

# Influence of Availability of Information Communication and Technology Infrastructure on the Use of Student Management Information System in Teacher Training Programmes by Distance Learning in Universities in Kenya

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**ABSTRACT:** Student Management Information Systems provide efficient, effective, and easier access to student information in educational institutions. In Kenya, 90% of the universities rely on the use of this system to support teacher training programmes. No sufficient scientific research has been carried out in Kenya to address this matter. Student teachers face several challenges on the use of this system, as evidenced via feedback from the students before, during, and after their residential sessions. This necessitated an investigation on how the availability of Information Communication and Technology infrastructure influences the use of Student Management Information Systems. This research was based on Adaptive Structuration Theory. It engaged a cross-sectional survey design of a sample size of 415 respondents composed of 2<sup>nd</sup> and 3<sup>rd</sup> year students who are enrolled in teacher training programmes by distance learning, and who use this system. A mixed-method approach was utilised to generate results from structured survey questionnaire, key informant interviews, and focus group discussions. The findings indicated that the lack of availability of Information Communication and Technology infrastructure had a significant influence on the use of Student Management Information Systems. Recommendation is made for the Government of Kenya to roll out rural electrification and to provide internet network to enable uniformity in all teacher training programmes by distance learning in all satellite universities in Kenya.

**KEYWORDS:** distance learning, ICT infrastructure, programmes, student management information system, teacher training programmes by distance learning, Universities in Kenya.

## I. INTRODUCTION

Digitalization of customer needs of having a one-stop shop has necessitated the automation of technology in higher learning institutions. There has been an overwhelming emergence of the information system which has opened up ways to better access information, in turn yielding better production, proficiency, and consistency (Laudon & Laudon, 2010). A student management information system (SMIS) is a set of interrelated, interacted components that collects, stores, and processes student information. In Kenya, universities use SMIS mostly to manage and enhance the decision-making processes of student bio-data. Universities in Kenya value high-quality SMIS which support teacher training programmes by distance learning.

The component of SMIS, with the access of internet and Information Communication and Technology (ICT), allows the registered university students any programme to access required information anywhere around the world. Due to its effectiveness and efficiency, the SMIS is widely used to retrieve different loads of information and execute tasks at the same time. For example, this system enables the entry of student information, and it captures several student-related records within the university programmes (Ndede-Amadi, 2013). SMIS

supports the maintenance and management of university students' personal information relating to the admission process: registration; fee status; examinations' records; academic progression; maintaining records of absences and attendance; capturing other student personal information (including those students registered for teacher training programmes by distance learning) such as date of birth, address, marital status, and accommodation.

In Kenya, teacher training programmes by distance learning are also referred to as Open and Distance Education Learning. It is a form of education that separates the teacher from the learner. It has a broad approach within the educational system, given that any traditional face-to-face (F2F) educational programme can be supplemented by online learning (web-enhanced learning; blended learning; fully online learning) (Fillip, 2001). It can improve the quality of teaching given (to student teachers). Teacher training programmes by distance learning are also known as school-based systems. In such systems, student teachers would begin their career and would develop professional and pedagogical skills which supported high-quality teaching and learning (Murtagh, 2001). In the context of education, teacher training programmes by distance learning have been used as a pre-service teacher preparation method through which learners get extensive F2F preparation. In developing and developed countries, teacher training programmes by distance learning has been deployed as an in-service vehicle that fulfils a mandate to upgrade student teachers' qualifications of an existing teaching force (Juma, 2001). It improves teaching through diversification of methods, content and performance, and it promotes an exchange of ideas, which are UNESCO's strategic objectives in learning (UNESCO 2002, 2005). ICT mastery has turned out to be a key ingredient which is necessary for the promulgation of technology-supported teaching and learning (for example, Distance Learning). This phenomenon therefore has paved ways to modern life which has impacted educational methodology both at conventional and distance education levels worldwide (UNESCO, 2005).

Teacher training programmes by distance learning function relatively well in Kenya and consume much of the social interactions that would normally be present in traditional learning settings (Nwagu, 2001). Universities offering these programmes need to demonstrate evidence of having a developed system to administer teacher training programmes to student teachers. The SMIS is developed and further adapted by ICT experts within higher learning institutions. It forms an electronic database which allows students to register anywhere and anytime, and it enables the distance learner to visit any satellite campus to receive F2F support, as evidenced by Galusha (1997).

