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AN ASSESSMENT OF THE POTENTIAL OF ICT IN IMPROVING THE QUALITY OF TEACHING AND LEARNING OF KENYA'S TECHNICAL EDUCATION

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AN ASSESSMENT OF THE POTENTIAL OF ICT IN IMPROVING THE QUALITY OF TEACHING AND LEARNING OF KENYA'S TECHNICAL EDUCATION

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Abstract

Purpose: The aim of this research was to investigate the integration of ICT in technical Education through current and emerging ICT-based solutions by considering ICT as a teaching tool for better grasping of concepts with the use of visual presentations, simulations and access to supplementary resources via the internet for quality technical education delivery.

Methodology: The research was conducted using a survey design approach. The study was conducted mainly in technical institutes, polytechnics and secondary schools. A purposive sampling technique was employed to locate the cases that have the required information with respect to the research objectives i.e. mainly in learning institutions. The target population is 2000 while the accessible is about 500. A sample size of 217 is desirable. A sample of 150 was chosen because it lies between 217 and 132. The compositions from various institutions were as follows: polytechnics 35, technical institutes 75 and secondary schools 30. Data collection was carried out in polytechnics, technical institutes and secondary schools using questionnaires, interviews, observations and document analysis. Chi –square (x^2) goodness of fit and percentage distribution technique were used to analyze the data. To assess the consistency and accuracy of the research exercise, the research reliability and validity were computed and various statistical conclusions drawn.

Findings: Findings revealed that ICT use in technical education is an asset, provision of affordable infrastructure, teacher training to facilitate dissemination of knowledge and skills, creating awareness of the opportunities offered by ICT as an educational tool to the technical education sector, are also necessary. Although ICT as an instruction tool is an asset, it does not replace the conventional teacher and the practical hands-on skills.

Unique Contribution to Theory, Practice and Policy: The study recommends that for effective utilization of ICT in the instruction Process, measures must be put in place to encourage the provision of infrastructure for access to local, national and international information resources at or next to the institutions.

Key Words: *ICT, Technical Education, Teaching Tool.*

1.0 INTRODUCTION

Technical and Vocational Education and Training (TVET) has been identified by UNESCO's member states as a priority area within UNESCO's range of development programmes (Gaya, 2007). The development of an effective TVET system is currently at the heart of education reform efforts. The chosen system must establish a framework which influences such important matters as access to and quality of TVET. As Gaya observed in the (African Union, Second Decade of Education for Africa, 2006 – 2015, Draft Plan of Action, 2006) there is need to re-examine and asses realistically the present technical education system that has been in use over the past. In this regard, the knowledge society of the 21st Century, dominated by information and communication technology and where labour market demands are constantly changing, providing relevant TVET programmes to both boys and girls is deemed central to the effort to foster sustainable development and attain MDG in Africa.

In the current globolized economy, a country requires an ICT- literate workforce that will enhance its participation in the knowledge economy. ICT education, therefore, is the national platform for equipping nations with ICT skills for dynamic and sustainable economic growth. Any country that fails to integrate ICT risks serious marginalization on the global scene (Republic of Kenya, 2006).

There is an underlying pool of knowledge that emphasizes three issues (Simiyu, 2007)

1. The increasing impact of ICT on society.
2. The need to prepare learners for modern technological society.
3. The shortage of well-trained teachers to assist learners in becoming critical well informed participating citizens of such society.

There is, therefore, a dire need to embark on new learning concepts to enhance curriculum delivery and promote performance and induction to the emerging society. This study was guided by the UNESCO's advice to its member states on integrating the use of ICT in their TVET programmes by revitalizing TVET systems and programmes and aligning them with the tenets of sustainable development (African Union, Second Decade of Education for Africa, 2006 – 2015, Draft Plan of Action, June 2006) through developing policy frameworks, renewing curricula and promoting international cooperation and dialogue on issues linked to ICT.

