This direction improves learning, changing it from a teacher-centered to a learner-centered approach, which develops creativity, enhances innovativeness and facilitates construction of learners' knowledge. Technologically enhanced use of resources significantly influences the promotion of knowledge construction and creativity among students (Kisirkoi & Mse, 2016). However, feasible means and methods of promoting capability of innovation among students still falls short from expected and desirable outcomes (Ailing, Liping, Xingsen, Zhang, & Dong, 2013).

Various studies have been carried out with regard to the relationship between technological strategies and students' performance in the context of institutions of higher learning as well as on the relationship between the quality of education resulting from strategies associated with technology. While researches have been carried out in different contexts, the main focus has been on the different factors influencing technology innovation. Few have evaluated the impact of technology innovation strategy on university students' performance. Furthermore, previous researches have revealed mixed findings on the impact of technology innovation on performance of university students overall.

A study by Ellis and Loveless established that technology innovation is inseparable from high student performance and educational achievement (Elvis & Loveless, 2013). The authors conclude that the significance of technology innovation in higher education performance cannot to be ignored. Another study by Chan *et al.* arrived at similar conclusions, observing and assigning great significance of technology innovation to education outcomes in higher learning institutions, especially the role that technology innovation plays on satisfying dynamic and new demands of university students (Chan, Bernal, & Camacho, 2013). Sari and Mahmutoglu carried out a study and concluded that for change to be brought forth in teaching methodologies in institutions of higher learning, it is necessary for a paradigm shift to be initiated towards the adoption and implementation of a student centered approach (Sari & Mahmutoglu, 2013). The authors argue that new methodologies in this regard need to turn students into active elements in their process of learning instead of rendering them to be passive participants. Using technology has made students to be active and learn a lot independently. It is instrumental for efficacy and adequacy to be core aspects of the teaching process. Iniesta-Bonillo *et al.* conclude that the implementation of technology innovation strategies significantly places learners in active positions, hence enhancing educational efficiency and efficacy (Iniesta-Bonillo, Sanchez-Fernandez, & Schlesinger, 2013).

Previous researches have also considered the implementation process and institutional culture aspects of technology innovation and the impact on performance and achievement of students in institutions of higher learning. Remarkable progresses have been established by evidence showing that regulations and policies supporting technology innovation and integration in education lead to positive outcomes. Administrators of universities and faculties adopt and implement appropriate methods of harnessing technology application to improve teaching approaches, which culminates to higher student performance (Attuquayefio & Addo,

2014). However, tangibility of performance attributed to policies and fuelled by technology innovation or its impact is yet to be identified comprehensively.

Additionally, various researches have evaluated and tracked the efficacy of technology. For instance, a study by SITES (Second Information Technology in Educational Study) described the application of technology on a global scale, ascertaining how faculties and administrations have deployed technology on different educational platforms. The study approached technology innovation from teachers' perspectives and perceptions on the association between technology innovation and performance of students, leaving out the explicit impact of technology innovation on academic performance (Croteau, Venkatesh, Beaudry, & Rabah, 2015). Several studies were also analyzed by Cruz-Jesus *et al.* on the impact of technology on Europe's educational institutions. The study established that evidence is incomparable and limited in terms of technology innovation's impact on performance of students (Cruz-Jesus, Vicente, Bacao, & Oliveira, 2016).

Technology innovation and adoption improved the quality of education and learning (Solar, Sabattin, & Parada, 2013). This summation augurs with Gallego *et al.* who concluded that for educational quality to be successfully improved, countries need to implement technology regulations and policies that are not only vigorous but also effective (Gallego, Gutierrez, & Lee, 2015). A study by Babaheidari and Svensson concluded that the association between technology innovation and students' performance is unclear (Babaheidari & Svensson, 2014). Another study by Lin *et al.* also reveal that evidence is lacking on the strong association between technology innovation and educational outcomes (Lin, Huang, & Chen, 2014). Wastiau *et al.* found positive effects of technology innovation in education (Wastiau, et al., 2013) but a negative conclusion was arrived by Venkatesh *et al.* arguing that studies are mainly founded on students' socio-economic backgrounds and institutional characteristics (Venkatesh, Croteau, & Rabah, 2014). These mixed results from past studies reveal that there is a paucity of empirical evidence and that there is a shortage of theoretical studies to reliably support the significance of technology innovation on education and students' performance. At national levels, qualitative studies have been carried out to investigate the relationship between efficacy and effectiveness of technology innovation and performance of students and have also showed mixed results (Macharia & Pelser, 2014).