Teacher training programmes by distance learning are offered both by public and private universities to meet the needs of learners. The programme requires the use of SMIS to give electronic support to students so that they can have access to fee statements, timetables, course registration, results, enquiries, and accommodation booking, among others. These support services are recommended by the Commission for University Education, Kenya, and they are important particularly to the universities in Kenya that offer limited F2F teaching and learning in study centres (Juma, 2001). Taking into consideration the above-mentioned, this study investigates the availability of ICT infrastructure and its influence on the use of SMIS in teacher training programmes by distance learning, mainly by looking at how the use of SMIS challenges and affects these programmes in 3 universities in Kenya.

## **I.I RESEARCH PROBLEM**

Despite the fact that 90% of the universities in Kenya are using SMIS as the premier management system for student information, there are still challenges on the availability of ICT infrastructure that cause SMIS to be underutilized. There is a continuous call by education practitioners in higher learning institutions in Kenya to suggest ways to counter the afore-mentioned problem that students might experience when they are about to use SMIS. There is also a need to examine the reasons why learners do not effectively use SMIS - with a view to addressing these reasons - since it is an established fact that universities which embrace the use of SMIS benefit in many ways (Zziwa 2001; Matovu, 2009). As a result of these problems, this extant study has emerged.

## **I.II RESEARCH OBJECTIVE**

To establish the extent to which the availability of ICT infrastructure influences the use of SMIS in teacher training programmes by distance learning in universities in Kenya.

### **I.III RESEARCH QUESTION**

To what extent does the availability of ICT infrastructure influence the use of SMIS in teacher training programmes by distance learning in universities in Kenya?

### **I.IV RESEARCH HYPOTHESES**

The study used hypotheses to present the following forms:

- H0** Availability of ICT infrastructure has no significant influence on the use of SMIS in teacher training programmes by distance learning in universities in Kenya.
- H1** Availability of ICT infrastructure has a significant influence on the use of SMIS in teacher training programmes by distance learning in universities in Kenya.

## **II. LITERATURE REVIEW**

Adaptive Structuration Theory (AST) is linked to, and has relation to, the influence of the availability of ICT infrastructure on the use of SMIS on teacher training programmes by distance learning in universities in Kenya. The proportioned belief of intervention is encouraged because it goes beyond the scope of this research. The proponents of this theory contend that the use of SMIS holds high expectations to transform teacher training in institutions of higher learning, and that its actual modifications rarely transpire or occur inconsistently. It is believed that AST allows for an extended notion of agency beyond human beings which can enrich representation and understanding of learning settings. This can positively convince teachers and learners to think of SMIS as a system that interacts with its users.

AST considers the interconnected interplay between ICT infrastructure and SMIS, contending that the two cannot be separated. In this same way, AST considers the users (teachers, learners, administration) and the system as two faces of the same coin, or two entities connected to one another in a circular way. AST examines the availability of ICT infrastructure and the use of SMIS from two approaches: the multidimensional and humanistic approaches. The multidimensional approach looks at the structures that provide advanced technologies, such as SMIS, internet, and electronic databases; the humanistic approach interacts with these technologies (efficiency, effectiveness, and quality) which are within the structures of the teacher training programmes by distance learning. The humanistic proponents of this theory contend that students hold high hopes for the potential of SMIS, recognising that this type of information management technology can positively transform the teaching-learning environment.

Universities in Kenya have invested greatly in the use of SMIS to ensure that the management of teacher training programmes by distance learning is executed through the availability and use of ICT infrastructure; however, its actual influence is paramount and has not greatly been realized (Feldman & March, 1981). DeSanctis and Poole (1994) add that the past decade has brought advanced information technology that enables multiparty participation in institutional activities through sophisticated management systems. Universities in Kenya have embraced the use of SMIS to manage students' bio-data and other information issues. However, the effects on the use of SMIS are due to the availability of ICT infrastructure and how these technologies are used by users (Rice, 1984; Huseman & Miles, 1988; Huber, 1990). These four afore-mentioned authors postulate that the use of SMIS can only be realized by effective interaction of certain components: management of teacher training programmes by distance learning, availability of ICT infrastructure, and SMIS (technology, system, and human resource). It is also highlighted that not only technology that can bring change to universities but also educational users (human resource) who can also evoke change in university pedagogical practices through the use of SMIS (Siegel, Dibrovsky, Kiesler & McGuire, 1986).

