



# Cloud-Based E-Learning Systems Implementation for Technical and Vocational Colleges in Kenya: A Case Study of Vihiga County

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**Abstract:** Most of the educational institutions in Kenya are unable to facilitate full functional services of e-learning using conventional e-learning systems due to various reasons such as providing the necessary information and communication technology support. Rapid advancement of technology has prompted the institutions to enhance teaching and learning. Cloud computing has become an emerging and adoptable paradigm in education around the globe over the years with its promising benefits such as reliability, scalability, flexibility and reasonable cost to provide more effective e-learning systems. The study explored the e-learning systems implemented in technical and vocational colleges in Vihiga County. The study was premised on Technology-Organization-Environment framework and Unified Theory of Acceptance and Use of Technology. The study adopted descriptive research design and mixed methods approach. Purposive and stratified sampling were used when selecting the sample size of 91 respondents drawn from the target population of 951 consisting of administrators, trainers from different departments and information and communication technology trainees using published tables. Questionnaires and interview schedules were the main data collection instruments. Content validity was used besides pilot study to measure the validity of the instruments while reliability was measured through the test-retest procedure using Cronbach's alpha coefficient. Quantitative data was analyzed using descriptive and inferential statistics while qualitative data was analyzed using thematic analysis. The results of quantitative analysis were presented using frequency tables, charts and graphs. The study established that the utilization of conventional e-learning systems in technical and vocational colleges in Vihiga County was below average and there was a gap in cloud-based e-learning systems implementation. The institutions had inadequate information and communication technology infrastructure and internet connectivity, inadequate technical capacity and policies to effectively implement cloud-based e-learning. The study concluded that the existing e-learning systems were insufficient to facilitate quality and reliable e-learning delivery.

**Keywords:** E-Learning, E-Learning Systems, Conventional E-Learning Systems, Cloud-Based E-Learning Systems, Cloud Computing, Framework

## I. INTRODUCTION

Technical and Vocational Education and Training (TVET) Institutions in Kenya play a pivotal role in imparting practical skills and knowledge crucial for workforce preparedness and economic development [1]. According to [2], most educational institutions often grapple with challenges when it comes to incorporating modern technologies, especially cloud-based e-learning systems, into their training approaches. The existing e-learning platforms not only grapple with the costs associated with development, deployment, and maintenance but also encounter issues related to dynamic scalability in response to infrastructure demands and integration with other e-learning platforms. Cloud computing is an excellent alternative for academic institutions with limited funds to host and administer their online learning systems [3]

According to [4], some of the Higher Education Institutions (HEIs) in Europe, America and Asia have gradually migrated some of their systems to cloud computing with great success. This migration provided many opportunities that improved learning, teaching and management in these institutions. [5] observed that cloud computing is already being adopted in various institutions in Europe, America and Africa because of its potential to improve efficiency and guarantee affordable costs. The global impact of the cloud computing revolution on HEIs was asserted by [6]. These institutions



consider cloud computing to be an indispensable tool in their endeavours to augment their capabilities and enhance the quality of their services.

According to [1], many educational institutions in Africa have moved towards implementing e-learning in their teaching learning processes in order to reach the students who may have no time to sit in class. [1] posited that the integration of e-learning offers a transformative opportunity for TVET trainers to connect with trainees across diverse settings, leveraging available ICT resources. This shift can overcome the limitations of time, space, and location that often impede training delivery. Additionally, TVET trainees stand to benefit significantly from a more varied range of course completion options and increased flexibility in training delivery, fostering a culture of lifelong learning. According to [7], the implementation of e-learning systems necessitates a substantial upfront investment in ICT infrastructure, software applications, and the human resources required to manage them. Many institutions in Tanzania have adopted a traditional web-based e-learning approach within their premises, which, according to [7], lack scalability, flexibility, and interoperability. This traditional mode does not efficiently utilize computing resources, often resulting in underutilized resources. [8] observed that e-learning systems adoptions in public higher learning institutions in Tanzania were affected by the lack of ICT infrastructure, lack of technical and managerial support and lack of computers and e-learning knowledge among facilitators.

[9] observed that the onset of the COVID-19 pandemic has significantly transformed the educational landscape in developing countries, compelling learning institutions to transition from traditional face-to-face teaching to online teaching-learning modalities. [10] asserted that the COVID-19 pandemic has significantly impacted several nations, resulting in the compulsory implementation of online learning and the provision of support by numerous educational institutions and schools for their pupils. According to [10], an important benefit of utilizing cloud computing technologies is the provision of an interactive online platform that enables instructors to engage in technology-enhanced learning and communicate with their students. For these objectives, educational institutions and schools frequently implement cloud computing applications like Google Meet, Zoom, and Microsoft Teams.