Existence of technology in the learning environment has significantly been effective especially with regard to improving preparation and education of teachers to ensure success in alignment of technology in learning processes. Subsequently, establishment of teacher-learning is making efforts towards preparation of tutors so as to ensure technology integration in futuristic teaching practices (Veletsianos, 2016). Technology strategies that have been adopted include technology introduction in learning units, modeling technology use among others. For example, in China, it has been established that the government has significantly been focusing on learner-tutor preparation in alignment with ICT policies for future practices of teaching and learning through provision of educational course works integrated with ICT. Incorporating technology in learning systems is a predominant objective in various countries due to the fact that performance of students is improved (Borokhovski, Bernard, Tamim, & Schmid, 2015). However, without interlink between technology and tutors, challenges prevail in attaining desired and expected targets. Understanding how incorporation is to be achieved requires tutors to be comprehensively trained on technology implementation. Tutors who receive adequate learning in technology innovation strategies have better outcomes in the educational process compared to tutors who do not receive training in technology innovation.

The integration of technology into education systems is acknowledged as a perspective of novel approaches of innovation aimed at transfiguring educational methods. Studies on projects, initiatives and impacts using technological innovation in education are pushing tutors towards acquiring necessary skills and knowledge

in application of technologies during instruction. It is inarguable that technology innovation is the foundation of the information era and as such, is considered to be a vital tool in education reforms and induction, bringing educational change and transforming students with regard to industriousness. Technology innovation critically ensures information growth in the society, responding adequately to students' needs. In this context, it is necessary for education stakeholders to enact reforms to improve educational methods, including adopting constructivist approaches so that both teachers' and students' outcomes are improved (Manca & Ranieri, 2017). Globally, many nations integrate technology innovation to teaching to ensure that academic achievement and performance is improved through emphasizing varied skills such as critical thinking, decision making, handling environmental dynamism, teamwork and communication efficacy (De Vita, Verschaffel, & Elen, 2018).

3.1 Research Design

Research design is a research project's structure (Wayne, 2013). It is a systematic or scientific process of discovering novel knowledge and is applied in interpreting facts and revising theories in the context of research problems. Further, methods of research design facilitate the collection of pertinent data respective to study variables that researchers are interested in. Research design is also a framework that provides the foundation of answers of a research problem or research questions (Hilde, 2017). The study used explanatory research design, which focuses on accounting for and explaining descriptive information. Explanatory research design is concerned with the "why" and "how" questions, which differs from descriptive research that is concerned with the "what" questions to a research problem. Explanatory research looks for causes and reasons, essentially providing refuting or supporting evidence, explanations or predictions. In addition, explanatory research is useful when researchers aim at reporting and discovering associations between a phenomenon's various aspects (Wilkerson, Iantaffi, Grey, Bockting, & Rosser, 2014).

3.2 Study Area

Kenya has a total of 31 public universities. The study was focused on 9 public universities. The universities were selected using simple random sampling. The criteria adopted by the researcher in selecting the 9 public universities followed the supposition which indicates that an adequately representative sample size that a researcher should target should be between 10% and 30% (Asenahabi, 2019).

3.3 Target Population

A target population is delineated as a specific group that the researcher considers relevant to the study (Asenahabi, 2019). It is also delineated as a group of individuals or objects with similarities in form or characteristics. In this study, the target population comprised 4,343 full time teaching staff that was drawn from the 9 public universities. Table 1 shows the sample size.