According to Giddens (1984), learners become accustomed to using SMIS to suit their specific needs, on one hand; on the other hand, some learners scan it briefly and decide whether it might be beneficial to them or not, some resist it partially or fully, or some fail to use it at all. The author stressed that the wide changes in patterns on the use of the system are dependent on learners' level of motivation and their personal objectives. Giddens further states that SMIS cuts across all levels of educational institutions: it is used by students, teaching faculty, and administration. However, it is still not clear whether teachers and learners have been able to get ICT infrastructure or not (because not being able to get the appropriate structures in place could severely hinder their

ability to interact properly with the system). Not having these structures in place would mean the under-utilisation or non-utilisation of the SMIS for admission, registration, exam results, and communication, among others (Giddens, 1984). This is because SMIS is designed to overcome human weaknesses such as malpractice, queuing, reduction (and possible elimination) of excess paperwork, time, and cost in institutions of higher learning (DeSanctis & Poole, 1994).

Volery and Lord (2000) acknowledged the important and critical use of SMIS in higher education settings. They sustained that this kind of technology allows for ease of access of, and navigation through, a lot of information. In this regard, it is necessary for education practitioners within higher education institutions to be trained in the use of SMIS - and to develop technical competence - to be able to interface with the very SMIS and learners. Soong, Chan, Chua, and Loh (2001) apostrophised that information, users, and the task should be considered in a holistic, interconnected way, and should be applied when using SMIS in order to promote effectiveness, efficiency, and satisfaction of use. In this way, the quality of teacher training programmes by distance learning in Kenya could be specified.

### **II.I RESEARCH FOCUS: AVAILABILITY OF ICT INFRASTRUCTURE**

Universities in Kenya are critically reliant on the ease of operation, functionality, and use of new innovations; in this case, one such innovation is SMIS (Tusubira, 2005). It is in this light that universities have embarked on its utilisation, given that it is reliable, easy to use, quick-working, cheap, and a robust support for ICT materials, tools and resources.

It is important to point out that the availability of ICT infrastructure enables the use of additional programmes, other than SMIS, to be used to produce better results that lead to more effective and efficient communication. Ndede-Amadi (2013) stated that the use of SMIS would reduce the overcrowding of students, especially during their residential sessions in April, August, and December. However, it entirely depends on the existence and availability of ICT infrastructure to allow for easy use of SMIS in the various educational programmes. Students registered in teacher training programmes by distance learning need to get access to use SMIS through the institutional computer laboratories that are networked and connected to the internet; in fact, access to SMIS would enable them to communicate with teaching faculty and administration, register for courses, access results, confirm timetables, pay fees, view exam cards, and verify admissions to their institutions, among others.

Students who registered in any of the teacher training programmes by distance learning are therefore forced to move to distant towns, in search of access to ICT and internet network, in order to use SMIS for communication and to get information from their various universities. These learners face several challenges due to the distance between their homes (or places of work) and the university institutional facilities that have been set up in Extramural Centres and in Cybercafés. Aho (2005) observed, on the one hand, that learners in non-distance teacher training programmes prefer any available electronic gadget. These learners quickly learn to use these devices to the extent that they are able to communicate easily with them. Aho (2005) also revealed that learners in teacher training programmes by distance learning, on the other hand, are faced with inadequate electronic devices and the unavailability of requisite ICT infrastructure. More often than not, these learners are located in remote areas where there is no electricity, internet, and network; in some instances, also, these learners are computer illiterate and often do not know how to use SMIS (Matovu, 2009).

Universities in Kenya have websites with fully functional SMIS. If ICT infrastructure were to be available in remote rural areas, distance learners would find it easier to use SMIS and would not frequently flock the offices of university system administrators, except only to check for missing marks and other non-pressing issues (Bigirimana, Jagero & Daudi, 2015). The authors further stated that among the other types of available systems developed, SMIS has proven to be efficient and can be used by learners for different purposes: checking academic results and personal records, and improving their skills in selecting educational courses, among others.

### **III. RESEARCH METHODOLOGY**

This research sought to investigate the influence of availability of ICT infrastructure on the use of SMIS in teacher training programmes by distance learning in universities in Kenyan. The sample population was purposively

selected to represent the larger population from the universities in Kenya which offer teacher training programmes by distance learning and which use SMIS to facilitate these programmes.

A cross-sectional survey design was utilised to provide quick, accurate means of assessing information in order to enable appropriate data collection (Zikmund, 2003). The cross-sectional survey quantifies social phenomena, particularly issues, conditions or problems that could be prevented, to give chance to capture a population's characteristics that would allow for hypothesis testing quantitatively and qualitatively. In this way, one could arrive at an objective conclusion of the study conducted. This kind of survey design enabled the researchers to recognise the significant influence and interconnected interplay among the variables (which depend on the resources available to the target population).

