UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

AN EVALUATION OF ACCESS TO TECHNICAL TRAINING IN TVETs USING TECHNOLOGY IN MARGINALIZED KENYA. A FOCUS OF WEST POKOT AND TRANS – NZOIA

Sang Hillary Kiplangat

Supervisor

Prof Daniel Orwa

A Project Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Technology Management, School of Computing and Informatics, University of Nairobi.

JULY, 2021

This research project is my original work and has not been presented for a degree in any other University.

Signature……Date: 4th July 2021.

Hillary Kiplangat Sang

Signature……Date: 19th August 2021

Prof Daniel Orwa

ACKNOWLEDGEMENT

It has taken effort for me to complete this project. However, it would not have been possible without the kind support and assistance of others. I wish to extend my sincere appreciation and acknowledgement to all of them.

First, I wish to express my sincere gratitude to God Almighty for the peace and patience He provided me during this project. I am highly indebted to Prof Daniel Orwa, my supervisor for his guidance and constant supervision as well as for providing necessary guidance and information regarding my project. I also wish to express my thanks to Mr. Christopher A. Moturi, one of the panelists for his support in completing the project.

I would like to express my gratitude towards my wife Mrs. Annastacia Sang and my children for their kind cooperation and encouragement which helped me in completing this project.

Lastly, I wish to express my thank you to the county government of Trans Nzoia, Ministry of Youth Affairs, Kitale, and Kapenguria TVETS for providing me with the data required for this project

ABSTRACT

This study is particularly concerned with how technology can be used to enhance educational access among TVETs in Kenya's marginalized areas. A comparison of available ICT educational resources has been evaluated. The study was guided by the following objectives: Identify the ICT challenges affecting vocational educational access in the marginalized areas of Kenya, identify a technological solution for vocational educational access in the marginalized areas of Kenya and evaluate how the identified technological solution has improved vocational educational access in marginalized areas of Kenya. This study used a longitudinal study design, where variables were compared as of March 2020- Pre-COVID (baseline) and in May 2021 - Post Covid. The target population was 650 respondents and a sample of 130 respondents was employed. However, 80% (105) respondents took part in the study. The study findings indicated that educational Access challenges were shown to negatively impact improved access ($\beta = 0.121$, $p = 0.049$). Pre COVID-19, the level of access was at 12.1% as indicated by the beta coefficient ($\beta=0.121$). However post-COVID 19, the educational access was at 95.4% ($\beta=0.954$) for the studied institutions. This meant that the system which was put in place during this period improved educational access to that extent. The study concluded that there were ICT challenges affecting vocational educational access in the marginalized areas of Kenya especially Pre-COVID 19. Once the infrastructure for ICT was developed virtual learning systems were developed to promote educational access based on a prescribed educational access. The virtual learning systems incorporated systems such as the google classrooms and other virtual models to ensure that teachers could continue teaching. These technologies improved access significantly. Evidently, technological equipment including computers, laptops, faster internet, and reduced access costs to schools and more online assessment performance for students, teachers and administrative staff was witnessed between the period. The study made the following research recommendation. The public and private sectors should come together in addressing the access challenges. The governments should also develop a universal framework that will ensure implementation of virtual learning systems in TVET institutions.Further studies recommend further studies on the effectiveness of the systems implemented especially with regard to hand-on training.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

BYOD - Bring your own device

ICT - Information Communication and Technology

OECD - The Organisation for Economic Co-operation and Development

PISA - Programme for International Student Assessment (PISA)

PRIMER - The National Framework for Rural and Remote Education in Australia

RIC - Resource in Common

TBL - Technology-Based Learning

TVET - Technical and Vocational Education and Training

UNESCO-UNEVOC - International Centre for Technical and Vocational Education

DEFINITION OF TERMS

Digital Literacy – This is the ability of a person to find, ability evaluate, utilize, share, and also be able to create content by using information technologies and the Internet

Pedagogical – Relating to teaching

CHAPTER ONE:

INTRODUCTION

1.1 Background of the Study

There is an obvious need for successful execution of vocational education programs in TVETs for Kenya to stand out technologically at a global level. Despite the importance of vocational training to the development of both individuals and the society at large, there has not been much emphasis placed on the effective implementation of these programs in Kenya. The frequent occurrence of low students' participation in vocational education courses has been a great concern to all-well- meaning individuals, institutions, and industries. This has been an even bigger concern in the marginalized and rural areas of Kenya (Maina & Nyambura, 2019).

Despite the fact that the TVET sub-sector in Kenya's marginalized and rural communities has grown, student enrollment in vocational education courses remains low. This has led to problems of in-access of educational resources by these students especially because the students in these regions are not able to visit the institution for one-on-one learning and in some cases the schools in these regions are more than the available number of teachers. TVETs in the region on the other hand have no funding to acquire technological equipment necessary to assist teachers in content delivery, they have little knowledge on the kind of technological solution necessary to solve the access challenge and have no access to the technological solutions necessary to solve educational access challenge. It has therefore become difficult to meet educational access goals in these regions (Kintu, 2019).

1.2 Problem Statement

The limited access to vocational educational resources deny youth the necessary skills required to secure employment and denies the country much needed technological resources to drive the country towards achievement of its blueprint vision 2030 which identifies the important role vocational training institutions play in nation building. (Bozo & Chilibasi, 2019).

Despite TVETs in Kenya having the potential to enroll twice the number of students that universities enroll, they only enroll 48% of their capacity Garbutt, & Wanami, 2017). The

problem manifests itself in the country through the high unemployment rates of youth currently at almost 60% (Akala & Changilwa, 2018). There is a need to change this trend if Kenya is to become a middle upper-level income country by 2030 as postulated by the country's blueprint vision 2030. The country has lagged other economies such as Malaysia and India who were Kenya's equals less than 5 decades ago through heavy investments in vocational educational technology to enhance access (Kintu, 2019). The question therefore has remained on what needs to be done to enhance students' participation in vocational education courses in the country.

1.3 Objectives of the Study

i. dentify the ICT barriers to vocational educational access in Kenya's underprivileged areas.
ii. Identify a technological solution for vocational educational access in the marginalized areas of Kenya.
iii. Evaluate how the identified technological solution has improved vocational educational access in marginalized areas of Kenya

1.4 Research Questions

1. What are the ICT barriers to vocational educational access in Kenya's underprivileged areas?
2. Which technological solution is suitable for vocational educational access in the marginalized areas of Kenya?
3. How has the identified technological solution improved vocational educational access in marginalized areas of Kenya?

1.5 Significance of the Study

The study will assist TVETs in West Pokot and Trans Nzoia counties, as well as all other counties in general, because they will have access to remedies to low participation in their counties. The department of vocational and technical training will also benefit from the study as it will have a solution to the low enrollments in TVETs in the country. Better educational opportunities will transform the living conditions of marginalized communities. The provisioning of education through digital platforms will ensure that the marginalized communities secure the necessary skills (Novak, Tjoa, 2018). This empowerment will foster economic advancement among these communities (Mammon, 2017).

CHAPTER TWO

LITERATURE REVIEW

2.1 Educational Resources

Teachers' key weapon for smoothing out lessons and leaving a lasting impression on their students is authentic teaching materials (Al Azri, Al-Rashdi, 2014). Learners are motivated and interested in learning when they are given authentic educational resources. The availability of quality learning materials affects the quality of education being offered to students. The introduction of ICT in Education promised great gain, however, cost consideration is critical in picking which ICT investment to engage in. ICT alone is not the cure for improved learning outcomes. The selection of educational ICT projects must be done with caution for the achievement of desired goals (Piper, Zuilkowski, Kwayumba & Strigel, 2016). The teaching and learning process requires many and different digital educational resources. The various learning tools available include:

Open education resources are teaching, learning, and research materials that are either in the public domain or available under an intellectual property license that allows others to use them for free (Al Abri & Dabbagh, 2018). E-journals contain research findings or content written by and for the faculty in a scholarly format and are a critical part of library subscription for scholarly literature (Kenchakkanavar, 2014).In most educational setting the journals are accessed from the Journals Database and the other university's digital journal collections

E-book or electronic book refers to a text in digital form or digital reading material. The e-book is a computer file containing words, images, and sound displayed through a digital device screen (Bozkurt & Bozkaya, 2015).

