Assessment of ICT Integration in Pedagogy in Technical Training Institutions in Nyeri and Nairobi Counties, Kenya

*Gatembu R. Mwangi, Njoka Johannes, Kimosop Maurice and Murumba W. Joan
Karatina University, P.O. Box 1957-10101, Karatina, Kenya

*Corresponding author's emil address: gatemburm@gmail.com

Abstract

Information and Communication Technology (ICT) provides an array of powerful tools that can help in transforming the present isolated teacher-centered and textbook-bound classroom pedagogy into technology-enriched student focused and interactive instructional environments. The purpose of this study was to assess the level of integration of Information and Communication Technology in pedagogy in technical training institutions in Nyeri and Nairobi Counties in Kenya. This study was guided by the Adaptive Structuration and Technical Pedagogical Content Knowledge (TPACK) theories as the theoretical framework. The study employed the positivism research philosophy and adopted the descriptive research design. The target population comprised of 10 principals, 1006 lecturers and 10 bursars. Purposive sampling technique was used to select 10 bursars and 10 principals. Stratified random sampling technique was used to select the lecturers. The Krejcie and Morgan (1970) tables were used to arrive at the sample size of the lecturers. The total sample in the study consisted of 10 principals, 290 lecturers and 10 bursars, whose aggregate was 310 respondents. The questionnaires were used to collect data from the 290 lecturers while the 10 principals and 10 bursars were taken through an interview guide. The data that was gathered was subjected to both descriptive and inferential analysis using the statistical software SPSS. The findings of the study revealed that there is a significant difference between the level of ICT integration in instructional processes between TTIs in Nyeri and Nairobi County (P=0.00, t=0.073049). The study recommended the need to strengthen capacity building of teachers in retooling them on ICT integration in pedagogy as an important component in the teacher professional development and performance contracting requirements for promotion and career growth.

Keywords: Integration, ICT, Instructional Processes, pedagogy, Technical Training Institutions

INTRODUCTION

Educationists and curricularists in the contemporary society are emphasizing on the need to impart the learners with the 21st century skills. The 21st century skills refer to a group of skills also known as the "four Cs" of the 21st century that comprise of the critical thinking, communication, collaboration and creativity. They also include acquisition of life skills in flexibility, imitativeness, social skills, productivity and leadership. The literacy skills include the information literacy, media literacy and technology literacy. These skills are instrumental in promoting learner centeredness during the teaching and learning process. The 21st century skills are particularly essential in the realization of Sustainable Development Goals (SDGs) (Sarkar, 2012). It also involves technical skill and digital skill improvements that have been emphasized in the job markets which requires students from higher level institutions and technical training institutions to be prepared to shift jobs and to be flexible in acquiring skills.

Digital literacy refers to a broad range of knowledge, abilities, attitudes, and exposures developed for understanding and applying digital devices and related technologies to address social issues in politics, business, technology, and education (Addah, 2012). Therefore, the upsurge of TVET institutions to advance in technological development, digital literacy will be paramount in ensuring digital transformation and digital usage among their trainers and students. For instance, the new ways explored in developing and delivering courses effectively to students such as open distance learning will require digital devices. Hence to ensure efficiency in application and use of technology in teaching and learning of both trainers and students, digital literacy will be essential to provide knowledge on application of the digital devices (Blevins, 2018).

Boholano (2013) posit that we live in a fast-changing world, and that producing more of the same knowledge and skills cannot suffice to address the challenges of the future. Further that a generation ago, teachers could expect that what they taught would last their students a lifetime. Today, however he argues that, because of the rapid technological, economic and social changes, schools have to prepare students for jobs that have not yet been created, technologies that have not yet been invented and problems that we do not yet know will arise. According to Krüger & Rhiel (2012) whereas the content that is taught in schools is changing regularly especially as new innovations and knowledge continues to shape the future, the methodologies of teaching and the instructional technologies used in schools has unfortunately remained outdated. The situation is even more profound in rural areas especially in sub-Saharan Africa where the trend of classroom and textbook based educational system is becoming more and more outdated. Instructional management aims at improving teaching and learning processes through a deliberate emphasis on ways and means of instilling excellence in quality of instruction.

Statement of the Problem
The integration of Information and Communication Technology (ICT) in education has become increasingly important in recent years, as digital technologies continue to revolutionize the way we learn and teach. ICT has the potential to enhance teaching and learning by providing access to a vast array of digital resources and technologies, enabling educators to personalize instruction and improve student engagement.

Recently, the Kenyan government has embarked on investing heavily in ICT infrastructure in educational institutions, including schools, colleges, and universities, to promote the use of ICT in instruction. Teachers and educators are being trained to use digital tools and resources to support student learning, and students are increasingly being encouraged to use ICT to access information, collaborate with their peers, and create and share their own digital content.