Traditional education methods are often unsuitable for societal progress and do not align with the demands of the digital age. While e-learning offers numerous advantages such as flexibility, diversity, and measurement capabilities, its implementation faces challenges due to high initial costs, insufficient infrastructure, and the need for investment in servers, PCs, storage, networks, and skilled staff [11]. Educational institutions face the challenge of requiring substantial IT infrastructure and significant investments to support e-learning, which becomes especially difficult to acquire during times of economic downturn [12]. Funding for HEIs has sharply decreased in times of economic slowdown, resulting in financial crises for these institutions. In response to financial shortfalls, HEIs are implementing various cost-cutting measures, including substantial reductions in IT budgets. As educational institutions grapple with the challenges posed by diminishing IT budgets and rising IT demands, the notion of cloud computing has surfaced as a potentially effective remedy [13].

Numerous institutions are contemplating the adoption of cloud computing as an alternative e-learning system implementation strategy due to the difficulties encountered with traditional e-learning systems [14]. Cloud computing signifies an unprecedented paradigm in the arrangement and administration of ICT resources. It is considered a cutting-edge technology utilized for the provision and hosting of services via the internet [14]. The implementation of a cloud-based e-learning framework can substantially mitigate the financial burden associated with implementing an innovative educational methodology. Cloud-based e-learning continues to be distinguished by its cost-effectiveness and partnership



benefits, given that educational institutions are solely accountable for the delivery of knowledge, content administration, and the learning process. In the interim, the vendor assumes responsibility for the development, construction, maintenance, and administration of the educational system. The cloud-based environment facilitates the development of e-learning systems of the highest caliber and is compatible with a wide range of hardware devices [3]

According to [15], it is now imperative that developing countries make use of cloud computing capabilities. When it comes to the development of their IT infrastructure, budgetary constraints present formidable obstacles for a number of low-income nations with limited resources, most notably in regards to internet-delivered educational technologies. The implementation of cloud computing in educational systems has the potential to mitigate the financial strain on institutions of higher education due to the comparatively modest cost of cloud computing services. [8] argued that inadequate ICT and e-learning infrastructure, lack of technical skills in e-learning and e-content development by teaching staff, financial constraints, lack of affordable and adequate internet bandwidth, lack of operational e-learning policies, and lack of interest and commitment were some of the major challenges affecting e-learning implementation of in Kenya.

Kenya boasts of a total of 1,423 public TVET institutions, categorized into 1,156 Vocational Training Centres (VTCs), 255 Technical and Vocational Colleges (TVCs), 11 National Polytechnics (NPs), and 1 Technical Trainers College (currently known as Kenya School of TVET) [16]. According to [16], a noteworthy development is the adoption of Open and Distance e-Learning (ODEL) platforms for curriculum delivery by some of these TVET institutions. [16] averred that the emergence of the COVID-19 pandemic, with its associated social distancing measures and lockdowns, accelerated the implementation of the Open Distance and e-Learning (ODEL) model. This shift was particularly evident as training institutions transitioned from traditional face-to-face methods to online training. Recognizing the importance of expanding access to TVET, initiatives have been undertaken to formulate an ODeL Policy for TVET along with corresponding standards. Additionally, certain TVET institutions have taken the initiative to establish ODeL platforms, aiming to enrich the delivery of flexible and blended TVET programs. According to [17], e-learning has reshaped traditional education into more flexible and efficient learning in developed countries but remains underutilized and in the rudimentary stages of development in developing countries like Kenya.

According to [18], the utilization of cloud computing has enabled academic institutions in Kenya to provide relatively inexpensive access to critical infrastructure (including storage, networks, and computer servers), platforms (including learning management applications), and software (including operating systems). As a result, cloud computing services have grown in appeal among academic institutions and have gained considerable popularity for their ability to support online services across a wide range of academic applications. This has facilitated the implementation of sophisticated online systems and services by institutions, thereby encouraging innovation and the testing of new systems.

## II. OBJECTIVE OF THE STUDY

The study explored the e-learning systems implemented in TVCs in Vihiga County with the view of leveraging on cloud computing platforms.

## III. REVIEW OF CLOUD-BASED E-LEARNING SYSTEMS

According to [19], educational institutions are currently implementing cloud-based e-learning systems to provide reliable and scalable services. Cloud computing has the capacity to significantly enhance the teaching-learning process by establishing a connection between cloud infrastructure and e-learning platforms. The primary advantages of cloud computing that contribute to its suitability for e-learning systems include cost reduction in IT investment, high



availability, accessibility, scalability, and efficient backup and recovery processes. According to [20], the future of e-learning technology and associated infrastructure lies in cloud-based systems. A cloud-based e-learning system is considered a subset of cloud computing specifically designed for educational purposes. Additionally, it encompasses all necessary provisions, including hardware and software resources, to enhance the conventional e-learning infrastructure. [21] asserted that HEIs are increasingly embracing e-learning. However, the transition has been more challenging for developing countries, many of which face issues related to inadequate infrastructure and limited financial resources allocated to higher education.