2.2 Marginalized and Rural communities

Marginalized communities refer to a group of people who are systematically excluded from participating in meaningful economic, political, and social life (Maitland, 2018). ICT has the potential to address to a great extent the development needs of the marginalized communities in various aspects of the marginalized people. The use of ICT in creating solutions for the marginalized requires an understanding of the role ICT can play to bridge the digital gap. The provision of connectivity to the marginalized will to a great extent offers far-reaching benefits to many public services including education and health care (Maitland, 2018; Dunn, 2016).

ICT4Education promises to improve access even among the marginalized communities, though challenges related to design and pedagogy are key issues that require to be resolved (Kamal, Diksha, 2019).

Marginalized communities refer to people whose access to quality and sustainable education remains elusive. The marginalized and rural people operate with little or no resources at all which continues to impoverish their lives and those of their children (Okilwa, 2015). The definition of a marginalized community enables project leaders to indicate the project intentions, monitor the project and indicate if the project transformed the community (Prilleltensky, 2014). Marginalization can be viewed as the deprivation of the social, economic and psychological well-being of a people (Milner, 2013).

2.3 Role of ICTs for Teaching and Learning in TVET

ICTs are transforming education by reducing barriers to learning and making knowledge more accessible to everyone (Futrell & Geisert, 2014). Technology- enhanced learning will be critical in the establishment of a lifelong learning culture, and it has the potential to empower learners by providing many pathways and channels to satisfy their educational and training goals (Faw & Waller, 2016). As a result, it's not unexpected that technology-based learning (TBL) is gaining popularity around the world.

Computer- based training systems, multimedia systems, electronic performance support systems, telecommunications systems, and the Internet with World Wide Web services are all examples of TBL. The rate at which people access the Internet is expanding at breakneck speedTBL can improve teaching and learning, and it has the potential to be cost-effective because it allows for more flexibility in terms of training delivery time and place (Furst-Bowe, 2016). TBL may also make institutional policies on access and equity easier to implement (Obioma, & Emmanuel, 2019). Technology also allows for more adaptability in teaching and learning to fit the cognitive and learning styles of students.

Despite the fact that information and communication technologies (ICTs) are by far the most important component supporting the foundation of TVET, there is a scarcity of literature and research on their implementation and use in this field of education and training. According to Attwell (2019), " While there has been a plethora of research and debate on the use of information and communication technology in higher education, there has been

little work on the possible influence on vocational education and training." Even the UNESCO-UNEVOC International Centre for Technical and Vocational Education (UNESCO-UNEVOC) database had very little information on current ICT use in TVET. As a result, every effort was taken to discover papers relating to TVET when examining the literature and conducting research for this area.

When no acceptable TVET-specific articles could be found, publications focused on general education were assessed. The reader can draw suitable conclusions about the discussion's relevance to TVET. In adult education, Imel (2018) recognized four possible applications of ICTs: Technology as curriculum, technology as a delivery method, technology as a supplement to instruction, and technology as an instructional tool are all examples of how technology can be used in the classroom.

2.4 Barriers to the Integration of ICTs in TVET

While technology- enhanced education has a lot of promise, it also has some immediate drawbacks in terms of capital expenditures for gear and software, as well as equal access to erase technological barriers "Haves" and " Have-Nots," suitable ways for integrating technology across curricula, copyright difficulties, and the availability of pedagogically competent materials are some of the issues that need to be addressed. Teacher development is a fundamental issue for implementing technology- enhanced learning because information technologies are both exciting in their possibilities and frightening in the uncertainty produced by the rapid pace of change for most teachers (Council of Ministers of Education, 1997).

The Conference Board of Canada highlighted nine of the most prevalent problems experienced by businesses who have attempted to use ICTs for workplace learning in their report published in 2000. Lack of time, money, and support; technological and systemic restrictions; difficulty using ICTs; no result evaluation; resistance to change; lack of preparation; lack of communication; lack of leadership; and learner resistance. The following talk will concentrate on two major barriers: the digital divide and the cognitive divide. Stevens (2001) identified five impediments to ICT- mediated learning in TVET, including: Content and curriculum, appropriateness and efficacy of technologies, program quality and branding, stakeholder resistance to innovations, and the digital divide are all issues that need to be addressed.

2.4 Theoretical frameworks

2.4.1 A framework for poverty alleviation with ICT

The framework for poverty alleviation stated that knowing the many characteristics of the digital divide experienced by the marginalized can be used to improve the poor's living conditions. The framework supports other studies that have indicated that educational policies are critical for the success of such engagements (Kozma, 2005).

The model key components include appropriate strategies that can be used to ensure ICT delivers the desired goal in education and other aspects of people's lives. The framework for poverty reduction using ICT tries to reduce the digital divide gap by employing strategies that are sensitive to the wishes of the poor (Harris, 2002).

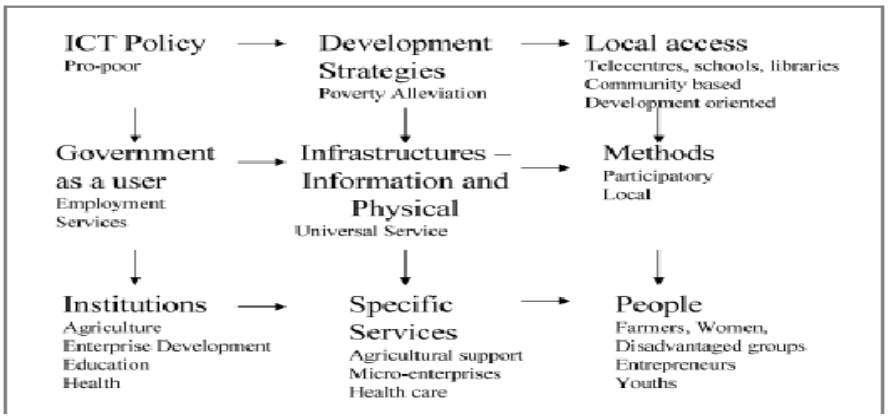


Figure 1: Framework for poverty alleviation with ICTs (Harris, 2002)

The Poverty Alleviation Framework equipped this research with the concept that research in ICT integration in rural areas should think about the poor, embrace government and other partners in building local access centers. The development of local educational initiatives should have the community member's involvement which ensures that local members support such projects.

2.4.2 FORE Framework

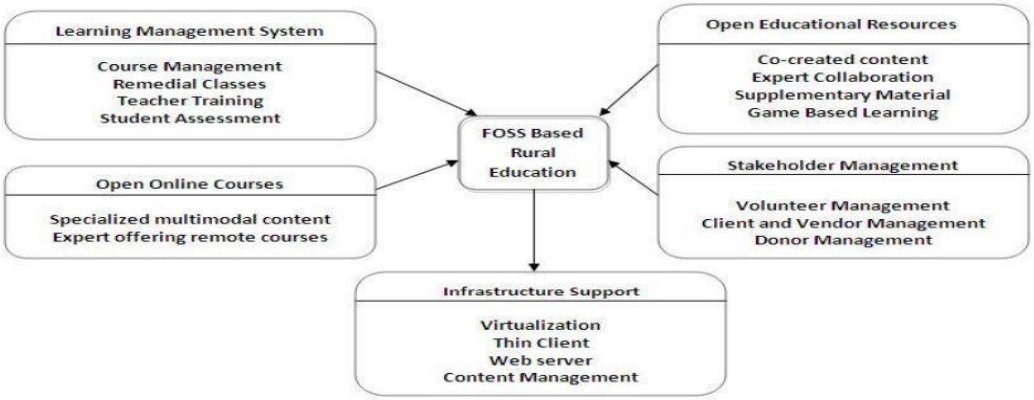


Figure 2: FORE Framework (Rekha, Adinarayanan, 2014)

The framework addresses the challenges of access to quality education materials in rural schools by incorporating the various open-source software and open education resources and other critical components like management in a learning center (Rekha, Adinarayanan, 2014). The FORE framework considered what the necessary parts for provisioning education are among the rural poor. The framework suggested that cost was a major hindrance to quality education. The Fore framework proposed an alternative and affordable solution driven by free and open-source software, open educational resources, content management solutions, management and local support and supporting infrastructure. The Fore framework proposed solutions to address the ICT infrastructure cost challenge which are major impediments in integrating ICT in education among the marginalized communities (Pringle & David, 2002). The Fore frameworks bring to this research the concept of free and quality open education resources, open-source software, appropriate hardware, and software and management necessary components in improving educational resources access for the rural poor.