However, there have been concerns that the rapid expansion of Technical and Vocational Education and Training institutions and associated enrollment has not been accompanied by the same growth of ICT integration in their operations. This is despite the Kenya Government supplying digital equipment such as the fiber optic cables to 43 TVET institutions in the year 2014. In particular, there are indications that teachers in TVET institutions are still comfortable with traditional instructional methods of talk and chalk. Therefore, this implies that although the Ministry of Education has taken steps to integrate ICT into all levels of training at TVET institutions, much work remains to be done before both teachers and students can fully fulfill its goals and retrieve from using the traditional teaching and learning approaches.

While there is a growing emphasis on the integration of ICT in education in the country, there is limited information on the level of ICT integration in TTIs in Nyeri and Nairobi counties, and the potential differences between the two counties. Therefore, there is a need to assess the level of ICT integration in instructional processes in these TTIs to inform future policies and interventions aimed at improving the use of ICT in instruction in Kenya.

Attempts to assess ICT usage has largely focused on secondary education perhaps due to reported earlier bias in ICT facilitation. However, the massive support for ICT in TVETs in the recent past has not been resonated on research front. The study by Abuya (2014) examined on the impacts of ICT integration in TTIs in Kenya. The study outlined the challenges faced by TTIs in ICT integration and also discussed on the general impact of ICT integration in all TTIs in Kenya. Another study by Agufana, Too and Mukwa (2018) determined the relationship between perceived ease of use and instructional use of ICT by lecturers in TTIs in Kenya. However, this study failed to discuss on the level of ICT integration in instructional use or processes.

In addition, among the studies conducted on ICT integration, very few have considered carrying out a comparative analysis to evaluate level of ICT integration among TVETs in different counties in Kenya. For instance, Maina, Ogalo and Mwai (2016) conducted a study on the pedagogical readiness of instructors towards achieving integration of ICT in TVET institutions in Kenya. The study was a comparative analysis between TVET institutions in Murang'a and Kiambu county, but it only examined the effects of pedagogical readiness on effective ICT integration in TVET institutions in Murang'a and Kiambu county. In this regard, this study sought to address the identified research gaps by assessing integration of ICTs in instructional processes in TTIs in the wake of digitalization and expansion of TTIs in Nyeri and Nairobi counties in Kenya.

Objectives of the Study
The study was based on the following two objectives;
i.   To assess the ICT integration in instructional processes in the Technical institutions in Nyeri and Nairobi Counties.
ii. Compare the levels of integration in the teaching and learning processes in the TTIs from the two Counties in Kenya.

Hypothesis
The study tested the following null hypothesis;
 Ho1: There is no significant difference between the level of ICT integration in pedagogy in technical institutions in Nyeri and Nairobi counties in Kenya.

LITERATURE REVIEW
Theoretical Review
The study was guided by the Adaptive Structuration Theory advanced by DeSanctis and Poole (1994) and Technical Pedagogical Content Knowledge (TPACK) model advanced by Koehle and Mishra (2005).

Adaptive Structuration Theory
It is based on Anthony Giddens' (1984) structuration theory. The theory is formulated as "the production and reproduction of the social systems through members' use of rules and resources in interaction". DeSanctis and Poole adapted Giddens' theory to study the interaction of groups and organizations with information technology, and called it Adaptive Structuration Theory (Barrett, 2018). The theory criticizes the techno centric view of technology use and emphasizes the social aspects. Groups and

organizations using ICT for their work dynamically create perceptions about the role and utility of the technology, and how it can be applied to their activities (Aktaruzzaman & Plunkett, 2016). These perceptions can vary widely across groups and may influence the way technology is used and hence mediate its impact on group outcome.

Adaptive structuration theory (AST) has been used for a number of years in the information systems discipline to study the use of new technologies in organizations (Elbasha & Wright, 2017). Organizations have adapted advanced ICT technologies aimed at bringing revolution to management activities through sophisticated technologies. Proponents of AST contend that developers and users of these systems (ICT) hold high hopes for their potential to change organizations for the better, but actual changes often do not occur, or occur inconsistently (Barrett, 2018). It examines the change process from two vantage points: firstly, the types of structures that are provided by advanced technologies, and secondly the structures that actually emerge in human action as people interact with these technologies.

The theory was relevant to this study because, ICT investments in TVETs have been done and aim at bringing about change and efficiency so as to meet challenges of labour requirements of 21st century (Deya, 2016). Indeed, Kenyan Government in collaboration with donors started with facilitating 43 institutions with digital equipment. Moreover, there have been efforts to improve ICT competencies of teachers and principals (MOE,2014). However, there has been doubts over achievement of the intended goals. According to Aktaruzzaman and Plunkett (2016), the impact of technology on management can only be realized through effective implementation. In this regard, the theory was useful in examining the status of ICT support both physical and human as well as scaling expected outcomes in relation to incorporation of ICT in the instructional processes of the TTIs.