Table 1: Target Population

Target	Number
Teaching staff	4343
Total	4343

3.4 Sample Size and Sampling Techniques

The choice of determination of sample size and methods of sampling are pivotal in applied statistics due to the fact that they allow researchers to arrive at correct conclusions. In an instance where the sample size is overly small, the researcher may be hindered from yielding expected outcomes. On the other hand, in an instance when the sample size is overly large, complexity of the study is increased, resulting in inaccuracies in findings.

Sample size plays a crucial role in empirical researches especially in instances when the objective of the researcher is to make inferences on the population from the sample selected. Simple random sampling was used in this study to determine sample size distribution. The researcher randomly selected 9 public universities which were then used in data analysis. Respondents were also selected by the researcher through simple random sampling from each of the selected public universities.

In an instance where the population falls below 10,000, sample size determination should utilize the 10% to 30% representation, hence for appropriate analysis, 10% is considered (Asenahabi, 2019). The sample size of the public universities in this study was arrived at using Asenahabi 2019 formula. Further, the Yamane formula was used to determine the sample size of teaching staff due to the fact that the population size was known (Yamane, 1973).

Public Universities

31 public Universities in Kenya

$$\frac{30}{100} \times 31 = 9.3$$

Hence, 9 universities were sampled.

Teaching Staff

$$N = \frac{N}{1 + N(e)^2}$$

Where:

N= population size = 4,343

n= sample size

e= standard error; acceptable level is 0.05.

$$N = \frac{4343}{1 + 4343(0.05)^2}$$

$$N = \frac{4343}{1 + 11.86} = 366$$

Hence 366 teaching staff were sampled.

Table 2: Sample Size

Target	Sample size
Teaching staff	366
Total	366

3.5 Data Collection

The study used questionnaires as the primary data collection instrument. Questionnaires as written instruments of data collection presents respondents in a study with question statements to which they are to react by selecting predefined responses from the statements provided or by giving written answers to questions (Creswell, 2014). Researchers utilize questionnaires when the data to be collected on studied phenomena is directly observable, such as inner experience of participants, values, interests and opinions due to the fact that comparable to observation, their convenience is higher (Creswell, 2014). Questionnaires present researchers with various benefits, which comprise their capacity of administration to large groups of respondents, respondents can fill the questionnaire conveniently, items in the questionnaire do not necessarily needs to be answered following a certain order, respondents can skip questions, items in the questionnaire can be answered in several sessions not necessarily in one sitting, respondents can provide comments in the questionnaire and the cost and time spent on the use of questionnaires is relatively low compared to other methods.

3.6 Response Rate

In this study, 366 questionnaires were administered to the participants. From the questionnaires administered, 294 were duly filled and returned to the researcher. The rate of return represented 80%. Subsequently, the researcher used the returned questionnaires for results interpretation. A response rate above 60% is appropriate and thus acceptable for comprehensive analysis. Alternately, a response rate of 75% is considered to be excellent and to have an adequate representation of the population for a phenomena to be studied (Nyanjom, 2013). Therefore, the response rate of 80% was adequate in this study.

Table 3: Response Rate

	Count	Percentage
Returned	294	80
Non-returned	72	20
Total	366	100

IV RESULTS

4.1 Demographic Information

Demographic information in this study was categorized as; age, education, programme and teaching experience. With regard to respondents' ages, 168(57.1%), were over 40 years, 96(32.7%) were between 31 and 40 years and 30(10.2%) were between 20 and 30 years. The results showed that majority exceeded 40 years, hence gave adequate information on implementation of technology innovation learning strategy in public universities.