[15] stated that cloud computing technology has been customized to provide improved services that are now widely accessible and sufficiently stable for both business and academic purposes. It offers faster on-demand infrastructure and readily processed data. Universities and educational institutions face the ongoing challenge of upgrading their information technology infrastructure to remain competitive and address evolving educational needs and challenges. This task can be financially demanding, especially for educational institutions in developing countries.

[22] suggested that emerging technology trends are simplifying access to high-end ICT facilities for students and trainers. Cloud computing services, including servers, application software, and system development platforms, are available online in scalable plans. Users can rent these services and are charged based on actual consumption at very reasonable rates. Additionally, internet-enabled devices have become more affordable for students. These advancements have created opportunities to explore how cloud computing can enhance the learning experience and provide better, widely accessible e-learning solutions.

[23] highlighted that technological aspects especially compatibility and complexity are important in determining how cloud computing technology is adopted by businesses. For numerous organizations, the integration of diverse cloud services with pre-existing infrastructure presents a substantial obstacle. [24] argued that some of the major concerns of cloud computing in education include security and privacy of data, compatibility, complexity and ease of use. [25] identified various technological factors that can influence cloud computing adoption such as relative advantage, cost reduction, ease of use, compatibility, operational requirement, security, sustainability, trialability and complexity. [26] also identified security and privacy as primary factors for cloud computing. They argued that protection of data is an important security issue for most of the educational institutions. According to [27], costs are a major challenge in implementing and delivering e-learning in third world countries. It was observed that many HEIs in the developing countries including Kenya work under tight financial constraints and therefore the implementation and sustainability costs for a reliable ICT infrastructure becomes a challenge. Some cost impediments included initial, maintenance, training, e-content development and bandwidth costs. HEIs also grapple with the ever-changing technological innovations and their varying costs, thus making it difficult for the institutions to keep up with these changes. [28] argued that cost impediment has been a major setback for institutions in developing countries when it comes to the purchase, implementation and maintenance of IT infrastructure. This can be mitigated through the selection and usage of cloud computing technologies to improve their competitiveness in the global education sector.

[29] argued that it is crucial that the strategies for adoption and implementation thoroughly address data and information security concerns when considering educational institutions in developing nations. This entails assuring compliance across all levels, including the network, host, application, and data. Particular emphasis should be placed on formulating strategies to accomplish these goals, specifically with regard to the migration of application security to the cloud. [30] underscored the critical nature of safeguarding the "integrity, availability, and confidentiality of data or



information" in relation to cloud computing security. Support from upper management is essential for the implementation of any substantial information system, including cloud-based e-learning, according to [31].

#### IV. METHODOLOGY

This study utilized descriptive research design. According to [32], descriptive research is concerned with depicting the qualities of a specific individual or group. The selection of a descriptive research design was appropriate for this study, as it enabled the sampling of a substantial population and offered a method to obtain profound understandings of participants' perspectives and encounters with conventional e-learning and cloud-based e-learning. According to [33], research designs are all-inclusive plans that include choices about everything from basic presumptions to specific techniques for gathering and analyzing data. According to [32], a research design encompasses the establishment of circumstances for data collection and analysis in a manner that aims to strike a balance between procedural efficiency and relevance to the research objective. The research approach employed in this study was mixed methods approach. Mixed methods approach was employed and it involved combining both qualitative and quantitative research data, techniques, and methods within a single research framework [34]. Mixed methods involve the collection and integration of both quantitative and qualitative data in a study [33].

#### Target Population

Population is a complete set of people with specified characteristics [35]. The target population for this study included any of the four key administrators (principal, two deputy principals and registrar), all trainers including ICT head of department, and ICT trainees in the four TVCs in Vihiga County. In these TVCs, the researcher identified a total of 16 administrators, 243 trainers, and 692 ICT trainees, totalling to 951 possible respondents as outlined in Table 1.

**TABLE I DISTRIBUTION OF THE TARGET POPULATION**

Institution	Administrators	Trainers	ICT Trainees	Total
Kaimosi TVC	4	141	465	<b>610</b>
Sabatia TVC	4	50	122	<b>176</b>
Chanzeywe TVC	4	21	57	<b>82</b>
Ebukanga TVC	4	31	48	<b>83</b>
<b>Total</b>	<b>16</b>	<b>243</b>	<b>692</b>	<b>951</b>

#### Sampling Frame

Sampling frame is an inventory of actual cases from which a sample must be drawn and must be representative of the population [36]. The selection of the four TVCs in Vihiga County for the study was based on several factors: the convenience of accessing the institutions, the feasibility of gathering the necessary data from the respondents, and the operational similarity of the TVCs to others in the Country.