The total sample population comprised a total of 9,936 learners in teacher training programmes by distance learning drawn from 3 purposively selected universities in Kenya: University of Nairobi [in Nairobi (Public)], Maseno University [in Maseno (Public)], and Mount Kenya University [in Thika (Private)]. Preference to take part in this study was given to universities that met all requirements: be a fully chartered university with a defined structure; have a high population of learners registered in teacher training programmes by distance learning; appropriate geographical location; type of university; similarity of the programmes, and a legal mandate to operate as an institution of higher learning in Kenya. Considering the afore-mentioned, it is germane to highlight that these universities exhibited elaborate similarities and relationships within the variables under study (CUE, 2014).

According to the Commission for University Education (2014), there are a total of 46 public and private chartered universities in Kenya. Only 12 of these universities offer teacher training programmes by distance learning and utilise SMIS in this regard. This research concentrated and focused on the 3 purposively selected universities in Kenya which gave a larger representation of the universities which offer teacher training programmes by distance learning and which use SMIS for the delivery of teacher training programmes by distance learning. A target sample size of 415 respondents was drawn and subsequently divided into various strata. The respondents interviewed consisted of 2<sup>nd</sup> and 3<sup>rd</sup> year learners in teacher training programmes by distance learning. These learners were directly the main users of SMIS in their universities who were capable of providing information about their university, with regard to the availability of ICT infrastructure and the use of SMIS in teacher training programmes by distance learning.

Purposive and simple random sampling techniques were used to obtain required, specific information from the target sample. Simple random sampling was used to select the participants of the study, following which in-depth interviews were conducted with 2<sup>nd</sup> and 3<sup>rd</sup> year learners registered in teacher training programmes by distance learning. According to Mugenda and Mugenda (2003), purposive sampling technique allows the researcher to use cases which make use of the required information. The simple random and purposive sampling methods were utilised in order to avoid prejudices; at the same time also, the random and purposive sampling methods allowed for the inclusion of all users involved in teacher training programmes by distance learning in the three (3) universities under study.

A pilot test on the questionnaire (the research instrument) was carried out on 60 participants to get better clarity and depth of the research instrument, all with the aim of covering relevant information on the influence of the availability of ICT infrastructure and on the use of SMIS in teacher training programmes by distance learning. The scales used in the pilot study had a high consistency as measured by Cronbach's alpha from cases of a total of 64 variables. Cronbach (1984) indicates that when the alpha coefficient is closer to a score of 1, the high inconsistency score of 0.60 or less would indicate that the items measure different characteristics. The outcome results were used to identify mistakes and make corrective changes and adjustments before proceeding to the field for the actual data collection from the target sample.

Stemming from the above paragraph, it is necessary to point out that validity is the degree to which a research accurately reflects or assesses the specific concept that the researcher is attempting to measure. Validating research instruments is a vital process, which promotes and fosters sound research practices, and should not normally be ignored or disregarded (Machuki, 2011). After the pilot test was carried out, the questionnaire was reviewed to determine the ability of the respondents to answer the questions without difficulty, and also to verify if the research objectives and questions had been achieved and answered.

After ascertaining validity of the research instrument, reliability of that same instrument had to be established as well. Reliability refers to the consistency of the scores obtained, and how consistent those scores are for each individual. Just like validity, the concept of reliability of any kind of research instrument should never be overlooked (Fraenkel & Wallen, 2008). In this pilot study, the consistency of scores was recorded, assessed and analysed from one administration of an instrument to another, and from one set of items to another. The score for the pilot study was 0.77 which confirmed that there was a high internal consistency in the data collection instruments.

The positivist research paradigm advocates that hypotheses testing should use quantitative techniques (Muijs, 2010). Primary and secondary data were collected, and observation techniques were used to analyse the data. Quantitative data were collected by means of a structured questionnaire which comprised 10 open-ended and 38 closed-ended questions, to give a total of 48 questions. For the close-ended questions, a five-point Likert scale was employed.

The 48 survey questions covered a range of issues which include the following: possession of a mobile device (smart phone); access to internet and internet connectivity nearest to a Cybercafé; area network services; whether or not there is access to high speed internet; whether or not there is assistance for troubleshooting problems; level of computer skills; whether or not respondents have SMIS training, and whether or not respondents are able to use SMIS for SMIS-related matters (finalizing course registration, paying student fees, accessing course schedule, and checking exam results, among others.

Qualitative data were obtained from F2F interviews. These interviews took the form of Focus Group Discussions (FGD) and Key Informant Interviews (KII) which were administered to 2<sup>nd</sup> and 3<sup>rd</sup> year learners in teacher training programmes by distance learning. Observation methods were used (Amin, 2005), and these provided substantial information which supplemented other methods of data collection. The Ministry of Science and Technology of Kenya approved the research permission, and this allowed the researchers to collect required information from the 3 universities in Kenya. The respondents were assured of the degree of confidentiality of the information gathered from them.