2.4.3 UNESCO ICT in Education Integration Framework

The Framework identifies the required ICT Access resources in local areas and the level of ICT integration within the local community educational setup. The framework checks the progress of the ICT integration by reviewing various access components within the local communities. The components reviewed by the framework include no school with electricity connection, no school with radio sets, and television sets. The framework further checks the students' computer ration within the schools and availability of basic telecommunication infrastructure like telephone within the local schools. Internet connection within the local schools and no students using the internet outside the schools concludes the first part of this framework. The

extended part of the framework checks by gender the number of students enrolled at the tertiary level in ICT-related fields. The number of ICT-qualified teachers available at the primary and secondary level is considered by the framework (UNESCO, 2006; Zlotnikova, Weide, 2011). The framework can lay a basis on what local communities need to improve access to education through ICT and assess the level of ICT for Education implementation.

2.4.4 National Framework for Rural and Remote Education in Australia- PRIMER Model

The National Framework for Rural and Remote Education is made up of three components. The vision of the framework is to provide education to people in the rural area or the remote sections of the community. The other components are principles and enablers. The framework borrows strongly the concept of ICT Enabled Education and as such includes ICT as one of the Enablers in improving Education in rural areas. The framework identified teacher training, management support, relevant content, improved access channels, multiple access channels, community inclusion and partnership as key ingredients for ICT integration in rural areas (Spring, 2001). The PRIMER model supports this study by pointing out what to consider if ICT is to be used in addressing the challenges of the rural poor. From the model ICT and other social aspects of the people must be combined to bring desired results among the rural communities (Alkhawaldeh et al., 2015).

2.5 Solutions to improve access to educational resources for the marginalized communities

Chilo Book model

The Chilo book solution was developed to address the connectivity challenge and acts to serve in places where the internet connection is a challenge. The model relies on the advantages offered by mobile devices and the advancement of e-book file formats. The Chilo based e-book framework is one of the leading solutions in improving access to e-books through its advanced text manipulations and access capabilities. The chilo framework allows the content and both the EPUB3 and HTML5 file format. The EPUB3 format offers access to content in areas where no internet is available while the HTML5 format offers access to those in areas with internet connection. Studies conducted on the use of Chilobook model indicated that 47% of the people who used the Chiloe-book were from developing counties where connectivity challenges are prevalent (Hori et al., 2016).

Bring your own device Initiative (BYOD)

Bring your own device concept allows students to bring their phones, tablets and laptops to schools and use them as learning tools. Bring your own device project allows students to access learning content on their devices with little restriction from school management (Afreen, 2014). This model can be used by marginalized communities to bring the cost of education down because students own the devices so the cost of securing the device is met by the students or the parents. The BYOD project allows students to continue learning even when away from schools. Students receive instruction from the teachers through the use of delivery tools like Skype which is used to guide the students at a specific time when assistance is required (Budiman, 2013). Skype and other supportive instructional tools are used for a short duration hence students from marginalized zones can join in those short brief guidance sessions.

NATIONAL FRAMEWORK FOR RURAL AND REMOTE EDUCATION						
Vision	By age 18 each young person residing in rural or remote Australia will receive the education required to develop their full potential in the social, economic, political, and cultural life of the nation.					
Principles	• Students and families living in rural and remote Australia have specific needs which are the direct result of living in particular geographic locations. • The needs of rural and remote students should be met through local commitment and ownership as well as through predictable and sustained government funded initiatives.			• There is a high degree of variability in the characteristics of rural and remote communities, both within and between states and the Northern Territory. • The provisions of education in rural and remote Australia requires creative and flexible approaches that utilize leadership capacity at all levels, innovative technology and methodology, and whole of government approaches.		
Essential Enablers	**P**ersonnel	**R**elevant Curriculum	**I**nformation Communication Technologies	**M**ultimode Delivery	**E**nvironments	**R**esourcing
Key Challenges and Requirements	Training & Development Leadership/Succession Recruitment/Retention Diverse & reliable supply Success plans Incentives Family assistance	Pathways Standards Outcomes Programs consistent with national goals Articulated planning for life-long learning Access to VET Enterprise Education	Quality Access Content Broadband provision Affordability and accessibility Reliable infrastructure	Flexibility Innovation Structures Support of current modes ICT Training and Development for staff Broadening of best practice networks	Cultural Sensitivity Partnerships Community Support of industry, civic, education, government and nongovernment collaboration Identification and use of local expertise and leadership	Predictability Assuring Quantity Building Capacity Support for local for social capital building Funding for equitable access Disseminate best practice Whole of government approaches

The libraries sharing model

This is an initiative where libraries share the books that they have with the aim of increasing the total number of books available to its users. Libraries can resolve the access challenge by allowing librarians of other libraries to access some of their books. The libraries from the

marginalized communities can use these options to access these books if the lending library allows sharing with other libraries.

The libraries sharing model when made available then avails resources to the marginalized community children. The sharing by libraries is through sharing the print titles or when libraries are weeding out some of their old titles. The libraries also share their digital banks or their discovery systems which offer multiple search capability (Machovec, 2013).

The other sharing aspect is based on the resource in common (RIC) model. The model is based on the fact that libraries have some common resources which can be shared by putting all the common books together for use by a larger group of users (Acadia, 2016). The increased demand for e-books has made the old printed books become available for sharing. The demand for more space occupied by the print books demands that libraries weed some of the old titles hence avail them to needy users (Acadia, 2016).

2.7 Evaluation Framework

The study employed an evaluation framework to guide the efficacy of existing information systems in the different TVETs. This will be the basis for the Programme for International Student Assessment (PISA) (OECD 2019). This framework lays out a thorough strategy for documenting how students access and use ICT resources both within and outside of school, as well as how teachers, schools, and education systems incorporate ICT into pedagogical practices and learning environments. The framework enables researchers to investigate how system-level factors influence schools' and students' ICT experiences, how ICT availability and use interact with various teaching practices, and how these associations correlate with students' learning outcomes and other outcomes such as ICT skills and well-being.

i. The three key dimensions of this ICT assessment approach are:
ii. ii. ICT Access, which includes the availability, accessibility, and quality of ICT resources, with a focus on (connected) technology that can assist learning (e.g., digital learning resources, learning management systems, etc.)
iii. iii. Use of ICT, which includes the frequency, types, and modalities of ICT use by students in an informal, possibly unsupervised, learning and leisure environment, as well as in a supervised situation in the classroom, notably through teachers' pedagogical practices with ICT; it also includes alternative uses of ICT by teachers to support teaching.

iv. Students' ICT competencies, which include both attitudes and dispositions toward ICT use as well as core competency categories outlined in existing assessment frameworks for " digital literacy" (for learning and for leisure). To assess students' ICT abilities, a self-efficacy measure is presented.

v. This paradigm evaluates the relationship between students' access to and usage of ICT and three unique outcomes: cognitive success, student well-being, and ICT competency.

vi. This framework relies entirely on existing PISA frameworks to measure students' cognitive achievement as well as their well-being. It also proposes an approach to assessing students' competencies in ICT, which are defined here in a broad sense that includes students' attitudes and dispositions toward ICT use in diverse circumstances as well as digital literacy as a specialized domain.