Technical Pedagogical Content Knowledge (TPACK) Model
Technological Pedagogical Content Knowledge (TPACK) was introduced by Mishra and Koehler (2006) as a conceptual framework for teacher knowledge specifically with regard to technology integration (Akyuz, 2018). TPACK is built on Shulman's (1986) study of Pedagogy, Content and Knowledge with the addition of technological knowledge by Mishra and Koehler (2006), to explain effective teaching with the use of technology. Although TPACK was mentioned by Mishra and Koehler (2006), this idea is not new as several researchers have addressed a similar concept while describing the associations between technology, content, and pedagogy (Herring, Koehler & Mishra, 2016). TPACK framework has currently become a reference of many types of research in integrating technology for teacher education. It has emerged as a clear and useful framework for researchers working to understand technology integration in teaching and learning (Baran, Chuang, & Thompson, 2011). Hence it is applicable to this study.

Empirical Review
Maina, Ogalo and Mwai (2016) indicated that instructional management aims at improving teaching and learning processes through a deliberate emphasis on ways and means of instilling excellence in quality of instruction. It involves guiding and influencing teachers and students to strive towards desirable teaching and learning behaviors to achieve educational goals and objectives, ICT ably fills the gap. Meryo & Boit (2012) also asserted that learning institutions are designed to educate students, train for work as well as generate creativity which cannot be achieved without incorporating ICT management systems.

A number of studies have been done to examine extent of ICT integration on curriculum instruction. One such study is ICT use in education in Europe commissioned by the European Commission to benchmark access, use and attitudes to ICT in schools in 31 countries across Europe (European Commission, 2013). Data was collected using questionnaires and analysed using descriptive statistics. Based on over 190,000 responses from teachers, students and head teachers, the survey came up with a number of key findings. Among notable findings is that digital resources such as exercise software, online tests, data logging tools and computer simulations were rarely used during lessons (Pradhan, Arvin, Nair & Bennett, 2020). It was also noted teachers are slow in abandoning traditional methods in classroom instruction.

The schools in the various South-east Asian economies are continuously undergoing radical changes and these changes are bringing structural shift in the educational practices across all levels of education (Afzaal,2012). Several structural reforms are not only overhauling the school curriculum and teaching-learning methods but also integrating ICT as a part of pedagogy to support the teaching and learning. It is for this particular reason that school systems are faced with intensive pressure to use ICT to enhance students' learning (Shukla & Yadav, 2019). In this regard, principals have been assigned an additional responsibility of not only working with technology but to introduce the technology as a part of pedagogy to enhance teaching and learning through it.

A study was conducted by Afzaal (2012) on school administrators use of ICT in management of primary schools in Brunei. The study surveyed 96 Bruneian primary schools' administrators (principals) in using the Information and Communication Technologies (ICT). Data was collected using questionnaires and analysed using both descriptive and inferential statistics. The study found that although there is adequate ICT facilities integration of ICT in teaching and learning is still at infancy stage. The findings are in tandem with UNESCO (2017) observation that the focus on supply of ICT equipment is not a guarantee to integration in teaching and learning. There is need to design ICT integration strategies to rationalize heavy ICT investments. The government of Kenya has heavily supported TVETs with ICT facilities in order to position them address the skill challenges of this millennium. There is need to evaluate how the ICT equipment have been utilized in TVET institutions.

Oyeronke and Fagbohun (2013) assessed computer and ICT Skills among secondary school teachers in Ota Ogun State in Nigeria. Specifically, the study focused on training, level of certification and willingness to acquire ICT skills. Moreover, the study sought to find out to what extent teachers integrate ICT in teaching and learning as well as in the administrative tasks. Data was collected using questionnaires and analysed using descriptive statistics. The study found that majority of teachers has undergone some level of training and are interested in ICT training. However, when it comes to integration of ICT in teaching and learning this is limited to word processing and power point presentation.

These findings were also corroborated by Sani (2014) in a review on status of Integration of ICT in educational practices in the same country in a study on ICT integration in schools in Enugu state. There is need therefore to find out how it compares to Kenya with regard to TVETs in which ICT is expected to bring about reform in vocation education and learning and notably enhance innovation, problem solving and creativity.

In Kenya, the National Commission Science and Technology (2014), undertook a baseline survey to assess the ICT capacities and competencies in Selected Kenyan secondary schools in 2007. One of the survey's aim relevant to the proposed study was to describe the level of ICT use by students, teachers and administrators It was based on qualitative as well as quantitative information. In this baseline survey both descriptive and explorative research designs were employed. A sample of 810 respondents were selected from 18 national schools and 81 schools of excellence. The NCST found that teachers to a less extent used ICT in either daily and/or weekly teaching and instruction purpose. Further, it was found that, though secondary school teachers acquired computer skills, they used the same to a less extent.