#### IV. RESEARCH RESULTS

In conjunction with the research objective, research question, and research hypotheses, the data obtained from the research instrument (survey/questionnaire) was analysed quantitatively and qualitatively. These results and findings are presented below.

For this research paper, *responses to only 6 survey questions have been presented* (Tables 1-6) because they capture the gist of this paper, and because responses to all 48 questions would be information overload.

Socio-demographic characteristics considered were gender, age, and marital status, all considered to be important variables in this research. In Table 1 below, these characteristics of the respondents are presented.

**Table 1. Distribution of Respondents Based on Socio-demographic Characteristics (n=415)**

<b>Gender</b>	<b>Frequency (f)</b>	<b>Percentage (%)</b>
Male	184	44.3
Female	227	54.7
Non-response	4	1.0
<b>Total</b>	<b>415</b>	<b>100</b>

  

<b>Respondent's Age (Years)</b>	<b>Frequency (f)</b>	<b>Percentage (%)</b>
80	80	19.3
150	150	36.2
100	100	24.0
42	42	10.2
30	30	7.2
13	13	3.1
<b>415</b>	<b>415</b>	<b>100</b>

Marital Status	Frequency (f)	Percentage (%)
Single	154	37.1
Married	246	59.3
Divorced	9	2.2
Widowed	3	0.7
Total	412	99.3
Non-response	3	0.7
<b>Total</b>	<b>415</b>	<b>100.0</b>

It can be observed in Table 1 above, with regard to gender, that the majority of the respondents - 227 (54.7%) - was female. This suggests that women make up the greater part of the work force and the student population at the universities considered in this study. For reasons unknown to the researchers, 4 respondents (1%) did not indicate to which gender type they belonged.

It can be seen in Table 1 above, with respect to age, that the majority of the respondents 372 [89.7%] fell below the age of 50 years, with less than half of these (150 [36.2%]) falling between the age range of 26-35 years. These results highlight that the universities under study have fewer 'older' adult learners in teacher training programmes by distance learning, as compared to 'younger' adult learners. This suggests that more and more young people are joining the university labour force, and more young people are taking the bold step of doing higher studies. Additionally, it can be highlighted that the minimum age of respondents was 19 years, while the oldest respondent was 56 years. Unfortunately, and for reasons unknown to the researchers, 13 (3.1%) of the respondents did not indicate their age.

As can be witnessed in Table I above, with reference to marital status, the majority of the respondents 246 (59.3%) indicated that they were married. In second position were those respondents who indicated that they were single (154 [37.1%]). The marital status of 3 respondents (0.7%) was unclear because they never gave any response to this question, as shown by the frequency. It is just to posit that the majority of the respondents of this study, registered in teacher training programmes by distance learning, are married and are living with their families. Despite their busy schedules, they find the time to interact and engage with SMIS. This implies that the respondents were knowledgeable enough to provide the necessary data for the accomplishment of this research.

As earlier pointed out in the methodology section of this paper, 2<sup>nd</sup> and 3<sup>rd</sup> year learners in teacher training programmes by distance learning would be surveyed. In this particular case, the survey question focused on the students' academic level of study. Table 2 below presents the results of the distribution of students by year of study.

**Table 2. Distribution of Learners in Teacher Training Programmes by Distance Learning by Year of Study (n=415)**

Year of Study	Frequency (f)	Percentage (%)
2 <sup>nd</sup> Year	221	53.3
3 <sup>rd</sup> Year	187	45.1
Non-response	7	1.6
<b>Total</b>	<b>415</b>	<b>100.0</b>

As can be seen in Table 2 above, the majority of respondents (221 [53.3%]) were in their 2<sup>nd</sup> year of teacher training by distance learning. It could be assumed that the numbers in this year of study is higher because of learner interest in technology-based education and study flexibility and convenience, among many other reasons. Since both 2<sup>nd</sup> and 3<sup>rd</sup> year learners have had much more access to (and interaction with) SMIS than their 1<sup>st</sup> year counterparts, they were deemed more knowledgeable to participate in this study and answer the survey questions. These students were the targeted respondents, and all of them participated.

There was a need to establish whether the learners in distance learning teacher training programmes had an institutional email address and if they were capable of using SMIS before, during and after the residential sessions and periods in April, August and December. The response to this question is provided in Table 3 below.