Students' cognitive achievement

PISA assesses students' cognitive achievement by determining not just whether they can reproduce knowledge, but also whether they can extrapolate from what they've learned and apply what they've learned in new settingsIt emphasizes process mastery, conceptual understanding, and the ability to function in a variety of situations" (OECD, 2017a). PISA attempts to document literacy, which is defined as "students' ability to apply knowledge and skills in important disciplines, as well as to effectively analyze, reason, and communicate as they identify, interpret, and solve issues in a range of situations" (OECD, 2017a). For the sake of simplicity, the following will be evaluated using assessment scores.

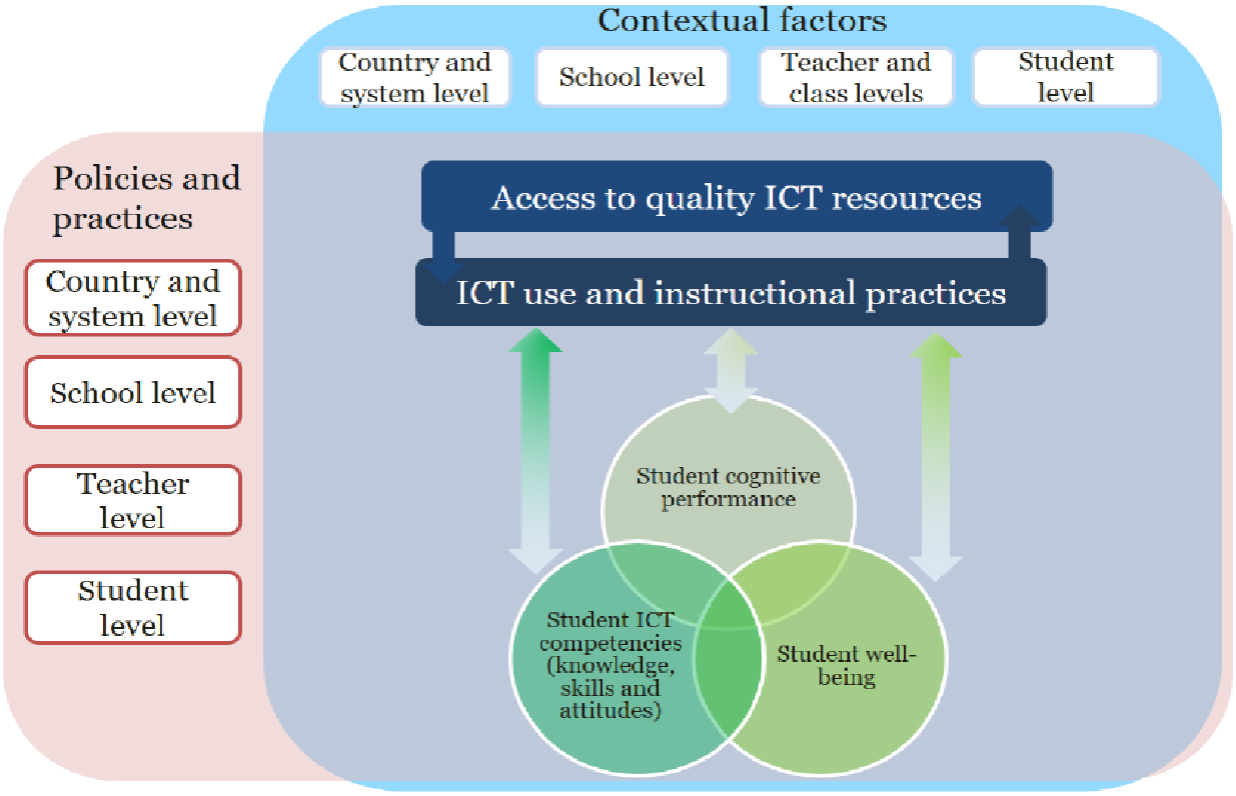
Assessing Students Well-being in PISA

The quality of students' life and their living conditions can be regarded as their well-being. There appears to be widespread agreement that well-being is a multi-dimensional construct containing both objective material and subjective psychological components. These many viewpoints are incorporated into the PISA 2018 framework for assessing well-being. The framework includes three other dimensions of well-being, each of which includes both objective and subjective components: self-related well-being, well-being in school environments, and well-being outside of school environments, in addition to students' overall perceived quality of life or life satisfaction (OECD, 2016a). Attitudes and dispositions toward ICT resources are used to measure them. Attitudes and dispositions are crucial to the learning process, according to research, and they contribute to human

development and well-being (EC, 2013; Almlund et al. 2011; Heckman, Stixrud and Urzua, 2006).

Students' competencies in ICT: Digital literacy

This framework, like past PISA cycles, takes a comprehensive view of ICT capabilities, which encompass the collection of knowledge, understanding, attitudes, dispositions, and skills required to survive in the digital era.



Source: OECD 2021Figure 3: PISA 2021 ICT Framework

Table 2.1: PISA 2021 ICT Framework

Access and Use	Students' cognitive achievement	Assessment Scores	Unit A
			Unit B
			Unit C
	Students Well Being	Attitudes and dispositions	Scale Ratings on Attitudes
			ICT Disposition rating
	Students' competencies in ICT	Digital literacy in defined competency areas	Information and data access, evaluation, and management
			Communication and information sharing
			Information and digital content transformation and creation
			Computational thinking and problem-solving in a digital context
			Appropriate ICT use (online security, safety and risk awareness and skills)

Table 2.2: Operationalization of Variables in the Evaluation Framework

Framework Construct	**Meaning**	**Matrix**
Factors Limiting Educational Access	Adequacy of technological hardware equipment	Number of ICT equipment
	Lack of Appropriate of Software	Number of software used for access
	Licenses issues	Level of Certification
Evaluation Framework	Level of resource sharing	Number of resources to access in the system
	Operational Costs management	Trends in costs to run the system
	Resource reliability	Number of system breakdown
Improved Access to Educational Resource	Number of Learning modules supported	Number of Learning modules supported
	Number of students with Access	Number of students with Access
	Stakeholders Access	Number of other students with Access

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The factors in this study were compared as of March 2020 and May 2021, using a longitudinal study design (Pre and post COVID 19). This was due to the desire to understand the correct situation as far as access to educational resources is concerned in Trans Nzoia and West Pokot Counties between the two time periods. The survey ensured that the marginalized and rural community conditions were understood and required statistical data was generated for developing and confirming the correctness of the model and the need for modification if such need was identified.

3.2 Target Population

This study target population included school principals, staff and students within the selected technical and vocational colleges in Trans Nzoia and West Pokot Counties. The study maximum available total population was 650

3.3 Sampling Design

Purposive sampling was used to pick different colleges already using different ICT educational learning systems. This was then compared using the evaluation framework to determine if there has been an improvement in access between the two time periods.

3.4 Sample size

Scientific research work demands that the sample size selected should be within 10% to 30% of the target population (Mugenda, Mugenda, 2003). The target population in the study was 650 respondents hence, considering that the sample size selected according to Patton (2006) should be within 10% to 30%, a 20% sample size was selected of the target population. The sample size was therefore 130 respondents. The sample consisted of the following 65 students, 22 lecturers and 18 administration staff.

3.5 Data Collections

This study used questionnaires as instruments of data collections due to the many advantages questionnaires offer in research work. Closed and open-ended questions were included in the questionnaires so that the research may benefit from both sorts of questions. Questionnaires could curb bias and are easy to administer through deep personal feelings or reactions that might not be captured. The study also used interviews for the TVET principals and country

staff. Other data was collected from secondary sources such as information provided by the TVET institutions, information from the county government.

3.6 Testing the research Instruments

A pilot test of the research instruments was conducted in TVETS in Kakamega County to enable modification if errors are found before actual data collection in Trans Nzoia and West Pokot Counties. The outcome of the research depended on the quality of the research data collection tools and procedures. This was done to increase the reliability and validity of the data collected.