Table 1: Demographic Data

Variable	Category	Frequency	Percent	Cumulative Percent
Age	20-30 years	30	10.2	10.2
	31-40 years	96	32.7	42.9
	>40 years	168	57.1	100.0
	Total	294	100.0	
Highest level of education	Diploma	0	0	0
	Degree	36	12.2	12.2
	Masters	120	40.8	53.1
	PhD	138	46.9	100.0
	Total	294	100.0	
Programme	Diploma	0	0	0
	Degree	168	57.1	57.1
	Masters	42	14.3	71.4
	PhD	84	28.6	100.0
	Total	294	100.0	
Experience	<5 years	66	22.4	22.4
	5-10 years	114	38.8	61.2
	10-15 years	48	16.3	77.6
	15-20 years	30	10.2	87.8
	>20 years	36	12.2	100.0
	Total	294	100.0	

With regard to education, 138(46.9%) had attained PhD qualifications, 120(40.8%) had master's qualification and 36(12.2%) had bachelors' qualification. This implied that majority of the lecturers had above master's qualification and could adequately explain implementation of technology innovation learning strategy in public universities. On the programme taught, majority 168(57.1%) of the lecturers have been teaching the undergraduate students, with 84 (28.6%) teaching the PhD class and 42(14.3%) teaching masters students. This showed that most of the lecturers taught the undergraduate students. Finally, on the teaching experience 114 (38.8%) had been lecturing for between 5 and 10 years, with 48 (16.3%) for 10 to 15 years, while 66 (22.4%) for less than 5 years, (36)12.2% for more than 20 years and (30) 10.2% for between 15 and 20 years. This indicated that majority of the lecturers had been teaching in the public universities for more than 5 years.

4.2 Technology Innovation

On technology innovation variable, most of the respondents agreed that more focus on technology improvement enhances job market potential (4.08) and online learning have provided an opportunity for busy students to learn (3.92). Computer based programs aid students to adapt to changing technology (4.24), investment in technology opens a potential for student scaling (3.94) and technology aims at knowledge development and student's performance (3.92). The respondents were undecided whether video conferencing was used by distant learning students to learn (3.31). The standard deviations range between 0.94 and 1.29.

Table 2: Technology Innovation

	Mean	Std. Dev	Skewness	Kurtosis
More focus on technology improvement enhances job market potential	4.08	0.95	-1.63	3.03
Online learning has provided an opportunity for busy students to learn	3.92	1.07	-1.26	1.30
Computer based programs aid students to adapt to changing technology	4.24	0.94	-1.85	3.94
Video conferencing is used by distant learning students to learn	3.31	1.31	-0.36	-0.89
Investment in technology opens a potential for student scaling	3.94	1.29	-1.22	0.36
Technology aims at knowledge development and student's performance	3.92	1.09	-1.19	1.04

4.3 Instrument Reliability

Research instruments are considered reliable when after administration to varying groups of participants in the population sample, there is consistency in results. In this study, Cronbach's (α)alpha was adopted in assessment of internal consistency (homogeneity) among items of the research instrument. Results from Cronbach's alpha analysis reveal the variables' coefficients as technology innovation (.856). The summation from these results was that Cronbach's coefficient was > 0.7 , hence the instrument was reliable.

Table 2: Reliability Statistics

	Cronbach's Alpha	Number of Items
Technology innovation	.856	6

4.4 Instrument Validity

Validity refers to the degree that an instrument measures what it is meant to measure. Before the researcher administered the research instrument in data collection, supervisors were consulted and the items discussed. Due to the fact that the researcher personally administered the research instruments, respondents were encouraged to be expressive in their opinions, which ensured that the questions were clear. Opinions provided by respondents were adopted by the researcher in improving the instrument. Additionally, Kaiser-Meyer-Olkin measures of sampling adequacy (KMO) and Bartlett's test of sphericity were utilized in testing existence of correlation between the study's variables. The researcher used factor analysis to determine whether the items in all sections of the instrument loaded into categories as expected. The

researcher applied Varimax rotation in validation of the constructs which are distinct in implementation of technology innovation learning strategy.