A study closer to this study on ICT adoption in the management of TVET institutions in Nairobi County was carried by Mwangi (2016). One of the objectives relevant to the proposed study was to examine the levels of usage of ICT in management of TVET institutions. Simple random sampling was used to select sample of TVETs institutions. Data was collected using interviews, observation checklist and questionnaires. Data was analyzed both qualitatively and quantitatively. The study focused on administrative issues such as student registration, communication and online marketing. The proposed study will be broader and in addition will focus on ICT integration in administrative tasks, management and instruction. Moreover, the study by Mwangi (2016), was limited to TVETs in urban setting while the proposed study will draw comparatives in both urban and rural set up.

METHODOLOGY

The study employed the positivism research philosophy and adopted the descriptive research design. The target population of the study consisted of 10 principals, 1006 lecturers in Nairobi (693) and Nyeri (313), and 10 bursars. To obtain a representative sample, a purposive sampling technique was employed to select the 10 bursars and 10 principals. The sampling frame was then stratified according to the TVET institutions; each TVET institution formed a stratum, thus creating a total of 10 strata. Stratification helps ensure that each subgroup within the target population is adequately represented in the sample. After stratification, proportionate sampling was applied to select participants from each stratum. Using the Krecjie and Morgan (1970) table, a sample of 290 lecturers was proportionately sampled. Thus, the final sample size for the study consisted of 10 principals, 290 lecturers, and 10 bursars, totaling 310 respondents. The study used the primary data collection methods which comprised of questionnaires and interview guide. The questionnaires were administered to the 290 lecturers while the 10 principals and 10 bursars were taken through an interview by the researcher at their own convenient time. The data that was gathered was subjected to both descriptive and inferential analysis using Statistical Package for the Social Sciences (SPSS) software Version 21.

RESULTS AND DISCUSSION

The first objective of the study was to assess the level of ICT integration in instructional processes in TTIs in Nyeri and Nairobi Counties in Kenya. The findings on level of ICT integration in the two institutions are presented in table 1 below.

Table 1: Level of ICT Integration in Instructional Processes

Statements	SD	D	MA	A	SA	Mean	Percentage avarage
The institution invests heavily in e- learning systems.	6.90%	9.91%	14.22%	40.52%	28.45%	3.74	74.8%
The institution has invested in training staff who operate the e-learning systems.	7.33%	12.07%	16.81%	32.33%	31.47%	3.69	73.8%
The institution has invested in computer hardware used by e-learners.	3.88%	8.62%	15.95%	40.52%	31.03%	3.86	77.2%
The institution has invested in software that enable lecturers to easily prepare their schemes of work and lesson plans.	7.76%	10.78%	16.81%	34.05%	30.60%	3.69	73.8%
The institution has invested in training of lecturers on presentation of online lessons.	6.90%	8.62%	14.66%	39.22%	30.60%	3.78	75.6%
The institution has invested in software that allow online video lessons such as google meet and zoom meeting.	8.19%	14.66%	14.66%	33.19%	29.31%	3.61	72.2%
The institution has invested in the use of interactive white boards for conducting physical lessons in classrooms.	5.17%	10.78%	15.09%	40.52%	28.45%	3.76	75.2%
The institution has invested in training of lecturers in using the teaching equipments such as interactive white boards and flipped classrooms.	9.48%	12.93%	17.67%	31.47%	28.45%	3.56	71.2%
The institution has invested in e-library, e-journals, e-books.	9.48%	13.36%	18.10%	34.48%	24.57%	3.51	70.2%

Key: SD-Strongly Disagree, D-Disagree, MA- Moderately Agree, A- Agree, SA-Strongly agree

The results from Table 2 indicated that 28.45%, 40.52% and 14.22% of the respondents strongly agreed, agreed and moderately agreed respectively with the statement that the institution invests heavily in e-learning systems. While 9.91% and 6.9% disagreed and strongly disagreed respectively. The percentage average of the responses was 74.8% implying that most of the respondents (83.19%) agreed the institution invests heavily in e- learning systems.

The results also found that 31.47%, 32.33% and 16.81% of the respondents strongly agreed, agreed and moderately agreed on the statement that the institution has invested in training staff who operate the e-learning systems. On the other hand, 12.07% disagreed and 7.33% strongly disagreed. This implied that majority of the respondents (80.61%) agreed that the institution has invested in training staff who operate the e-learning systems, this was also confirmed by the percentage average of responses of 73.8%.