3.7 Data Analysis

The data was examined for any errors that may have happened throughout the data collection process. The errors were evaluated and their impact on the research determined. The coding phase was next to establishing a retrieval mechanism. The coding process leads to theme development. The findings of the open-ended questions were to be coded into different themes, and the quantitative data was analyzed using SPSS. The central tendency was calculated, and the results were displayed in tables and graphs.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1.1 Response Rate

Out of the targeted 130 respondents, the study was able to collect responses from 105 respondents. This indicated a response rate of 80.8%. This was considered sufficient for the study.

Interviews were also conducted with:

1. CEC Tvet Trans Nzoia (Youth and Training)
2. ICT director Trans Nzoia
3. Principal Kitale polytechnic
4. Principal Kapenguria VTC
5. ICT Director Kapenguria VTC

4.2 Demographics of the Respondents

The study sought to analyze the demographics of the respondents. The study findings were presented in table 4.1 and table 4.2.

Table 4.1: Demographics of the Respondents

Category		
	Frequency	Percent
Student	65	61.9
Lecturer	22	21
Admin Staff	18	17.1
Total	105	100
Gender		
	Frequency	Percent
Male	66	62.9
Female	39	37.1
Total	105	100
Years in Employment		
	Frequency	Percent
5 – 10 Years	20	19
11 – 15 Years	14	13.3
Over 15 Years	6	5.7
Total	40	38.1
Students / Missing	65	61.9
Total	105	100

The study findings indicated that 65 (61.9%) of the respondents who participated in the study were students, 22 (21%) were lecturers and 18 (17.1%) were administrative staff. The study indicated that 66 (62.9%) of the respondents who participated in the study were male while 39 (37.1%) were female. The study findings indicated that 20 (19%) of the respondents who participated in the study had worked for between 5-10 years, 14 (13.3%) had worked for 11-15 years, 6 (5.7%) had worked for over 15 years while the students had not worked at the institution.

Table 4.2: Cross-tabulations Category * Age Cross tabulation

Category * Age Cross tabulation						
			Age			Total
			18 – 35 Years	36 – 50 Years	Over 50 Years	
Category	Student	Count	65	0	0	65
		% within Category	100.00%	0.00%	0.00%	100.00 %
	Lecturer	Count	0	14	8	22
		% within Category	0.00%	63.60%	36.40%	100.00 %
	Admin Staff	Count	0	11	7	18
		% within Category	0.00%	61.10%	38.90%	100.00 %
Total		Count	65	25	15	105
		% within Category	61.90%	23.80%	14.30%	100.00 %

The study findings indicated that 65 (100%) of the students were aged between 18-35 years. The study findings indicated that 14 (63.60%) of the lecturers were aged between 36-50 years, 8 (36.40%) were aged over 50 years. The study findings indicated that 11 (61.10%) of the admin staff were aged between 36-50 years, 7 38.90%) were aged over 50 years.

Table 4.3: Cross-tabulations Category * Age Cross tabulation

Category * Years in Employment Crosstabulation						
			Years_in_Employment			Total
			5 – 10 Years	11 – 15 Years	Over 15 Years	
Category	Lecturer	Count	10	9	3	22
		% within Category	45.50%	40.90%	13.60%	100.00 %
	Admin Staff	Count	10	5	3	18
		% within Category	55.60%	27.80%	16.70%	100.00 %
Total		Count	20	14	6	40
		% within Category	50.00%	35.00%	15.00%	100.00 %

The study findings indicated that 10 (45.50%) of the lecturers had worked for between 5-10 years, 9 (40.90%) had worked for between 11-15 years and 3 (13.60%) had worked over 15 years. The study findings indicated that 10 (45.50%) of the admin staff had worked for between 5-10 years, 5 (27.80%) had worked for between 11-15 years and 3 (16.70%) had worked for over 15 years.

4.3 Analysis as per Objectives

The study sought to analyze the data collected as per research objectives.

4.3.1 Identify the ICT challenges affecting vocational educational access in the marginalized areas of Kenya.

The study sought to identify the ICT challenges affecting vocational educational access in the marginalized areas of Kenya. The study findings indicated that of the respondents, mean = 4.413 were of the opinion that despite fee subsidy, some schools still charge development fees which some students cannot afford, mean = 4.105 of the respondents were of the opinion that cost of educational material is above reach for many students, mean = 3.810 of the respondents were of the opinion that near all students cannot afford computing device for use in school, mean = 3.448 of the respondents were of the opinion that some classes/subjects have no teachers to teach them hence schools improvise.

A mean of 3.438 of the respondents were of the opinion that teacher student ratio is below the national accepted standard. mean = 3.343 of the respondents were of the opinion that most schools in the region are not power connected, mean = 2.981 of the respondents were of the opinion that student absenteeism in the region is very high.

Finally, mean = 2.819 of the respondents were of the opinion that their region has an insufficient number of TVET institutions, mean = 2.800 of the respondents were of the opinion that classes have insufficient power plugins, mean = 2.476 of the respondents were of the opinion that cultural aspects heavily influence school learning in this region, mean = 2.257 of the respondents were of the opinion that internet and Mobile network is a problem in the region.

Table 4.4: ICT challenges affecting vocational educational access in the marginalized areas of Kenya.

Descriptive Statistics							
	N	Mean	Std. Dev	Skewness		Kurtosis	
	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
The cost of the educational resources above reach for many students	105	4.105	0.919	-1.196	.236	0.893	.467
Students are not able to afford computing device for use in school	105	3.810	1.272	-.778	.236	-0.803	.467
Despite fee subsidy, some schools still charge development fees which some students cannot afford	105	4.143	1.004	-1.629	.236	2.546	.467
There counties do not have sufficient schools	105	2.819	1.574	.155	.236	-1.589	.467
Teacher student ratio is below national accepted standard	105	3.438	1.525	-.544	.236	-1.257	.467
Some subjects have no teachers to teach them hence schools improvise	105	3.448	1.563	-.687	.236	-1.141	.467
Schools have insufficient number of textbooks	105	1.867	1.264	1.101	.236	-0.425	.467
Most school in the region are not power connected	105	3.343	1.492	-.273	.236	-1.458	.467
Classes have insufficient power plugins	105	2.800	1.534	.409	.236	-1.458	.467
Internet and Mobile network is a problem in the region	105	2.257	1.394	.548	.236	-1.381	.467
School student's absenteeism in the region is very high	105	2.981	1.373	-.215	.236	-1.404	.467
Cultural aspects heavily influence school learning in this region	105	2.476	1.468	.503	.236	-1.273	.467
Valid N (listwise)	105	3.036	Aggregate Mean Percentage = 60.72%				

On aggregate, the study findings show that 60.72% (mean 3.036) of all respondents noted that there are ICT challenges affecting vocational educational access in the marginalized areas of Kenya. These findings are supported by Oden (2015) who noted that Vocational Training

Institutes in developing countries face a myriad of challenges relating to the adoption of ICT for use in teaching and learning.

Table 4.5: Categorization of Major Challenges affecting ICT adoption

Descriptive Statistics							
	N	Mean	Std. Dev	Skewness		Kurtosis	
	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
Physical Infrastructure	105	0.276	0.449	1.016	0.236	-0.988	0.467
Technological infrastructure	105	0.181	0.387	1.682	0.236	0.843	0.467
Financial Infrastructure	105	0.143	0.352	2.071	0.236	2.333	0.467
Human Resource Infrastructure	105	0.152	0.361	1.963	0.236	1.888	0.467
Valid N (listwise)	105						

The study of the majority stated that 0.276 (27.6%) of the respondents were of the opinion of physical Infrastructure was the major challenge, 0.181 (18.1%) of the respondents were of the opinion of technological infrastructure is the major challenge, 0.152 (15.2%) of the respondents were of the opinion of human Resource Infrastructure is the main challenge while 0.143 (14.3%) of the respondents believed financial Infrastructure is the major ICT challenge. These findings are supported by Lelei, Weidman, Sakaue (2018) who noted that educational expansion required in the marginalized areas requires addressing first the physical infrastructure like building of schools with computer labs, with security and with the necessary infrastructural support including electricity and internet connections to support ICT and virtual learning.