#### Sample Size and Sampling Technique

A sample is a subset of the population used to draw conclusions about the entire population [35]. Published tables with precision level or sampling error of 10% were employed to determine the sample size of 91 participants from the target population of 951 respondents for the four institutions. Stratified sampling and simple random sampling were both utilized in the study. The target population was divided into three strata using stratified sampling: administrators, trainers, and ICT trainees. Stratified sampling works best when the population is diverse because the varied population can be broken up into several similar groups called strata [37]. According to [32], stratified sampling is used to obtain a



representative sample when the population is not homogeneous. Sample items are extracted from each stratum by dividing the population into strata which are non-overlapping subpopulations. The strata are then subsequently sampled using simple random sampling to guarantee that each item has an equal opportunity of being included. According to [37], this technique yields more precise and impartial parameter estimates.

### Data Collection Instruments

The main data collection instruments were questionnaire and interview schedules. Questionnaires were employed because they possess several merits in comparison to alternative survey formats. These include cost-effectiveness, reduced questioner effort compared to verbal or telephone surveys, and the provision of standardized responses, which facilitates data compilation [34]. Structured questionnaires, which included a combination of closed-ended and open-ended inquiries, were utilized to gather quantitative data for this research endeavor. Two analogous questionnaires were developed by the researcher, one intended for trainers and administrators and the other for ICT trainees. For the collection of qualitative data, structured interviews were conducted, featuring consistent questions in the same order. According to [38], detailed interview schedule facilitates the analysis, coding, and comparison of data. The interview schedule was directed at the Heads of ICT Department in the 4 TVCs and covered thematic areas related to cloud-based infrastructure, institutional readiness, user characteristics, and financial resources.

## V. RESEARCH FINDINGS AND DISCUSSION

The e-learning systems implemented was measured by these constructs; usage and accessibility of e-learning system by trainees; usage of e-learning system by trainers and administrators; reliable internet connection; availability of e-learning system and LMS implemented; level and duration of implementation of e-learning system; means of access of online content by trainees; trainees' level of satisfaction and challenges with the e-learning system; trainers and administrators level of satisfaction with the e-learning system; familiarity and concerns about of cloud-based e-learning system; and implementation of cloud-based e-learning system and preference of e- learning systems.

### Usage and Accessibility of E-Learning System by Trainees

The study sought to find out whether the trainees had used e-learning system in their respective institutions and the frequency of use. The findings are displayed in Table 2.

TABLE II USAGE AND ACCESSIBILITY OF E-LEARNING SYSTEM BY TRAINEES

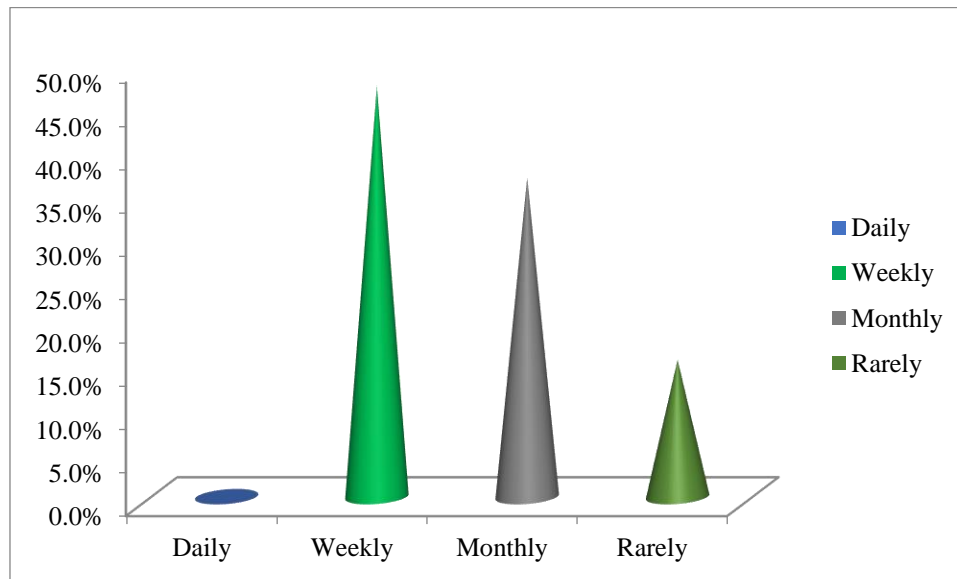
Used e-learning	Frequency	(%)	Access to e-learning	Frequency	(%)
Yes	41	73.2	Daily	5	8.9
No	15	26.8	Weekly	18	32.1
			Rarely	18	32.1
			Never used	15	26.8

From the findings, 41 (73.2%) of the trainees confirmed to have at some point used e-learning or online platforms for their studies in their respective colleges. However, 26.8% appeared to had never used or accessed any e-learning system. With regard to the frequency by which they accessed the platforms, 5 (8.9%) confirmed they used it daily; 18 (32.1%) accessed it on weekly basis; and another 18(32.1%) rarely used the system. On the other hand, 15 (26.8%) had never accessed the e-learning system at all.