Conventional technical education is not able to address the scope and scale of the challenge of bringing TVET to the millions of people of Africa, (UNESCO/BREDA, 2007; Bhuwanee, 2007). Bhuwanee (2007) observed that ICT-supported open and distance learning can open up new potential in technical education and training through facilitating the delivery of technical education training and the provision of learning content. Computer-enhanced delivery of education and training (e-learning) is becoming increasingly widespread and can make technical education and training available to many more people around the world in different forms and quality.

For a long time, delivery of technical education has tended to rely on traditional pedagogical approaches hence denying the youth the opportunity to develop their ICT skills. (Gaya, 2007). More than ever before, global technological trends are now placing pressure on the youth to be equipped with skills that will enable them handle the issues they may face after school, including career choice, job placement and interaction with the web.

The application of computer technology in industrial plants, construction, mining or manufacturing process is becoming one of the most effective methods of automated production. On the other hand educational systems are taking varied techniques that use computer techniques such as e-learning, computer based simulations, numerical control systems to present the behavior of real –life situation by using computerized models (Chemwa, 2005). The integration of these two aspects can greatly boost the educational system.

Education is considered a major key to development and therefore improving it for the world of work can help in the promotion and sustainability of theory and practice in response to emerging society needs. The evolution of computers and information technology has a lot of promise; it is, therefore, fashionable for scholars and technologists to look into the future and try to predict and prepare for the world of tomorrow.

Bhuwanee, 2007 observed:

> The internationally agreed standards and practices described in the normative instruments can provide valuable guidance to policy-makers and practitioners engaged in reforming TVET systems in order to make them relevant to the labour market projections for the years ahead. In this respect, developing countries must not lag behind in the race for technology as more and more teaching is transferred to on-line programmes offered over the World Wide Web. The developments discussed notwithstanding, the stakeholders recognize that more effort is required to address the existing challenges. First is the need to create awareness on the importance of ICT in technical education and secondly to steer curriculum digitalization to aid faster integration. The fundamental effect in this area thus relates the need to integrate ICT into technical education sector operations.

As the country envisages the achievement of vision 2030, the information and communication sector is expected to come up with ways to boost information Technology (IT) in the country in order to boost its global competitiveness. This will create a preferred investment destination for ICT related activities that will create more wealth and employment opportunities. To achieve this goal, all stakeholders must develop and support an efficient ICT infrastructure which will provide easy access to international and national network, establish legislative and regulatory frameworks for ICT development, promote and ensure quality ICT education, and provide a pool of world class professionals to meet the needs of local and global markets. E- Learning should be introduced in all learning institutions to prepare students fit well in the ICT driven market (Republic of Kenya 2007)

Statement of the Problem

The present technical education may have served us well over the past but it may no longer be able to address the intricacies of the challenges being brought about by new ICT solutions and globalization. The UNESCO's member states have been urged to revitalize TVET systems and programmes and to align them with the tenets of sustainable development by inclusion of ICT

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(African Union, Second Decade of Education for Africa, 2006 – 2015, Draft Plan of Action, 2006).

The delegates Round Table conference organized by British Council and Commonwealth of Learning raised the issue of flexible delivery of TVET as a strong agenda item for the conference (Gaya, 2007). The major concern was that adoption of flexible delivery is essential if countries were to increase quality and access to Vocational Education and Training. Delivery by traditional methods in purpose built institutions may no longer meet the demands for training in many countries, particularly in a developing world.

There is either a low level, or in some cases, a near absence of use of ICT education systems in general and in technical education systems in particular in order to induce learners in a technologically rich society. The challenge here is for TVET to innovate and modernize its curricula to focus on the moving target of technology by strengthening and making TVET curricula more relevant (Kerre, 1995). This study therefore examined whether ICT as an instructional tool can be incorporated into technical education program for grasping of concepts to improve the quality of teaching and learning in technical education.