**Table 3. Availability of Institutional Email Address (n=415)**

Availability of Institutional Email Address	Frequency (f)	Percentage (%)
Yes	44	10.6
No	371	89.4
<b>Total</b>	<b>415</b>	<b>100.0</b>

As indicated clearly in Table 3 above, the majority of learners in distance learning teacher training programmes (371 [89.4%]) did not have institutional email addresses. These results highlight that the majority of the learners were unable to use SMIS for communication and other internet-based communication purposes. This gave a clear indication that the computer (either desktop or laptop) is a requirement for the use of SMIS and that any other technology-related communication: emailing, registration, request of transcript, and access to timetable and courses, among others.

Considering that this research sought to establish the extent to which the availability of ICT infrastructure, as an institutional factor, influenced the use of SMIS in teacher training programmes by distance learning in the 3 universities in Kenya, respondents were required to indicate whether or not they were in possession of a computer. The response to this question is presented in Table 4 below.

**Table 4. Possession of Computers (n=415)**

Possession of Computers	Frequency (f)	Percentage (%)
Yes	144	34.7
No	265	63.9
Missing System	6	1.4
<b>Total</b>	<b>415</b>	<b>100.0</b>

As can be observed in Table 4 above, the majority of respondents (265 [63.9%]) did not possess computers at all. This implies that learners relied totally on other form of information dissemination, like the daily newspaper, to get institutional information on the opening of residential teacher training sessions. This state of affairs infers that the majority of these learners could not be connected online, for financial reasons, to make informal contact with lecturers, administration, and other learners in the programme. Only 144 (34.7%) affirmed to be in possession of a computer. This could be interpreted that not having personal computers acts as a hindrance to the use of SMIS; therefore, a percentage of the learners is disadvantaged and negatively affected by the non-use of SMIS.

In keeping with the research objective, research question, and research hypotheses, respondents were questioned about where they were able to access computers from. This information is shown in Table 5 below.

**Table 5. Access of Computer (n=415)**

Point of Access of Computer	Frequency (f)	Percentage (%)	No. of Cases	Percentage of Cases
Personal Computer	99	23.8	263	23.2
School/Faculty Computer Lab	105	25.3	327	28.8
A Friend's Computer	25	6.0	66	5.8
Home	90	21.6	229	20.2
Cybercafé	96	23.1	250	22.0
<b>Total</b>	<b>415</b>	<b>100.0</b>	<b>1135</b>	<b>100</b>

As can be witnessed in Table 5 above, a very small number of learners (25 [6%]) in distance learning teacher training programmes made use of their friend's computer. The majority of respondents indicated that they used either the school/faculty computer lab (105 [25.3%]), their personal computers (99 [23.8%]), or a Cybercafé (96 [23.1%]). The use of university/institutional facilities implies that learners only accessed computers during



their residential sessions which resulted in their having limited access to (and use of) SMIS. The reason for this could be due to learners not being able to access computers at their own convenience.

To better understand the availability of various ICT infrastructures in different learning institutions, this research sought to find out about the degree of access of internet by learners in the teacher training programmes by distance learning. To this end, a cross-tabulation was undertaken to check on internet access and the major source of internet access. 95.4% of the respondents were able to access the internet, while the remainder (4.6%) were unable to access the internet. Important to point out is that 53% of the respondents accessed the internet from a Cybercafé, while 4.6% of them revealed that they were able to have internet access from other sources (such as mobile phones and offices). From these responses, it was deduced that the majority of respondents could access the internet and use SMIS from wherever they were, with the highest source being that of Cybercafés.

Networking was another important question to be addressed by respondents. Research participants were asked whether or not the computers at the 3 universities under study were networked. A cross-tabulation was conducted to ascertain whether computers at the various learning institutions had been networked, and whether there was a system administrator who managed the networked computers and/or helped with troubleshooting issues. The response to this question is presented in Table 6 below.

**Table 6. Networking of Computers (n=415)**

		Computer Networked		Total
		Yes	No	
Have a system administrator who manages the	Yes	38.9	14.7	53.6
networked computers or helps with trouble shooting	No	12.4	34.0	46.4
<b>Total</b>		<b>51.3</b>	<b>48.7</b>	<b>100.0</b>

As can be seen in Table 6 above, the majority of respondents (51.3%) affirmed that the computers at their higher education institutions had been networked. Similarly, the majority of respondents (53.6%) confirmed that they had a system administrator who helped them with issue related to the use of SMIS. These results are very encouraging.