These findings are also supported by respondent KVTC001 who noted that
"*This vocational training institute is affected by a number of challenges including the lack of secure computer labs where the students and teachers alike can access ICT resources. This has made ICT and virtual learning a big problem but slowly we have been making progress towards this end."*

Further respondent KNP001 noted that

"*The adoption of online learning in the school is hampered by the lack of the necessary ICT resources including technological infrastructures including servers and sufficient ICT equipment to facilitate the learning process. This is mainly because the school does not have the required finances to make these kinds of investments*"

4.3.2 Identify a technological solution for vocational educational access in the marginalized areas of Kenya.

The study sought to identify technological solutions for vocational education access in the marginalized areas of Kenya.

ICTD001KVTC 001 also noted that.

"*As of March 2020, the TVETs had few technological devices that were incorporated in the teaching and the learning process. The available ones included; Computers in computer rooms for ICT learning shared among different students, PCs for few administrative tasks, shared projectors for presentations and other personal laptops owned by staff and students privately*."

According to ICTD001KVTC 001 noted that "*as of 2021, the introduction of the virtual learning system was therefore developed as a way to enhance learning for TVETs now and in the future. This would help deal with many problems that hamper learning in these institutions for many years to come*."

To ascertain the usefulness of the developed virtual learning system, an evaluation framework was developed. The study findings were presented in table 4.6.

Table 4.6: Evaluation Framework for Existing ICT System

Descriptive Statistics					
	N	Mean	Std. Dev	Skewness	Kurtosis

	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
The system has all the learning resources required	105	3.248	1.081	-0.278	0.236	-1.221	0.467
There are no cases of system downtimes	105	3.533	1.136	-0.405	0.236	-1.057	0.467
There are no cases of system slow speed	105	3.391	1.148	-0.271	0.236	-1.149	0.467
There system maintenance costs are low compared to benefits	105	3.486	1.128	-0.395	0.236	-1.097	0.467
The system requires very few people to operate	105	3.476	1.066	-0.374	0.236	-1.071	0.467
The system functionality is always 100%	105	3.429	1.125	-0.293	0.236	-1.162	0.467
The system has never had downtime of more than 24 hours	105	3.438	1.065	-0.176	0.236	-1.276	0.467
Valid N (listwise)	105	3.429	Aggregate Mean Percentage = 68.58%				

The study findings showed that a majority of the respondents mean of 3.533 were of the opinion that there are no cases of system downtimes, a mean of 3.486 of the respondents were of the opinion that there system maintenance costs are low compared to benefits, mean of 3.476 of the respondents were of the opinion that the system requires very few people to operate, mean = 3.438 of the respondents were of the opinion that the system has never had downtime of more than 24 hours, mean = 3.429 were of the opinion that the system functionality is always 100%, mean = 3.391 of the respondents were of the opinion that there are no cases of system slow speed, mean = 3.248 of the respondents were of the opinion that the system has all the learning resources required.

An aggregate mean of 68.58% was interpreted to mean that the technological solutions in use at the TVETs were not good enough based on an evaluation framework based on some pre-defined parameters. It was therefore necessary to have a suitable ICT solution that could meet the predefined criteria in the evaluation framework. These findings are supported by Mayer, (2015) who noted that a good ICT framework should be reliable and robust to meet its system goals.

Table 4.7: Improved Access for Educational Access between March 2020 and May 2021

Descriptive Statistics

	N	Mean	Std. Dev	Skewness		Kurtosis	
	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
More students prefer to use the system	105	3.610	1.355	-0.674	0.236	-0.688	0.467
More teachers rely on the system for use in teaching	105	3.762	1.297	-0.703	0.236	-0.643	0.467
All learning modules have been incorporated in the system	105	3.629	1.332	-0.755	0.236	-0.520	0.467
All stakeholders can use the system	105	3.781	1.271	-0.953	0.236	-0.005	0.467
All paper/manual activities can be handled by the system including administrative and assessment roles	105	3.667	1.306	-0.730	0.236	-0.508	0.467
System is used in institution resource planning activities	105	3.619	1.296	-0.659	0.236	-0.562	0.467
The system gives a picture of the operations of the institution	105	3.943	1.216	-1.264	0.236	0.841	0.467
Valid N (listwise)	105	3.716	Aggregate Mean Percentage = 74.32%				

The study findings indicate that a majority of the respondents mean = 3.9 were of the opinion that the system gives a picture of the operations of the institution under study, mean = 3.8 of the respondents were of the opinion that all stakeholders are able to use the system comfortably, this was a mean of 3.762 of the respondents were of the opinion that more teachers rely on the system for use in teaching, mean = 3.667 of the respondents were of the opinion that all paper/manual activities can be handled by the system including administrative and assessment roles, mean = 3.629 of the respondents were of the opinion that all learning modules have been incorporated in the system, mean = 3.619 of the respondents were of the opinion that system is used in institution resource planning activities and mean = 3.610 of the respondents were of the opinion that more students prefer to use the system.

An aggregate mean of 74.32% was interpreted to mean that the ICT system in use was likely to improve access to 74.32%. This meant that addressing the issues in the evaluation framework could go a long way in improving access to education in the marginalized areas. The study findings are supported by Deshwal (2015) who noted that educational access in the marginalized areas can be improved by developing ICT systems that address challenges specific to these regions.

Further CECTC001 noted that.

"*There is a need to develop a virtual learning system that can be used in the marginalized areas to enhance educational access to deal with issues such as the current pandemic, overcrowding in classes and other challenges such as the shortage of teachers in the schools*."

ICTD001KVTC 001 also noted that.

"*Various TVETs have made frantic efforts to adopt virtual learning systems to date that can assist students learn online, take exams online and access notes online. These systems however have not been able to fully cover all students, modules, and other administrative tasks. This however have been good prototypes that can assist developers build on this by addressing existing challenges*"

"Examples of technological devices that have been introduced to help improve educational access include Laptops for administrative staff, Computers to support the virtual system, integrated software to support learning, internet services with increased speeds and hotspots."

4.3.3 Identify technological solution has improved vocational educational access in marginalized areas of Kenya

The study sought to Identify technological solutions that have improved vocational educational access in marginalized areas of Kenya.

4.3.3.1 How technological solutions have improved vocational educational access in the marginalized areas of Kenya.

ICT challenges were assessed against improved access for the ICT system and the results were presented for March 2020 and May 2021. This was then moderated against the proposed evaluation framework to assess if there is likely to be any impact on the outcome. The results of this were presented in table 4.8 which was a regression model table.

A R Square value of 77.7 (R Square = 0.777) in the model fit summary indicated that enough data was used to compute the regression equation. A goodness of fit test of p = 0.000 showed that the model had not been computed by chance.

Table 4.8 Illustration of the Effect of Technological Solutions Between March and May 2021

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.488[a]	0.238	0.231	0.500		
2	.881[b]	0.777	0.772	0.272		
a. Predictors: (Constant), Education Access Challenges						

b. Predictors: (Constant), Education Access Challenges, Evaluation Framework						
ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.050	1.000	8.050	32.242	.000[b]
	Residual	25.717	103.000	0.250		
	Total	33.767	104.000			
2	Regression	26.232	2.000	13.116	177.551	.000[c]
	Residual	7.535	102.000	0.074		
	Total	33.767	104.000			
a. Dependent Variable: Improved Access						
b. Predictors: (Constant), Education Access Challenges						
c. Predictors: (Constant), Education Access Challenges, Evaluation Framework						
Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.239	0.354		3.503	0.001
	Educational Access	0.655	0.115	0.488	5.678	0.000
2	(Constant)	0.564	0.197		2.861	0.005
	Educational Access	-0.162	0.082	0.121	-1.990	0.049
	Evaluation Framework	0.976	0.062	0.954	15.688	0.000
a. Dependent Variable: Improved Access						

Educational Access challenges were shown to negatively impact improved access ($\beta = 0.121$, $p = 0.049$). This was interpreted to mean that ICT challenges specific to the marginalized areas were the main issues affecting the level of access to education using the virtual learning systems. In March 2020, the level of access was at 12.1% as indicated by the beta coefficient ($\beta=0.121$) but by May 2021 the educational access was at 95.4% ($\beta=0.954$) for the studied institutions. This meant that the system which was put in place during this period improved educational access to this extent.