Moreover, the findings regarding whether the institution has invested in computer hardware used by e-learners revealed that 31.03% of the respondents strongly agreed,

40.52% agreed and 15.95% moderately agreed. Additionally, 8.62% and 3.88% disagreed and strongly disagreed respectively. This meant that most of the respondents (87.5%) agreed that the institution has invested in computer hardware used in e-learning and this was also confirmed by the percentage average of the responses of 77.2%. These findings concurred to those of Raiham & Shanim (2011) which showed that web-based or online instruction in TVET system in Bangladesh are leapfrogging while in Korean TVET institutions e-Learning is extensively used. Oyeronke and Fagbohun (2013) study also indicated that majority of teachers in Nigeria have undergone some level of training and are interested in ICT training. However, when it comes to integration of ICT in teaching and learning this is limited to word processing and power point presentation.

Furthermore, findings indicating whether the institutions have invested in softwares that enable lecturers to easily prepare their schemes of work and lesson plans showed that 30.6% strongly agreed of the respondents, 34.05% agreed, 16.81% moderately agreed, 10.78% disagreed and 7.76% strongly disagreed. The percentage average of the responses was 73.8% meaning that most of the respondents (81.46%) agreed that institutions have invested in softwares that enable lecturers to easily prepare their schemes of work and lesson plans.

The results also found that 30.6%, 39.22% and 14.66% of the respondents strongly agreed, agreed and moderately agreed concurrently with the statement that the institutions have invested in training of lecturers on presentation of online lessons. While 8.62% and 6.90% of the respondents disagreed and strongly disagreed concurrently. The percentage average of the responses was 75.6% implying that majority of the respondents (84.48%) agreed that the institutions have invested in training of lecturers on presentation of online lessons.

On the other hand, 29.31%, 33.19% and 14.66%, of the respondents strongly agreed, agreed and moderately agreed respectively with the statement that the institutions have invested in softwares that allow online video lessons such as google meet and zoom meeting. Whereas, 14.66% disagreed and 8.19% strongly disagreed. This revealed that majority of the respondents (77.16%) agreed that the institutions have invested in softwares that allow online video lessons such as google meet and zoom meeting. Thus, resulting in a percentage average of the responses of 72.2%.

These findings were also in agreement with Hooker et al (2011) study which stated that ICT should facilitate virtual learning environments as well as developing learners 21st Century skills. This involves access to ICT facilities which involves access to efficiently integrate the new tools and methodologies in curriculum instruction. Whereas, Pradhan, Arvin, Nair and Bennett (2020) study showed exercise software, online tests, data logging tools and computer simulations were rarely used during lessons, and teachers are slow in abandoning traditional methods as classroom instruction.

The results regarding whether the institutions have invested in the use of interactive white boards for conducting physical lessons in classrooms also indicated that , 28.45% of the respondents strongly agreed, 40.52% agreed and 15.09% moderately agreed, 10.78% disagreed and 5.17% strongly disagreed. The percentage average of the responses was 75.2% meaning that most of the respondents (84.06%) agreed that the institutions have invested in the use of interactive white boards for conducting physical lessons in classrooms.

In addition, 28.45%, 31.47% and 17.67% of the respondents strongly agreed, agreed and moderately agreed on the statement that the institutions have invested in training of lecturers in using the teaching equipments such as interactive white boards and flipped classrooms. While 12.93% and 9.48% disagreed and strongly disagreed concurrently. These resulted to the percentage average of the responses of 71.2% which implied that majority of the respondents (77.59%) agreed that the institutions have invested in training of lecturers in using the teaching equipments such as interactive white boards and flipped classrooms.

The findings showing whether the institutions have invested in e-library, e-journals, e-books also indicated that 24.57% of the respondents strongly agreed, 34.48% agreed, 18.10% moderately agreed, 13.36% disagreed and 9.48% strongly disagreed. The percentage average of the responses was 70.2% meaning that majority of the respondents (77.15%) agreed that the institutions have invested in e-library, e-journals, e-books. Similarly, the survey by UNESCO (2014) outlined those Caribbean countries (particularly Anglophone) had higher integration levels of ICT assisted instruction, essentially ICT infrastructure including hardware, internet connectivity than most Latin American countries. Engida (2011) study also indicated that countries like Uruguay with strong ICT policies had higher levels of integration. There is need to find out whether strong ICT policy is commensurate with high levels of ICT integration in teaching and learning in TVET institutions.

Moreover, the principals and bursars who were interviewed were also requested to give their opinion with regard to Instructional processes;
A percentage total of the principals (59%) said that the KNEC curriculum policies put in place to ensure effective use of essential software in teaching and learning in classrooms are still inadequate. While 41% of the principals agreed that there is an increase in the supply and use of essential software in teaching and learning in their institutions.
The 78% of the bursars noted that the budgeted amount for the e-learning systems, lesson preparation software and teaching equipment is approximately 15% of the total institutional budget.