2.0 CONCEPTUAL FRAMEWORK WORK

The research idea is guided by the Venn diagram models representation below developed by the researcher.

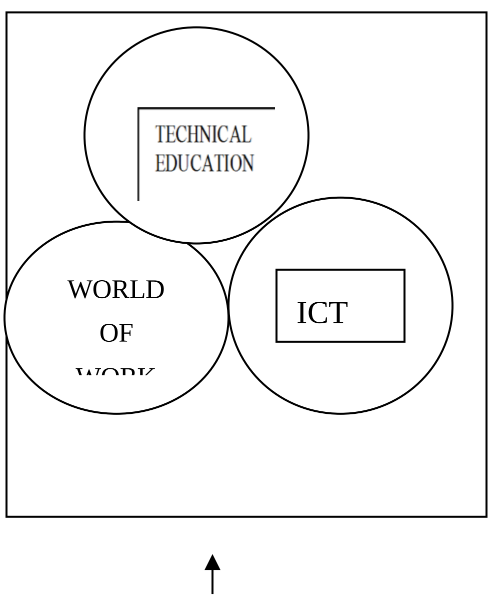

Fig 1 Present State

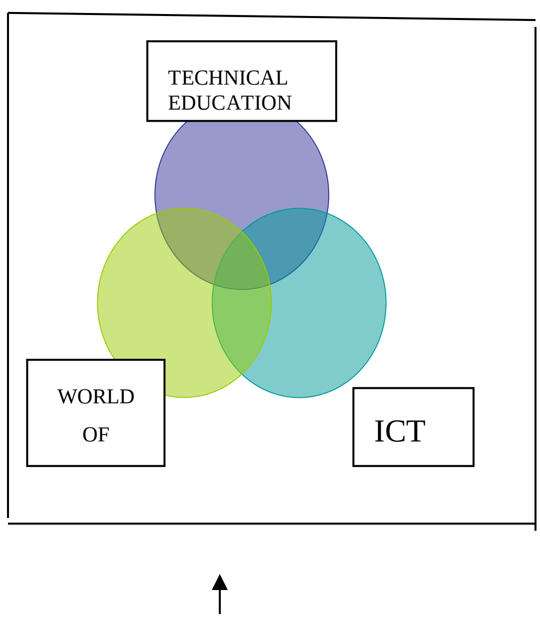

Fig 2 Proposed State

Fig 1 and 2 Venn diagram model representation of present and proposed state of technical education developed by the researcher.

The model stresses for a linkage between the three sectors to produce a balanced whole. The study is supported by the UNESCO's demands that member states make their education systems more responsive to the present world of work needs. Since new technologies have their impact not only on substitution of labour with capital but also elicit changes in work organization and of the qualifications required; Technical education must therefore build a new and broader approach in terms of focus, concepts, methodologies and technologies, which must not be considered in isolation.

For example, in a building construction, a building can be simulated before the actual house is physically set up. A client can be allowed to virtually move through the house, open doors, pull drawers and close windows all in a computerized environment. In this example the building represent the world of work, construction of the building represent technical education, and the computerized environment represent ICT. Another example involves car assembly process where design of motor brake pads involves designing the model using computer aided design software then feeding them into to an automated machine which engineers the required shapes and dimensions.

There have been a lot of breakthroughs in the field of education, communication, research, commerce, art and design, technology since the inception of ICT. The breakthroughs change our lifestyles and job requirements and therefore technical education, ICT, world of work must not be treated in isolation but as mutually interacting. The present professional utilization of computers is still at its infancy stage; the model, therefore, stresses for an interaction between technical education, world of work and ICT-solutions so as to meet the challenges lying a head. The evolution of computers and information technology has a lot of promise, it is therefore fashionable for scholars and technologists to look into the future and try to predict and prepare for the world of tomorrow. Future trends in information and communication technology will be characterized by rapid evolution in computer hardware and software, artificial intelligence and expanded information superhighways.