#### IV.I HYPOTHESES TESTING

In a bid to establish the level of association between the dependent and the independent variables, the hypotheses were tested using chi-square ( $\chi^2$ ). This research used hypotheses to present the following forms:

- H0** Availability of ICT infrastructure has no significant influence on the use of SMIS in teacher training programmes by distance learning in universities in Kenya.
- H1** Availability of ICT infrastructure has a significant influence on the use of SMIS in teacher training programmes by distance learning in universities in Kenya.

The null hypothesis and the alternative hypothesis were presented as follows:

$$H0: \mu_1 = \mu_2 \quad \mu_1 - \mu_2 = 0$$

$$H1: \mu_1 \neq \mu_2 \quad \mu_1 - \mu_2 \neq 0$$

Table 7 below presents the results of the hypothesis test on the availability of ICT infrastructure.

**Table 7. Hypothesis Test on Availability of ICT infrastructure (n=415)**

	Value	Df	Assymp. Sig (2sided)
Pearson Chi-Square	62.609 <sup>a</sup>	4	.000
Likelihood Ratio	69.294	4	.000
Linear-by-Linear Association	55.208	1	.000
N of Valid Cases	<b>415</b>		
<b>a. 0. cells (0.0%) have expected count less than 5. The minimum expected count is 25.50.</b>			

The chi-square indicated the value for the availability of ICT infrastructure,  $\chi^2 (4), (N=415) = 62.609, p=.000$ , implying that there was a significant influence of the availability of ICT infrastructure on the use of SMIS in teacher training programmes by distance learning in universities in Kenya. The p-value is less than  $\alpha (0.05)$ ; thus, the null hypothesis was rejected and the alternative hypothesis adopted. This research, therefore, stresses that the availability of ICT infrastructure does have a profound impact and influence on the use of SMIS in teacher training programmes by distance learning in universities in Kenya.

Table 8 below presents the results of the availability of ICT infrastructure and symmetric measures.

**Table 8. Availability of ICT Infrastructure and Symmetric Measures (n=415)**

		Value	Approx. Sig.
Nominal by Nominal	Phi	.379	.000
	Cramer's V	.379	.000
N of Valid Cases		<b>415</b>	

a. Not assuming the null hypothesis.  
 b. Using the asymptotic standard error assuming the null hypothesis.

As can be observed from Table 8 above, the researchers used the Phi Cramer's V to assess the strength and direction of the influence of the availability of ICT infrastructure on the use of SMIS in teacher training programmes by distance learning. The results indicate a symmetric measure of  $\phi=.379$  which is a (slight) positive relationship between the two variables.

#### IV.II RESEARCH FINDINGS

In connection with the research objective, research question, and research hypotheses, the findings show that the majority of 2<sup>nd</sup> and 3<sup>rd</sup> year learners undertaking teacher training programmes by distance learning were females. The mean age for the respondents was 31.02, which inferred that the majority of the respondents were 31 years old. The standard deviation of 6.275 implied that learners' ages were sparsely dispersed, and there was no age limit identified in teacher training programmes by distance learning. The older respondents said that they were enrolled in the programme to enable them to get promotions and retire with a better pension, while others said that they opted to open educational institutions in order to practise and implement the knowledge and experience gained. Their younger counterparts stated that they were doing it as a requirement for a degree course.

These findings showed that learners in distance learning teacher training programmes understood that there was the need for availability of ICT infrastructure to enable them to use SMIS. This would ease the strain and discomfort of having to travel from one centre to another in search of SMIS. Only 44 (10%) of the respondents had an institutional email address but could access the internet to use SMIS. When probed further, a group of respondents informed that they were not able to use or handle the institutional email addresses due to distance and unavailability of ICT infrastructure. In addition, the results showed that the majority of the respondents 398(90%) did not have institutional email addresses. The respondents further admitted that due to the distance from social amenities and lack of electricity in their homes and workplaces, it was very difficult to even charge their mobile telephones; in fact, if they managed to charge their phones, they were not be able to use them for any other business other than making calls. It was also revealed that there was a major problem with the service provider network, to the extent that they could not even get access to the internet to use SMIS. Some respondents highlighted that there was no internet coverage and that one would normally have to walk a long distance to be able to access the network. Additionally, other respondents emphasised that they did not possess any personal internet plan; as such, internet access was just not possible.

On the issue of the utilisation of SMIS, respondents agreed that even though SMIS was in place in their universities, it is not being sufficiently utilized by users in the programme, and that system administrators spent several hours dealing with learner/learning issues related to the use of SMIS. It was also revealed that learners in distance learning teacher training programmes spent long hours in queues during residential sessions, in order to seek assistance from system administrators, with a view to resolving issues and obtaining information on SMIS. Due to this, they would end up missing lessons, classes, and sometimes examinations. The study revealed that some of the learners came from remote rural areas without internet access where, due to distance and lack of ICT

infrastructure, they were not able to use SMIS. Owing to this, the impact of this management system for student information was not fully felt.