Test of Hypothesis
A t-test analysis was conducted to test the stated null hypotheses H_{01}: There is no difference between ICT integration in Instructional Processes in TTIs in Nyeri and Nairobi Counties in Kenya. Figure 1 below present the mean results of the level of ICT integration in instructional processes.
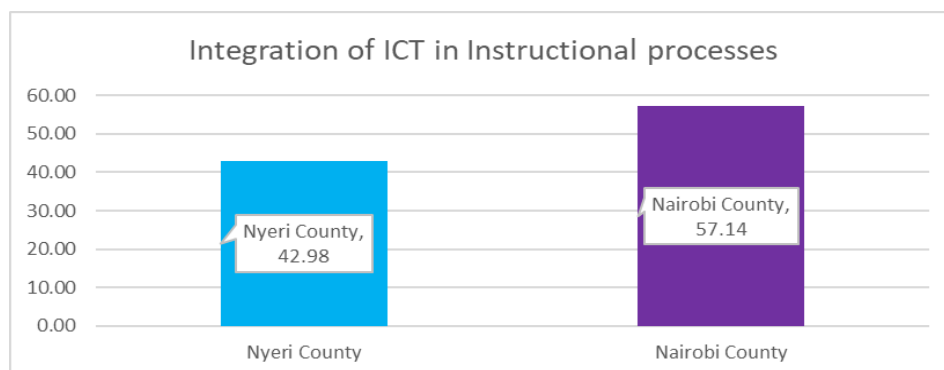

Figure 1: Level of Integration of ICT in Instructional Processes in TTIs in Nyeri and Nairobi Counties

The aggregate results from Figure 1 in regard to the level of ICT integration in instructional processes found that TTIs in Nyeri County had 42.98% while TTIs in Nairobi County had 57.14%.

Moreover, t test was used to determine there was a significance difference in ICT integration in institutional process between the two institutions. Results of the analysis are presented in table 2 below.

Table 2: T-test Analysis for ICT Integration in Instructional Processes

Variables	Counties	Percent %	Mean	T-statistic	P-value
Av_instructional processes	Nyeri	42.98	2.552867	0.085745	0.000
	Nairobi	57.14	3.394033	0.10728	
	Total		5.94	0.073049	

The results in table 4.5 revealed that the t-statistic value for TTIs in Nyeri County was 0.0857 while that of Nairobi County was 0.1073, and the p-value was (0.000), which was less than the alpha value of 0.05. This demonstrated that there is a significant difference between the level of ICT integration in instructional processes in TTIs in Nyeri and Nairobi County. Thus, the null hypothesis was rejected.

CONCLUSION AND RECOMMENDATIONS

The study concluded that there was a higher level of ICT integration in instructional processes for TTIs in Nairobi County than in Nyeri county. The study also rejected the null hypothesis.

From the findings of the study, the following recommendations are made;
i.   The Kenyan government should increase investment in ICT. Although the respondents agreed that TTIs in both Nyeri and Nairobi counties invest in ICT integration in instructional processes, there is still room for improvement. It is recommended that TTIs increase their investment in ICT to ensure that students have access to the latest technologies and resources.
ii.   Policy makers and the TTIs management should address the discrepancy between Nyeri and Nairobi counties: The significant difference in the level of ICT integration between TTIs in Nyeri and Nairobi counties highlights the need for further investigation. TTIs in Nyeri could benefit from studying the best practices of TTIs in Nairobi and implementing them in their instructional processes.
iii. TTIs should provide professional development opportunities for teachers and staff to help them develop the skills necessary to effectively integrate ICT into instructional processes.

REFERENCES

Abuya, T. K. (2014). Impacts of Adopting ICT Integration in Technical Training Institutions of Kenya. *International Journaof Research In Information Technology*, *2*(5), 551-558.

Addah, J. (2012). Computer literacy and E-learning: Attitudes among first year students in a Ghanaian medical school. *International Journal of Computer Applications*, *51*(22), 21-25.

Afzaal H. S. (2012). A Preliminary study of school administrators' use of information and communication technologies: Bruneian perspective. *International Journal of Education and Development using Information and communication Technology, 8*(1), 29-45

Agufana, P. B., Too, J. K., & Mukwa, C. W. (2018). Assessment of perceived ease of use and instructional use of ICT by lecturers in technical training institutions in Kenya.

Aktaruzzaman, M., & Plunkett, M. (2016). Adapting Structuration Theory as a Comprehensive Theory for Distance Education: The ASTIDE Model. *European Journal of Open, Distance and E-Learning*, *19*(1), 19-35.

Akyuz, D. (2018). Measuring technological pedagogical content knowledge (TPACK) through performance assessment. *Computers & Education*, *125*, 212-225.

Amukhuma, C. E. (2018). *Challenges Facing the Implementation of Integrated Financial Management Information Systemin Technical and Vocational Education and Training Institutions in Nairobi County, Kenya* (Doctoral dissertation, KCA University).

Anita, R. & Smriti, M. (2013). ICT skills and attitude as determinants of ICT. *Pedagogy Integration European Academic Research*, 1(3).