2.0 METHODOLOGY

The research was conducted using a survey design approach. The researcher adopted a heuristic fieldwork methodology that included observation and interview methods of personal and others' opinions, values experiences and expectations. The study was conducted mainly in technical institutes, polytechnics and secondary schools. A purposive sampling technique was employed to locate the cases that have the required information with respect to the research objectives i.e. mainly in learning institutions. The target population is 2000 while the accessible is about 500. A sample size of 217 is desirable. A sample of 150 was chosen because it lies between 217 and 132. The compositions from various institutions were as follows: polytechnics 35, technical institutes 75 and secondary schools 30. Data collection was carried out in polytechnics, technical institutes and secondary schools using questionnaires, interviews, observations and document analysis. Chi –square (x^2) goodness of fit and percentage distribution technique were used to analyze the data. To assess the consistency and accuracy of the research exercise, the research reliability and validity were computed and various statistical conclusions drawn.

4.0 RESULTS AND DISCUSSIONS

4.1. ICT Establishment

Table 1: Institutional ICT Establishment

ICT ESTABLISHMENT				
ESTABLISHED ICT DEPARTMENT	YES	NO	NO COMMENT	TOTAL
FREQUENCY	70	60	20	150
PERCENTAGE FREQUENCY	46.66667	40	13.33333333	100

Table 2: Chi Square Test for Goodness of Fit

COMMENT	OBSERVED	EXPECTED	(O-E)	$(O-E)^2$	$(O-E)^2/E$
YES	70	50	20	400	8
NO	60	50	10	100	2
NO COMMENT	20	50	-30	900	18
TOTAL	150	150	0	1400	28

Step 1: Stating the hypothesis

H_0: There exists no difference in ICT establishment.

H_1: There exists difference in ICT establishment.

Step 2: Finding the critical value

d.f = n-1, 3-1=2

C.V= =5.991

Step 3: Test value: = 28.000

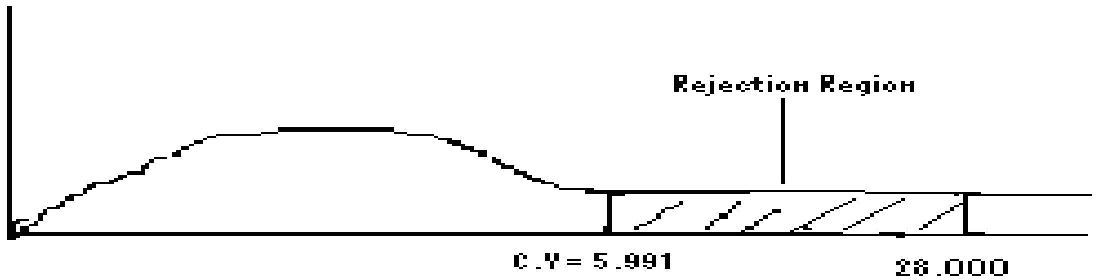

Fig 4 Standard Normal Distribution

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is enough evidence to support the claim that there exist discrepancies in ICT establishment in Technical institutions.

Variable	N	C.V	d.f	χ^2	α=0.05
Respondents opinion on infrastructure development	150	5.991	2	114.213	0.05

4.2 Infrastructure Development

In order to find views on ICT infrastructure development, various respondents were asked to provide their views on their institution infrastructural development and their responses are summarized in the Table 2(c) and Chart 1(b).

Table 3: Institutional ICT infrastructure development

INFRUSTRUCTURE	POOR	FAIR	GOOD	V.GOOD	TOTAL
FREQUENCY	40	90	12	8	150
% FREQUENCY	26.66667	60	8	5.333333	100

Table 4: Chi Square Test for Goodness of Fit

COMMENT	OBSERVED	EXPECTED	(O-E)	$(O-E)^2$	$(O-E)^2/E$
POOR	40	37.5	2.5	6.25	0.166667
FAIR	90	37.5	52.5	2756.25	73.5
GOOD	12	37.5	-25.5	650.25	17.34
V. GOOD	8	37.5	-29.5	870.25	23.20667
TOTAL	**150**	**150**	**0**	**4283**	**114.2133**

Step 1 stating the hypothesis:

H_o: There is no significant difference in infrastructure development. (Claim)

H_1: There is a significant difference in infrastructure development.