### Usage and Accessibility of E-Learning System by Trainers and Administrators

The study sought to find out the frequency usage of e-learning system by the trainers and administrators as displayed in Figure 1.



**Fig. 1 Usage of E-Learning System by Trainers and Administrators**

On the part of trainers and administrators with regard to frequency with which they used their current e-learning system in their institutions, 10 (43.5%) said they used the system weekly, with another 8 (34.8%) saying they used the system monthly in training delivery. However, 5 (21.7%) the trainers and administrators said that they rarely used the e-learning systems in their respective institutions.

### Reliable Internet Connection, Availability of E-Learning System and LMS Implemented

The study sought to find out from the trainers and administrators whether their institutions had reliable internet connection, availability of e-learning system and type of LMS implemented to support e-learning. The findings are displayed in Table 3.

**TABLE III RESPONSE ON RELIABLE INTERNET CONNECTION, AVAILABILITY OF E-LEARNING SYSTEM AND LMS IMPLEMENTED**

Response	Yes	Percentage (%)	No	Percentage (%)
Reliable Internet Connection	17	73.9	6	26.1
E-Learning System Available	17	73.9	6	26.1
LMS Implemented	20	87	3	13

From the findings, 17 (73.9%) of the trainers and administrators who responded affirmed that their institutions had reliable internet connectivity. However, 6 (26.1%) of trainers and administrators were of the contrary view that their institutions did not have reliable internet. Furthermore, 73.9% confirmed that their institutions had e-learning systems; while 26.1% said no. Additionally, 87% of trainers and administrators affirmed that their institutions had already adopted and are implementing the Moodle LMS with just 13% having contrary view on the question. The findings on internet connectivity however contradicted the opinion of the HODs who during interviews indicated that indeed internet connectivity was not as sufficient as had been observed by the trainers and administrators. One respondent indicated that;



“...our main challenge is having sufficient bandwidth that can support all the users of the cloud environment. Even though we have internet, we also have great challenges on its efficiency..... IS3”

The opinions of the HODs were in agreement with [39] who identified inadequate internet connectivity as a significant obstacle hindering the acceptance of e-learning. Similarly, [40] observed that reliable and sufficient internet bandwidth is an essential requirement for accessing cloud computing services.

### Level and Duration of Implementation of E-Learning System

The study sought to find out from the trainers and administrators the level and duration of implementation of e-learning in their institutions. The findings are displayed in Table 4.

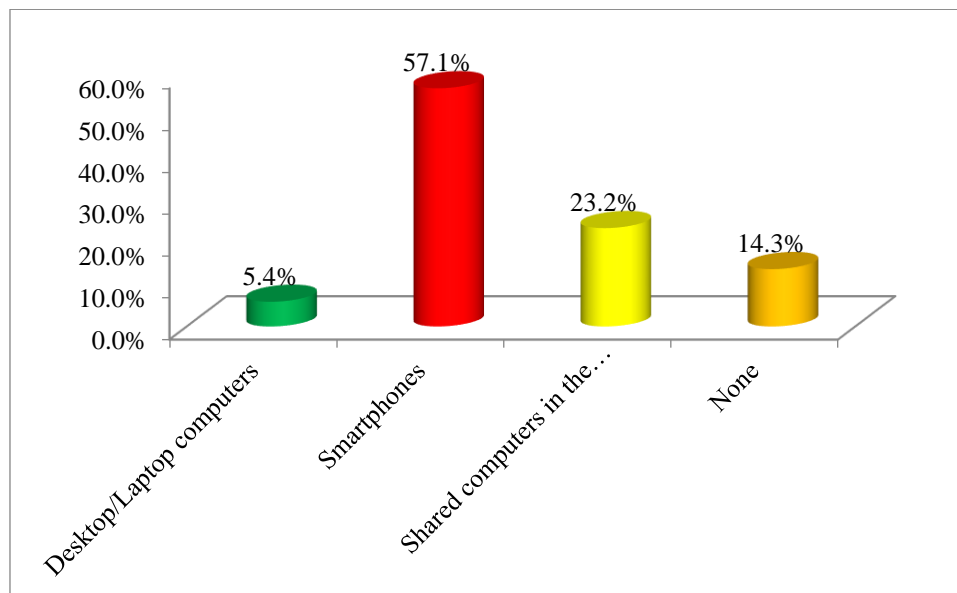
**TABLE IV LEVEL AND DURATION OF IMPLEMENTATION OF E-LEARNING SYSTEM**

Level of Implementation			Duration of Implementation		
Response	Frequency	(%)	Response	Frequency	(%)
Whole institution	1	4.3	Less than 1 year	18	78.3
Partially	22	95.7	1-4 years	5	21.7

From the findings, 22 (95.7%) of the trainers and administrators said that the current implementation in their institutions is partial, while only 1(4.3%) said the implementation had taken effect in the whole institution. In addition, 18 (78.3%) of trainers and administrators affirmed that the e-learning system had been implemented in their institutions for a period of less than one year. On the other hand, 5 (21.7%) said their institutions had rolled out the system for a period of between one and four years.