Baran, E., Chuang, H. H. & Thompson, A. (2011). TPACK: An emerging research and development tool for teacher educators. *TOJET: The Turkish Online Journal of Educational Technology*, 10(4), 370–377.

Barrett, A. K. (2018). Technological appropriations as workarounds: Integrating electronic health records and adaptive structuration theory research. *Information Technology & People*, *31*(2), 368-387.

Blevins, B. (2018). Teaching digital literacy composing concepts: focusing on the layers of augmented reality in an era of changing technology. *Computers and Composition*, *50*, 21-38.

Boholano, H. (2013). ICT based instruction in a constructivist classroom. *Int .J. Comp. Educ. Dev.,* 15(2), 124-136.

Chidobe, R. (2015). Extent of ICT application in the management of administrative and student personnel records in the public universities in Enugu State, Nigeria. *Journal of Education, 5(4), 64-61.*

Deya, J. (2016). *Relationship between dynamic capabilities and competitive advantage of Technical, Vocational and Entrepreneurship Training Institutions in Kenya* (Doctoral dissertation, Business Administration (Strategic Management), JKUAT).

Dixon, R. A., & Hutton, D. M. (2016). STEM and TVET in the Caribbean: A Framework for Integration at the Primary, Secondary and Tertiary Levels. *Caribbean Curriculum*, *24*, 1-26.

Elbasha, T., & Wright, A. (2017). Reconciling structure and agency in strategy-as-practice research: Towards a strong-structuration theory approach. *M@ n@ gement*, *20*(2), 107-128.

Engida, T. (2011). *ICT-enhanced teacher development model. UNESCO, IICBA*. Addis Ababa, Ethiopia: UNESCO-IICBA.

European Commission. (2013). The use of ICT in education: A survey of schools in Europe. *European Journal of Education* , 4(8), 11-27.

Herring, M. C., Koehler, M. J., & Mishra, P. (Eds.). (2016). *Handbook of technological pedagogical content knowledge (TPACK) for educators* (Vol. 3, pp. 189-200). New York: Routledge.

Hooker, M., Mwiyeria, E., Waweru, S., Ocharo, M., Bassi, R., Palmer, L., & Clarke, D. (2011). *TIVET ICT baseline survey*. TIVET Institutions

Hutchison, A. and Reinking, D., (2011). Teachers' perceptions of integrating information and communication technologies into literacy instruction: a national survey in the United States. *Reading Research Quarterly*, 46, 312-333.

Juma, K. S., Raihan, M. A., & Clement, C. K. (2016). Role of ICT in higher educational administration in Uganda. *World Journal of Educational Research,* 3(1), 1.

Kanwar, A., Balasubramanian, K., & Carr, A. (2019). Changing the TVET paradigm: new models for lifelong learning. *International Journal of Training Research*, *17*(sup1), 54-68.

Khan, M. S. H., Bibi, S., & Hasan, M. (2016). Australian technical teachers' experience of technology integration in teaching. *Sage Open*, *6*(3), 2158244016663609.

Kimosop, M. & Mulwa. D. (2016). Towards an ICT integrated management of school curriculum: A review of the status in secondary schools in Uasin-Gishu and Nandi Counties, Kenya. *Journal of Educational Policy and Entrepreneurial Research*, 3(4), 49-59.

Kipchumba, F. S. (2021). Teachers' readiness to implement ICT for teaching and learning of science in Public Secondary Schools in West Pokot County, Kenya.

Kiplangat, S. H. (2021). *An Evaluation of Access to Technical Training in Tvets Using Technology in Marginalized Kenya. A Focus of West Pokot and Trans–Nzoia* (Doctoral dissertation, University of Nairobi).

Kozma, R. B. (2011). *The technological, economic, and social contexts for educational ICT policy in R. B. Kozma, (ed.), Transforming Education: The Power of ICT Policies.* Paris: UNESCO.

Kristiawan, M., & Muhaimin, M. (2019). Teachers' obstacles in utilizing information and communication technology. *International Journal of Educational Review*, *1*(2), 56-61.

Krüger, J., & Rhiel, M. (2016). *Determinants of ICT infrastructure:A cross-country statistical analysis, Darmstadt Discussion Papers in Economics*, No. 228.

Latchem, C. (2017). *ICTs, blended learning and TVET transformation*. Using ICTs and Blended Learning in Transforming TVET, 27.

Lawrence, J. E., & Tar, U. A. (2018). Factors that influence teachers' adoption and integration of ICT in teaching/learning process. *Educational Media International*, *55*(1), 79-105.

Maina, M. T. M. (2018). An Audit of ICT Funding Towards Effective Integration of ICT in Selected TVET Institutions in Kenya. *COMMISSION FOR UNIVERSITY EDUCATION*, 220.