Step 2: Finding the Critical value:

d. =n-1, 4-1=3

At α = 0.05 C.V= 7.815

Step 3: Test value: = 114.213

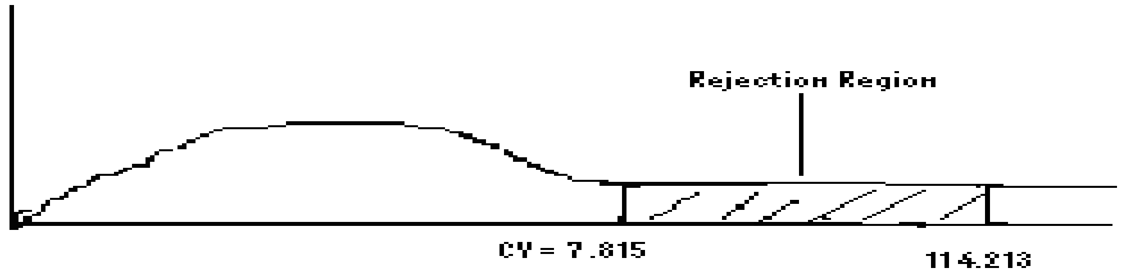

Fig 5 Standard Normal Distribution

Step 4: Decision
We reject the null hypothesis because the test value lies in the rejection region.
Step 5: Summary

From the statistical analysis results above, there is no enough evidence to support the claim that there exists no significant difference in infrastructure development.

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	7.815	3	114.213	0.05

4.3 ICT INFRUSTRUCTURE DEVELOPMENT WITH REGARDS TO REGION

In order to find views on ICT infrastructure development, various respondents were asked to provide their views on infrastructure development and their responses are summarized in the Table 2(d) and chart 1(c).

Table 5: Regional ICT infrastructure developments

INSTITUTION	**RURAL**			**SURBAN**			**URBAN**		
	O	**E**	**(O-E)2/E**	**O**	**E**	**(O-E)2/E**	**0**	**E**	**(O-E)2/E**
POLYTECHNICS	**0**	**0.6956**	**0.6956**	**0**	**1.217**	**1.2174**	**4**	**2.087**	**1.75351**
TECHNICAL INSTITUTES	**0**	**3.304**	**3.304**	**8**	**5.782**	**0.85074**	**11**	**9.913**	**0.11919**
SECONDARY SCHOOLS	**12**	**8**	**2**	**13**	**14**	**0.07143**	**21**	**24**	**0.375**
TOTAL	**12**	**11.9996**	**5.9996**	**21**	**21**	**2.13957**	**36**	**36**	**2.2477**

Table 6: Chi Square Test for Independence

INSTITUTION	**RURAL**	**SURBAN**	**URBAN**	**TOTAL**
POLYTEHNICS	0	0	4	4
TECHNICAL INSTITUTES	0	8	11	19
SECONDARY SCHOOLS	12	13	21	46
TOTAL	**12**	**21**	**36**	**69**

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019
www.iprjb.org

$E_{11} = \frac{R_T X C_T}{C_{I\ T}}$ $E = \frac{R_T X C_T}{C_{I\ T}}$ $E_{11} = \frac{R_T X C_T}{C_{I\ T}}$

$E_{11} = \frac{R_{11} X C_{11}}{T_{RC}}$ $E_{11} = \frac{4X12}{69} = 0.6956$ $E_{12} = \frac{R_{12} X C_{12}}{T_{RC}}$ $E_{12} = \frac{4X21}{69} = 1.2174$