### Means of Access of Online Content by Trainees

The research aimed to investigate how trainees access online content within their respective colleges. The results are illustrated in Figure 2.



**Fig. 2 Means of Access of Online Content by Trainees**





On the statement which asked them to state how they primarily accessed e-learning content, 3 (5.4%) confirmed using desktop or laptop computers. Additionally, 32 (57.1%) revealed they use their smartphones; 13 (23.2%) said they used the shared computer facilities in their institutions; while 8 (14.3%) said none. This question seemed not to match the earlier response on usage and frequency of access to the online platforms. It revealed that 48 (85.7%) of the trainees had access to the e-learning content against 41 (73.2%) who already confirmed to have used and accessed the e-learning platforms in their respective colleges. According to [41], the presence of desktop computers, laptops, and other devices is crucial for the efficient utilization of e-learning, given that this pedagogical approach relies on computer-based methods.

### Trainees' Level of Satisfaction and Challenges with the E-learning System

The study sought to find out trainees' level of satisfaction and challenges with the existing systems in their respective colleges. The findings are shown in Table 5.

**TABLE V TRAINEES' LEVEL OF SATISFACTION AND CHALLENGES WITH THE E-LEARNING SYSTEM**

Challenges	Frequency	(%)	Satisfaction	Frequency	(%)
Yes	27	48.2	Very Dissatisfied	14	25
No	29	51.8	Dissatisfied	6	10.7
			Neutral	22	39.3
			Satisfied	11	19.6
			Very Satisfied	3	5.4

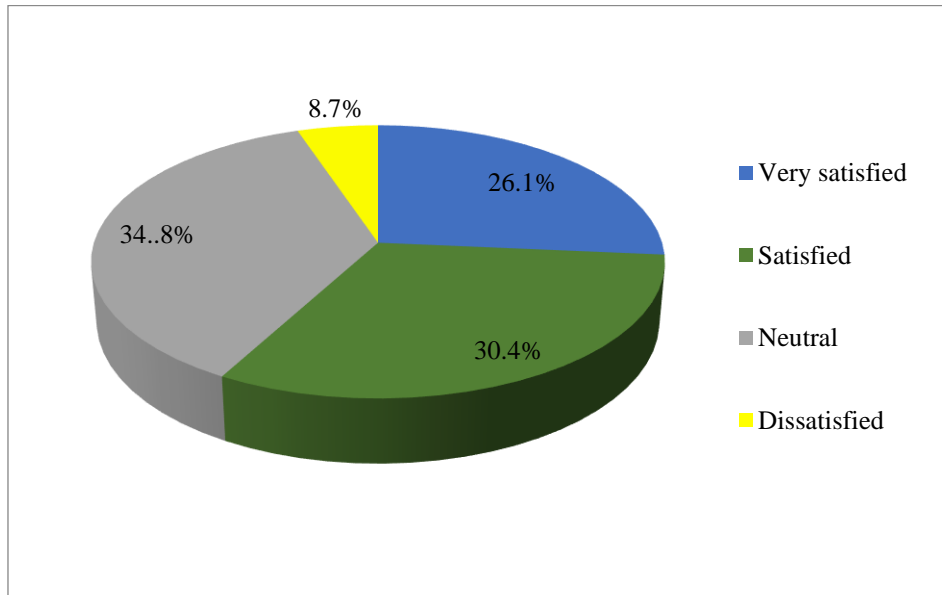
When asked to rate their level of satisfaction with the institution's current e-learning system, many of the trainees were either neutral or dissatisfied. Cumulatively, 20 (35.7%) were dissatisfied with the online platforms in their institutions, while 22 (39.3%) remained neutral on the question. The large numbers of neutral responses implied confusion and this corroborated the results from the interviews with HODs in which one respondent indicated that;

*"...whether cloud-based systems work better or not, we are not yet sure, you can only confirm what you have used or worked with. Until that time, we are not sure whether it is a good idea to go full on cloud-based system...  
ISI"*

However, only 11 (19.6% very satisfied) and 2 (5.4% satisfied) affirmed their satisfaction levels. On the contrary, 51.8% of the trainees did not seem to have any challenges or did not encounter any difficulties when using the e-learning systems in their institutions. Only 48.2% agreed that they had issues while using the current online platforms in their institutions. Nearly all the respondents (trainees, trainers and administrators) confirmed that the most noticeable challenges were inadequate internet connectivity, inadequate infrastructure in their institutions and lack of data for trainees using smartphones.