These findings were supported by various interviewees.

CECTC001 noted that "*Some of the polytechnics and VTCs that had adopted the virtual learning systems had seen learning continue taking place for some of the courses. Module*

three students all who were nearly sitting for the KNEC exams in particular were given priority to use the system for learning during the pandemic era"

Further respondent KNP001 noted that "*Design of the virtual learning systems had ensured that access of educational resources was enhanced. That the TVETs could slowly resume operations and that the cost of learning was cut down."*

These findings were supported by Daont (2015) who noted that there are various advantages associated with the online learning systems including increasing access, cutting down on operational costs and creating flexible teaching and learning schedules for all the stakeholders. The system ensures that institutional operations ensure educational goals are met in the most efficient manner.

4.3.3.2 Extent to Which Technology has Improved Educational Access based on Access Indicators

The study sought to evaluate how the identified technological solution has improved vocational educational access in marginalized areas of Kenya using the educational access indicators

Table 4.9 Results on Operationalization of Variables in the Evaluation Framework

Variable	Variable Category	Indicator	Measurement	March 2020	October 2020	June 2021
Independent Variable	Factors Limiting Educational Access	Adequacy of technological hardware equipment	Number of ICT equipment	Computers = 73 Laptops = 22 Internet = 100 people	Computers = 325 Laptops = 518 Internet = over 3000 people	Computers = 410 Laptops = 530 Internet = over 3000 people
		Lack of Appropriate of Software	Software Licenses and Fee Payment	None	Yes	Yes
Moderating Variable	Evaluation Framework	Level of resource sharing	Size of Database	500 MBS	4 Terabyte	4 Terabyte
		Operational Costs management	Trends in costs to run the system	Average Kshs 2000 per person	Average Kshs 150 per person	Average Kshs 150 per person
		Resource reliability	Number of system breakdown	Average 10 times a month	Average twice a year	Average twice a year
Dependent Variable	Improved Access to Educational Resource	Number of Learning modules supported	Number of Learning modules supported	None	37 Course Supported	37 Course Supported
		Number of students with Access	Number of students with Access	Less than 100	Over 3,000	Over 3,000
		Stakeholders Access	Administrative Functions Supported	Less than 10	Over 50 Administrative Functions Supported	Over 50 Administrative Functions Supported

Source, Kapenguria Vocational Training Centre and Kitale Youth Polytechnic, 2021

Table 4.9 illustrates that there were positive changes after adoption othe virtual learning system in the TVETs. Specifically, Number of ICT equipment increased. Computers increased from 73 in *March 2020* to 325 in *October 2020,* and further to 410 in *June 2021* for the two institutions, laptops increased from 22 in March to 518 in October and to 530 in June 2021.

There was also an increase in the number of students and staff who have access to the internet which was at 100 in March 2020 increased to 3000 in October and remained the same as of June 2021.

Database size expanded from 500 MB to 4 Terabyte, access cost per individual on average reduced from Kshs 2000 to about Kshs 150 per term and the reliability of the system improved from about 10 breakdowns per month to about just 2 per year. Finally, the system was able to support 37 modules from 0, support learning for over 3,000 students and support over 50 administrative tasks from less than 10.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The study finds that there are challenges with educational access in the institutions under study. This was indicated by 60.72% of the respondents. The majority stated physical Infrastructure was the major challenge, 0.181 (18.1%) of the respondents were of the opinion of technological infrastructure is the major challenge, 0.152 (15.2%) of the respondents were of the opinion of human resource Infrastructure is the main challenge while 0.143 (14.3%) of the respondents were of the opinion of financial Infrastructure is the major ICT challenge.

An aggregate mean of 68.58% was interpreted to mean that over two thirds of the respondents had supported the technological solutions that the TVETs had put in place between March 2020 and May 2021. Further on improved access, an aggregate mean of 74.32% was interpreted to mean that the ICT system had considerably improved access in May 2021 from about 20% as was indicated by the challenges affecting access identified in March 2020.

Educational Access challenges were shown to negatively impact improved access ($\beta = 0.121$, $p = 0.049$). This was interpreted to mean that ICT challenges specific to the marginalized areas were the main issues affecting the level of access to education using the developed virtual learning systems. In March 2020, the level of access was at 12.1% as indicated by the beta coefficient ($\beta=0.121$) but by May 2021 the educational access was at 95.4% ($\beta=0.954$) for the studied institutions. This meant that the system which was put in place during this period improved educational access to this extent.

There were positive changes after adoption of the virtual learning system in the TVETs. Specifically, Number of ICT equipment increased. Computers increased from 73 to 325 then to 410 in *June 2021* for the two institutions under study. Laptops increased from 22 to 530 and the internet was now accessible to over 3000 staff and students from about 100 in March 2020. Software for learning was adopted, and this further promoted access. Database size expanded from 500 MB to 4 Terabyte, while access cost per individual on average reduced from Kshs 2000 to about Kshs 150 per term. The reliability of the system improved from about 10 breakdowns per month to about just 2 per year. Finally, the system was able to support 37

modules from zero. It was also able to support learning for over 3,000 students and support over 50 administrative tasks from less than 10.

5.2 Conclusion

The study concluded that there were ICT challenges affecting vocational educational access in the marginalized areas of Kenya especially before March 2020. Specifically, in the marginalized areas, educational expansion required addressing the physical infrastructure like building of TVET institutions with computer labs, with security and with the necessary infrastructural support including electricity and internet connections to support ICT and virtual learning. Other challenges related to lack of finances and ICT resources.

Once the infrastructure for ICT was developed virtual learning systems were developed to promote educational access based on a prescribed educational access. The virtual learning systems incorporated systems such as the google classrooms and other virtual models to ensure that teachers could continue teaching. These technologies tripled level of access to education among the TVETs in the marginalized areas between March 2020 and 2021

Evidently, technological equipment including computers, laptops, faster internet, and reduced access costs to schools and more online assessment performance for students, teachers and administrative staff was witnessed between the March 2020 and 2021 period. Significant access had therefore been witnessed between these two periods compared in this study as a result of the TVETs adopting technological solutions to enhance educational access.

5.3 Recommendations

The study made the following research recommendation to help increase educational access. The government should increase financial allocation to the TVET institutions; this will enable them to purchase ICT equipment which will support the utilization of virtual learning platforms which will increase access

The study calls for better Public and Private sector partnerships that would help address challenges on resources access in TVETS

There should be more involvement of donor community and other partners in addressing challenges faced in the rural TVETs,

The government should ensure that progressive ICT policies and frameworks are developed and implemented within the TVETs in Kenya. This includes the 2021 framework that sets the standards for the use of ICT in TVETs

The TVET institutions should come up with ways to sustainably generate income on their own to reduce over reliance on government and outside funding.

5.4 Recommendations for Further Studies

Research in the vocational sector is critical if significant growth is to be achieved in Kenya. The ICT blueprint 2019 made only one mention of technical and vocational training hence this research will make a valuable contribution to this important sector and more so move the thinking from formal only learning to even informal learning which is possible through mobile kiosks (Chinapah, Odero, 2016). The technical and vocational training authority is still in the process of developing a TVET National Quality Assurance framework; the finding of this study will form necessary input in the development of such a quality framework (TVETA Strategic Plan, 2018). Further studies recommend further studies on the effectiveness of the systems implemented especially with regard to hand-on training.

REFERENCES

Akala, W. J., & Changilwa, P. K. (2018). Status of Technical and Vocational Education and Training TVET) in Post-secondary Education in Kenya. *Journal of Popular Education in Africa*, *2*(7).

Al Abri, M., & Dabbagh, N. (2018). Open educational resources: A Literature Review. Journal of Mason Graduate Research, 6(1), 83-104

Al Azri, R. H., & Al-Rashdi, M. H. (2014). The effect of using authentic materials in teaching. International journal of scientific & technology research, 3(10), 249-254.