4.5 Rotated Factor Matrix on Measurement Items for Technology Innovation

In terms of technology innovation, one component had eigen values >1.0 and a 60.413% total variance. The findings also show a KMO of .735 which is an indication of inter-correlation sufficiency, whereas the sphericity test was significant (Chi-square = 979.187, $p = 0.001$). The results showed that technology innovation was factorially distinct and unidimensional, hence all items were loaded on one factor. All statements were retained, computed and renamed technology for additional analysis.

Table 3: Rotated Factor Matrix on Measurement Items for Technology Innovation

Survey Items	Component
Technology Innovation	
More focus on technology improvement enhances job market potential	.794
Online learning has provided an opportunity for busy students to learn	.799
Computer based programs aid students to adapt to changing technology	.798
Video conferencing is used by distant learning students to learn	.569
Investment in technology opens a potential for student scaling	.858
Technology aims at knowledge development and student's performance	.813
KMO	.735
Chi-Square	979.18
Bartlett's Test of Sphericity (df=15)	7
Eigenvalues	.000
% of Variance (60.413)	3.625
	60.413

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

4.6 Correlation Analysis

Technology innovation positively and significantly influenced student performance ($r=0.498$, $p=0.00$). Hence, an increase in technology positively influenced student performance.

Table 4: Correlation Analysis

Performance	Pearson		1**	7**	8**	2**	6**
	Correlation						
	Sig. (2-tailed)		0	0	0	0	0
Technology	Pearson	8**	9**	7**		1**	1**
	Correlation						
	Sig. (2-tailed)	0	0	0		0	0

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

b. Listwise N=294

4.7 Hypotheses Testing

The β coefficients for implementation of integrated learning strategies were generated to test the study's hypotheses. The contribution of implementation of integrated learning strategies on the model was measured using the t-test.

H0₁: There is no effect of technology innovation on the academic performance of students in Kenyan public universities

The results revealed a significant positive association between technology innovation and performance of students ($\beta_3=.358$ and $p<0.05$). The p value was >0.05 , hence the null hypothesis (**H0₁**) was not accepted. Technology innovation significantly influenced performance of students in public universities.

Table 5: Linear Regression Results

Variable	
Technology	
Constant	2.249(.146)
Coefficients	.358(.037)*
R Square	.248
Adjusted R Square	.245
R Square Change	.248
F	96.150
Sig.	.000

*significant at 0.05

V: Discussion

The study sought to establish the effect of implementation of technology innovation learning strategy on the academic performance of students in Kenyan public universities. Majority of the respondents agreed with the majority of the aspects of technology innovation and strongly agreed with the statement that computer-based programs aided students to adapt to changing technology with the highest mean of (4.24). The standard deviations range between 0.94 and 1.29. The correlation results showed that technology innovation positively and significantly influenced student performance ($r=0.498$, $p=0.00$). Hence, an increase in technology positively influenced student performance. The linear regression results revealed a significant positive association between technology innovation and performance of students ($\beta_3=.358$ and $p<0.05$). The findings therefore indicated a significantly positive relationship between technology innovation and the academic performance of students in Kenyan public universities. This therefore rejects the null hypothesis (H_{01}) that there is no effect of technology innovation on the performance of students. It thus indicates that technology innovation has an impact on the performance of students.

5.1 Conclusion

In terms of technology innovation, computer-based programs have aided students to adapt to changing technology, online learning has given an opportunity to the busy and distance students and also it has developed student knowledge which has translated to student performance. Involving tutors in the process of implementation of technology innovation learning strategy is instrumental in enhancing learning and to guarantee that the strategy is advantageous for students in the long run. Further, it is essential for tutors to acknowledge that there is need for compatibility between teaching practices and technology innovation to be established. Technology integration in the educational context is expected to be improved in the future where teaching methodologies are concerned. Therefore education stakeholders should be prepared for the variations in the dynamic environment (Blanchard, LePrevost, Tolin, & Gutierrez, 2016). This study essentially enlightens administrators and instructors in universities to enhance initiatives with regard to technology innovation strategies in teaching and learning processes due to the fact that modern innovation not only advances the quality of teaching but also advances the quality of students' learning outcomes.

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