### Trainers and Administrators Level of Satisfaction with the E-Learning System

The study sought to find out administrators' and trainers' level of satisfaction with the existing systems in their respective institutions. The findings are shown in Figure 3.



**Fig. 3 Trainers and Administrators Level of Satisfaction with E-Learning System**

From the findings, 13 (56.5%) of trainers and administrators said they were satisfied with the online platforms, 8 (34.8%) remained neutral while 2 (8.7%) said they were dissatisfied with the systems.

#### **Familiarity and Concerns about of Cloud-Based E-Learning System**

The study sought to find out trainees' familiarity and concerns about the proposed concept of cloud-based e-learning. The findings are displayed in Table 6.

**TABLE VI TRAINEES FAMILIARITY AND CONCERNS ABOUT CLOUD-BASED E-LEARNING SYSTEM**

<b>Responses on trainees' familiarity and concerns about cloud-based system</b>				
<b>Response</b>	<b>Familiarity</b>		<b>Concerns</b>	
	<b>Frequency</b>	<b>(%)</b>	<b>Frequency</b>	<b>(%)</b>
Yes	22	39.3	38	67.9
No	34	60.7	18	32.1

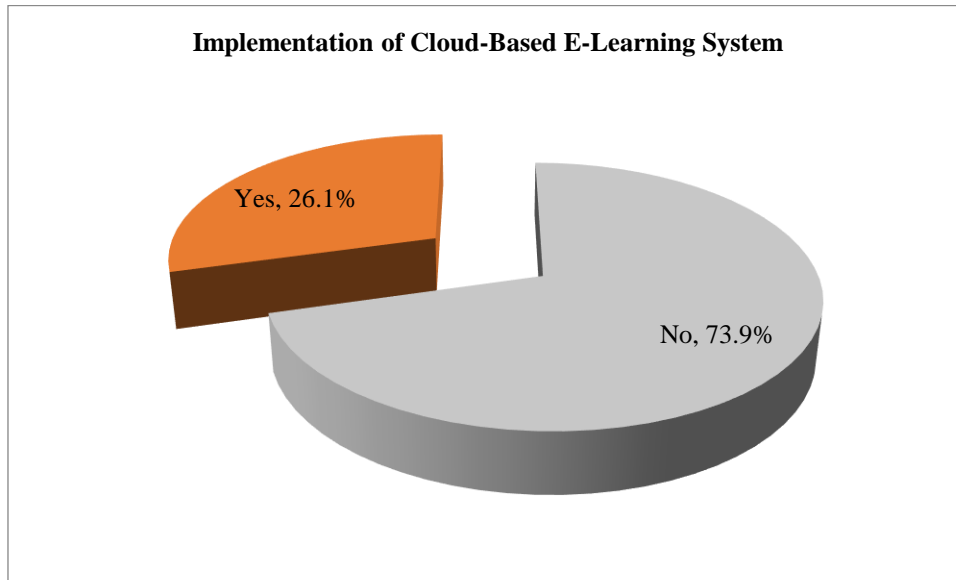
On cloud-based e-learning concept, 22 (39.3%) of the trainees were familiar with the idea while 34 (60.7%) were not aware of the concept. This agrees with the findings from the interviews with HODs in which one respondent said;

*".... most of our trainees and staff are not familiar with the idea of cloud-based e-learning systems because we are not apparently using it, but once the process of implementation is done, we expect that we will be having trainings and capacity building to ensure that all trainees and staff are acquainted with the idea...ISI"*

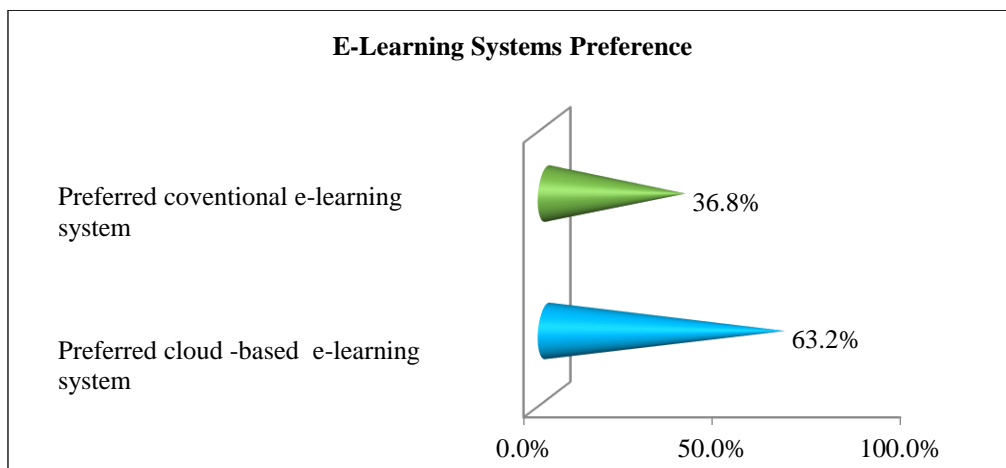
However, despite majority of the trainees being unfamiliar with cloud-based e-learning system, 38 (67.9%) of the said they did not have any reservations or concerns about using the cloud-based system. Only 18 (32.1%) had reservations or concerns about the cloud-based e-learning system.