Alkhawaldeh, M. F., Olimat, E., & Al-Rousan, A.(2015) A Blended Theoretical Framework for Integration of ICT within Early Year Education: an Overview.

Attwell, G. (2019). CDEFOP research resource base on ICTs and vocational education and training: An introduction and guide. *CDEFOP: Germany p1*.

Bozkurt, A., &Bozkaya, M. (2015). Evaluation criteria for interactive e-books for open and distance learning. The International Review of Research in Open and Distributed Learning, 16(5).

Bozo, B. J., & Chilibasi, K. M. (2019). Green Economy Marketing in Technical and Vocational Education and Training in Kenya. *Africa Journal of Technical and Vocational Education and Training*, *4*(1), 2-12.

Chinapah, V., &Odero, J. O. (2016). Towards inclusive, quality ICT-based learning for rural transformation. Journal of Education and Research, 5(2/1), 107-125.

Faw, H. W., & Waller, T. G. (2016). Mathemagenic behaviours and efficiency in learning from prose materials: Review, critique and recommendations. *Review of Educational Research*, *46*(4), 691-720.

Futrell, M. K., & Geisert, P. (2014). *The Well-trained Computer: Designing Systematic Instructional Materials for the Classroom Microcomputer*. Educational Technology.

Garbutt, G., &Wanami, S. (2017). Challenges Facing Implementation of Distance Education in Kenya. Africa Journal of Technical and Vocational Education and Training, 2(1), 132-139.

Imel, S. (2018). Technology and Adult Learning: Current Perspectives. ERIC Digest No. 197

Kenchakkanavar, A. Y. (2014). Types of e-resources and its utilities in library. International Journal of Information Sources and Services, 1(2), 97-104.

Kintu, D. (2019). TECHNICAL VOCATIONAL EDUCATION AND TRAINING INSTITUTIONS'CONTRIBUTION TO PROMOTING SUSTAINABLE DEVELOPMENT.

Maina, K. D., & Nyambura, M. E. (2019). Combined Effect of Personality Factors and Cognitive Factors on Students' Self-Employment Intentions in Technical, Vocational Education and Training in Kenya. *International Journal of Business and Economics Research*, *8*(3), 133.

Maitland, C. F. (2018). Now you see it, now you don't: Digital connectivity in marginalized communities. Computer, 51(6), 62-71.

Mamoon, D. (2017). Society case study: Why formal education is the common goal of human progress. Journal of Economic and Social Thought, 4(4), 433-436.

Milner IV, H. R. (2013). Analyzing poverty, learning, and teaching through a critical race theory lens. Review of Research in Education, 37(1), 1-53.

Piper, B., Zuilkowski, S. S., Kwayumba, D., &Strigel, C. (2016). Does technology improve reading outcomes? Comparing the effectiveness and cost-effectiveness of ICT interventions for early grade reading in Kenya. International Journal of Educational Development, 49, 204-214

Pringle, I., & David, M. J. R. (2002). Rural community ICT applications: The Kothmale model. The Electronic Journal of Information Systems in Developing Countries, 8(1), 1-14.

Rekha, S., &Adinarayanan, V. (2014). A free and open source framework for rural education. In 2014 Seventh International Conference on Contemporary Computing (IC3)(pp. 56-61). IEEE.

Wanjohi, W. E., Kagema, J., Kimiti, R., & Kimosop, M. (2019). Challenges Facing Technical Training Institutes in Kenya: A Case of Nyeri, County. *African Journal of Education, Science and Technology*, *5*(2), 229-23

APPENDICES

Appendix I: Questionnaire

Questionnaire for ICT and Administrative Staff

Kindly answer the following questions by ticking or commenting in the spaces provided.

Your responses will be treated with at most confidentiality.

Section A: Demographic Information of Respondents

i. Gender
   a) Male [ ]
   b) Female [ ]

ii. Age
   a) 18 – 35 Years [ ]
   b) 36 – 50 Years [ ]
   c) Over 50 Years [ ]

iii. Educational Background
   a) Form Four [ ]
   b) College [ ]
   c) Undergraduate [ ]
   d) Post Graduate [ ]

iv. Area of Specialization / Department of Work _____

v. Years in Employment
   a) Less than 5 Years [ ]
   b) 5 – 10 Years [ ]
   c) 11 – 15 Years [ ]
   d) Over 15 Years [ ]

Section B: Factors Limiting Educational Access for Marginalized Persons

1. Kindly indicate the extent to which you agree with the following statements on the factors limiting educational access in this region

SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

	Factors Limiting Educational Access for Marginalized Persons	SA	A	U	D	SD
EA1	Cost of educational material is above reach for many students					
EA2	Near all students cannot afford computing device for use in school					
EA3	Despite fee subsidy, some schools still charge development fees which some students cannot afford					
EA4	There region has an insufficient number of schools					
EA5	Schools in the region are far from reach of many pupils					
EA6	Teacher pupil ration is below national accepted standard					
EA7	Some classes/subjects have no teachers to teach them hence schools improvise					
EA8	Schools have sufficient number of textbooks					
EA9	Most school in the region are power connected					
EA10	Classes have sufficient power plugins					
EA11	Internet and Mobile network is not a problem in the region					
EA12	Stakeholder participate in the running of activities of this school					
EA13	ICT usage is promoted in the school as defined by the MoE legislations					
EA14	School pupils absenteeism in the region is very high					
EA15	Cultural aspects heavily influence school learning in this region					

2. What are the other challenges affecting the education access in the region?

_____
_____
_____

Section C: Evaluation Framework

3. Kindly rate the following statements based on the extent to which you agree with them about the workings of the ICT educational access model.

		SA	A	U	D	SD
EF1	The system has all the learning resources required					
EF2	There are no cases of system downtimes					
EF3	There are no cases of system slow speed					
EF4	There system maintenance costs are low compared to benefits					
EF5	The system requires very few people to operate					
EF6	The system functionality is always 100%					
ER7	The system has never had downtime of more than 24 hours					

Section D: IMPROVED ACCESS

1. Kindly rate the following statements based on the extent to which you agree with them about the workings of the ICT educational access model.

		SA	A	U	D	SD
EF1	More students prefer to use the system					
EF2	More teachers rely on the system for use in teaching					
EF3	All learning modules have been incorporated in the system					
EF4	All stakeholders are able to use the system					
EF5	All paper/manual activities can be handled by the system including administrative and assessment roles					
EF6	System is used in institution resource planning activities					
ER7	The system gives a picture of the operations of the institution					

Appendix II: Interview Schedule for Principals and County Government Officials

1. Kindly comment on educational access situation in TVETS
   _____
   _____
   _____
2. What are the challenges affecting the education access in TVETs?
   _____
   _____
   _____
3. In your opinion how do you think the use of has assisted increase educational resource access in TVETs?
   _____
   _____
   _____
4. Kindly indicate major ICT attributes that the ICT model in place can incorporate to be more effective
   _____
   _____
   _____
5. How do you think the ICT educational access changed from March 2020 to 2021 to adapt to the changing education environments as a result of COVID 19?
   _____
   _____
   _____

Appendix III: Schedule

Activity 2021	**Jan - March**	**April**	**May**	**June**	**July**
Writing proposal					
Presenting proposal					
Data collection					
Data analysis					
Data presentation					

Appendix IV: Budget

ACTIVITIES	ITEMS/PARTICIPANTS	COST (KSHS)
Proposal development	Library search and Travelling expenditure by the researcher, typing, photocopying and binding of the pr oposals.	3000
Designing and developing Research instruments	Typing and Photocopying of research instruments	2000
Research permit	Transport and accommodation of the researcher	1000
Research induction and t raining	Transport of the researcher and research assistants	2000
Pilot Survey	Transport for researcher and research assistants	5000
Main field data collection	Travel and subsistence for 30 days Researcher-15000 Research assistants-9000	10000
Data processing, analysis and t hesis writing	Researcher's subsistence, transport, typing, Photocopying and binding	10000
Purchases	Flash disk Stationery	3000 2000
Miscellaneous		5,000
Total		**43,000**