The findings show that the majority of the learners in distance learning teacher training programmes were from remote areas of the country where electricity was not available, and thus getting access to internet for SMIS use was impossible. It was noted that teacher training programmes by distance learning sessions were organized in residential institutions (like secondary schools) with no networked computer laboratories. This was a disservice to SMIS users, given that they were not able to use the system to check their bio-data and other institutional information. These institutions should have had/should have working and networked computer laboratories to enable learners to use SMIS during the residential sessions.

It has been established already that 90% of the universities in Kenya have SMIS in place and that learners in distance learning teacher training programmes use it to check for fees, results, registration, and admission, among others. The main challenges faced by these learners, with regard to the use of SMIS, included the unavailability of sufficient ICT infrastructures like networked computers and road networks. Most of the students indicated that distance was a factor, given that the majority was from the remote areas of Kenya where ICT infrastructure was inadequate and inaccessible. Other respondents stressed that they did not have any nearby ICT infrastructure to enable them to use SMIS. Another issue highlighted was that the universities in Kenya offering teacher training programmes by distance learning would spend a lot of money on expensive newspaper advertisements when communicating to learners. Such costs could be cut down by the use of SMIS, and that the money saved could be used to improve the programme, network computer laboratories, and to increase the overall ICT infrastructure. This move, in their minds, would be a catalyst for promoting effective, efficient, high-quality and meaningful teacher training programmes by distance learning in Kenya.

Davis and Tearle (1999), who obtained similar findings in their research, underscored that ICTs have the potential to engage students to relate learning experience, to be viable for tomorrow's teachers, as well as to strengthen teaching-learning practices within educational institutions of higher learning. In order to enable the use of SMIS, there is a need for availability of ICT infrastructure to be in place. This infrastructure includes the use of smartphones, tablets, and computers. The use of SMIS goes a long way in compensating for limited internet capability in some remote regions in Kenya; at the same time, it gives students the chance to continue with their education without upsetting their work and family life.

Tsubira (2005), whose findings are similar (to some extent) to the findings obtained in this present study, asserted that any modern university is critically dependent on the smooth operation of SMIS using ICT facilities. The author further contended that these technology-related facilities should be established in order to pave the way for efficient and effective communication between learners, administration, and lecturers. This is to say, *learner-learner communication*, *learner-lecturer/teacher communication*, and *learner-administration communication*. Having efficient system administrators will further ensure that computers are serviced regularly, and that any problems emerging at early stages can be detected and resolved immediately, thus allowing for a smooth functioning and use of SMIS.

The findings are similar to those of Oliver (2002) who affirmed the need for ICT in higher education pedagogical practices, and who supported the call for ICT infrastructure to be established in order to provide many options and choices for universities in Kenya. These choices extend from *when* (anytime learning) students can choose to learn, to *where* (anyplace learning) they learn. The concept of 'any time, any place learning' is manifested in the diminishing traditional F2F classroom learning environment and the emergence of learning in a work-based setting with students being able to access programmes from anywhere and at any time within the country.

## V. CONCLUSIONS

Based on the findings on this study, and in conjunction with the research objective, research question, and research hypotheses, a mechanism should be devised to provide ICT infrastructure (such as good road networks, internet, and electricity in remote and rural parts of Kenya). The aim of this much needed initiative would be to give students the required access to SMIS, and to allow them to use the said system without interruption during their academic pursuits from any part of the country, anytime and anywhere.

As has already been established in this paper, 90% of universities in Kenya have adopted and implemented teacher training programmes by distance learning (as a core instructional delivery mode and methodology). Experience, in both developed and developing countries, has shown that universities in Kenya should engage in inter-university cooperation in remote regions. This can be achieved by establishing and running research centres that have sound student support services, with adequate ICT infrastructure, which can be maintained to support teacher training programmes by distance learning in Kenya.

The government of Kenya should put in place a mechanism that eliminates frequent power disruptions which would limit access to SMIS. One way to attain this objective is to ensure that there is adequate technical support and standby power generators in all institutions of higher learning.

The internet network service providers should stretch the network cables to the rural areas to enable distance learning users to access SMIS just like their counterparts in the urban areas. Without internet access, it would be virtually impossible to use SMIS. The government of Kenya should make this a priority.

For future/further study, a qualitative research should be conducted to obtain in-depth information about personal attributes and about the use of SMIS to facilitate learning in teacher training distance learning programmes in all universities in Kenya.

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