Maina, T. M., Ogalo, J., & Mwai, N. (2016). The Pedagogical Readiness of Instructors towards Achieving Integration of ICT's in TVET Institutions in Kenya. *Research in Pedagogy*, *6*(1), 55-65.

Meryo D. K., & Boit J. M. (2012). *The challenges of using information commuinication technology in school administration in Kenya*. Moi University.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record*, *108*(6), 1017-1054.

MOE. (2012). *Sessional Paper No. 10 of 2012 on Kenya Vision 2030*. Nairobi: Government Printer.

MOE. (2014). *Report on Ministry achievements in the last one year*. Nairobi: Kenya.

Mugiraneza, J. P. (2021). Digitalization in teaching and education in Rwanda. *The Report*, *28*.

Murgor, T. K. (2015). Challenges Facing Adoption of Information Communication Technology in African Universities. *Journal of Education and Practice*, *6*(25), 62-68.

Muyaka, J., & Kitainge, K. M. (2021). Implementation Of Whole Youth Development Skills in Kenya's TVET Institutions.

Mwalongo, A. (2011). Teachers' perception about ICT for teaching, professional development, administration and personal Use. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*. 7(3), 36-49.

Mwangi, J. (2016). *ICT Adoption In The Management Of TVET Institutions In Kenya* (Doctoral dissertation, University Of Nairobi).

NCST. (2010). *ICT capacities and capabilities in secondary schools in Kenya*. Nairobi, Government Printer.

Obwoge, M. E., & Kibor, S. J., (2016). Factors influencing trainee career choice in TVET institutions in North Rift Kenya. *Social Sciences*, *3*(03), 2016.

OECD (2014), *Measuring innovation in education: A new perspective*. Paris: OECD Publishing.

Oyeronke, A & Fagbohun, M. (2013). An Assessment of computer and ICT skills among secondary school teachers in Ota Ogun State. *Library Philosophy and Practice (e-journal). Pape*r 846.

Patra, J. N., & Mete, J. (2014). The Role of ICT in improving the Quality of School Education in India. *International Educational E-Journal*, *3*(2), 2277-2456.

Peeraer, J., & Van Petegem, P. (2011). How to address integration of ICT in teaching practice? Research on factors influencing the use of ICT in education. *Education in a technological world: communicating current and emerging research and technological efforts*, 237-244.

Pradhan, R. P., Arvin, M. B., Nair, M., & Bennett, S. E. (2020). Sustainable economic growth in the European Union: The role of ICT, venture capital, and innovation. *Review of Financial Economics*, *38*(1), 34-62.

Raihan, M. A., & Shamim, M. R. H. (2013). A study to explore the practice of ICTs in TVET in Bangladesh and South Korea. *International Journal of Engineering Science and Innovative Technology*, 2(4), 351–360.

Roberts, R., & Sikes, J. (2011). How IT is managing new demands: Mckinsey Global Survey Results. *Mckinsey on Business Technology*, 22(Spring), 24-33.

Rowley, J. (2014). Designing and using research questionnaires. *Management research review*.

Saina, A. K., Mukwa, C., & Kyalo, M. (2018). TVET in Driving Sustainable Development: Strategies for Mitigating Challenges Associated with the Integration of ICT in Instruction of Engineering Subjects. *Africa Journal of Technical and Vocational Education and Training*, *3*(1), 229-237.

Sani A.(2014) Towards the effective integration of ICT in educational practices; a Review of the situation in Nigeria. *American Journal of Science and Technology.* 1(3), 116-121.

Sarkar, S. (2012). The role of information and communication technology (ICT) in higher education for the 21st century. *Science*, *1*(1), 30-41.

Tok, B. R., & Sora, M. (2013). Perspective of emerging integrating technology (ICT) in learning and teaching. *International Journal of Information and Education Technology*, *3*(2), 282.

Tomaro, Q. P. V. (2018). ICT integration in the educational system of Philippines. *Journal of Governance and Public Policy*, *5*(3), 259-282.

UN. (2015). *Sustainable Development Goals.* Newyork: UN

UNESCO. (2011). *Transforming education: The power of ICT policies*. Paris:

UNESCO. (2014). *ICT competency standards for teachers (policy framework, competency standards modules, implementation guidelines).* Paris, UNESCO

UNESCO. (2015) . Unleashing the Potential: Transforming TVET, Paris.

UNESCO. (2017). *Beyond access, ICT enhanced innovative pedagogy in Asian Pacific Countries*. UNESCO: Bangkok.

Wilberforce, K. P. (2017). Influence of awareness and institutional accessibility on the choice of training by students in technical institutes of science and technology in Bungoma county, KENYA. *European Journal of Education Studies*.

World Bank. (2017). *Survey of ICT and education in Africa: Kenya country report*. InfoDev ICT and Education Series. World Bank, Washington, DC. © World Bank.