#### **Implementation of Cloud-Based E-Learning System and Preference of E- Learning Systems**

The research aimed to inquire with trainers and administrators about the implementation of cloud-based e-learning systems in their institutions and their preference between conventional e-learning systems and cloud-based e-learning systems. The results are presented in Figures 4 and 5.



**Fig. 4 Implementation of Cloud-Based E-Learning System**



**Fig. 5 E-Learning Systems Preference**

From the findings, 17 (73.9%) of trainers and administrators confirmed that they had not implemented cloud-based e-learning system in their respective colleges. Only 6 (26.1%) of them said they to some extent tried to implement the system. This is supported with the opinion of the HODs who indicated that cloud-based e-learning systems had not yet been fully implemented. One respondent indicated that;

*“.... we are in the phase of implementing cloud-based e-learning systems and we have high prospects that once fully implemented, the problems of online learning will have been solved. Integration takes time but once they have been fully implemented, we will only have to worry about maintenance...IS4”*

Based on these responses from trainers and administrators and from the fact that majority of trainees equally said they were not familiar with the cloud-based e-learning systems, it was clear that the concept was still new among many TVCs in Kenya. Despite the lack of clear implementation mechanisms for cloud-based e-learning system in the institutions whose trainers and administrators participated in this study as respondents, many of them still had a strong belief that it is better than the conventional e-learning system. These results aligned with the discoveries made by [42], indicating that



a considerable majority of individuals in Kenya lacked awareness about cloud computing and its advantages. This lack of awareness suggested that certain organizations were expending significant resources, despite the potential for cost savings, given the escalating labour costs, energy-intensive systems, challenges in data system management, and increasing user demands.

With regard to e-learning systems preference, 15 (65.2%) preferred cloud-based e-learning system whereas 8 (34.8%) were comfortable with the conventional e-learning system. However, the implementation of e-learning was still facing financial challenges due to limited resources. On this statement only 7 (30.4%) of the trainers and administrators said that their respective institutions had set aside some funds although the budget was inadequate. The majority at 16 (69.6%) said that their institutions had not budgeted for implementing e-learning programs. The results align with the observations made by [15] affirming that developing countries encounter substantial challenges in allocating sufficient budgetary resources, particularly for higher educational institutions, to sustain e-learning initiatives.

### Discussion

The study sought to determine the e-learning systems implemented in TVCs in Vihiga County. All the trainees, trainers and administrators who took part in the study confirmed that their institutions had adopted and used the conventional e-learning systems in their respective institutions. The findings were corroborated by those of [39] who confirmed that e-learning was a familiar concept among students, academic staff, and administrators but was still emerging as an alternative and complimentary pedagogy. Despite the existence of e-learning platforms in the TVCs in Vihiga County, generally the entire framework for e-learning was still weak and most trainees, trainers and administrators who took part in this study strongly registered their reservations about their systems. According to [27], previous studies confirmed that in as much as HEIs were trying to utilize e-learning systems in teaching and learning, some of the challenges that inhibit its implementation were common thus influenced the full realization of the benefits and opportunities of e-learning. Furthermore, many trainees, trainers and administrators had not accessed and used cloud-based e-learning in their institutions. This was because nearly all the TVCs in Vihiga County did not have the capacity for cloud-based e-learning systems implementation. The findings were in line with [40] who posited that various challenges hamper the adoption of cloud-based e-learning in educational institutions in Kenya. Despite this weakness, the trainees, trainers and administrators appreciated the importance of cloud-based e-learning and were ready to adopt it.

## VI. CONCLUSION AND RECOMMENDATION

### Conclusion

The research concluded that the existing conventional e-learning systems in Vihiga County were insufficient to support quality and reliable e-learning delivery. The study emphasized that there was a considerable gap to cover in achieving fully developed e-learning in TVCs in Kenya.

### Recommendation

Findings indicated that the use of e-learning systems was still below average and the existing conventional e-learning systems were still not much popular with the users. It was therefore recommended that TVCs in Kenya be encouraged to adopt cloud-based e-learning systems as an alternative to conventional e-learning systems considering that cloud-based



systems offer benefits such as on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured services, providing flexibility and scalability for users.

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