$E_{13} = \frac{R_{13} X C_{13}}{T_{RC}}$ $E_{13} = \frac{4X36}{69} = 2.087$, $E_{21} = \frac{R_{21} X C_{21}}{T_{RC}}$, $E_{21} = \frac{12X19}{69} = 3.304$

$E_{22} = \frac{R_{22} X C_{22}}{T_{RC}}$, $E_{22} = \frac{21X19}{69} = 5.7821$, $E_{23} = \frac{R_{23} X C_{23}}{T_{RC}}$ $E_{23} = \frac{36X19}{69} = 9.913$

$E_{31} = \frac{R_{31} X C_{31}}{T_{RC}}$ $E_{31} = \frac{12X46}{69} = 8.000$, $E_{32} = \frac{R_{32} X C_{32}}{T_{RC}}$ $E_{32} = \frac{21X46}{69} = 14.000$ $E_{33} = \frac{R_{33} X C_{33}}{T_{RC}}$,

$E_{33} = \frac{36X46}{69} = 24.000$

$\chi^2 = \frac{(O-E)^2}{E}$ $\chi^2 = 5.9996 + 2.13957 + 2.2477$ $=10.38687$

<u>Step 1: stating the hypothesis:</u>

H_o: Infrastructural development is independent of the region. (Claim)

H_1: Infrastructural development is dependent of the region.

<u>Step 2: Finding the critical value:</u>

The critical value (CV) =d.f= (R-1) x (C-1)

d.f = (3-1) (3-1) = 2x2= 4

At α = 0.05 C.V= 9.448

<u>Step 3: Test value:</u> = 10.38687

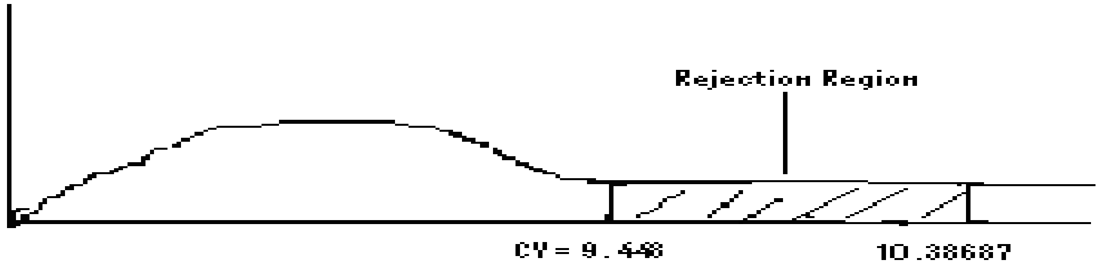

Fig 6 Standard Normal Distribution

<u>Step 4: Decision</u>

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is no enough evidence to support the claim that Infrastructural development is independent of the region

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	69	9.448	4	10.38687	0.05

4.4 ICT LITERACY

In order to investigate ICT literacy, respondents were asked to provide their opinion on ICT access and usage; this was in the light that effective ICT utilization calls for clear understanding of the underlying concepts and techniques in ICT. Their responses are denoted in table 3 (a) and chart 2 (a)

Table 7: Access to computers

ACCESS TO COMPUTERS	YES	NO	TOTAL
FREQUENCY	100	50	150
% FREQUENCY	66.666667	33.33333	100

Table 8: Chi Square Test for Goodness of Fit

RESPODENTS	OBSERVED	EXPECTED	(O-E)	(O-E)2/E
YES	100	75	25	8.333333
NO	50	75	-25	8.333333
TOTAL	**150**	**150**	**0**	**16.66667**

Step 1: stating the hypothesis:

H_o: All Technical stakeholders have access to ICT facilities.

H_1: Not all Technical stakeholders have access to ICT facilities.

Step 2: Finding the critical value:

The critical value (CV) = d.f= n-1, d.f = 1

At α = 0.05 C.V= 3.841

Step 3: Test Value: = 16.66667

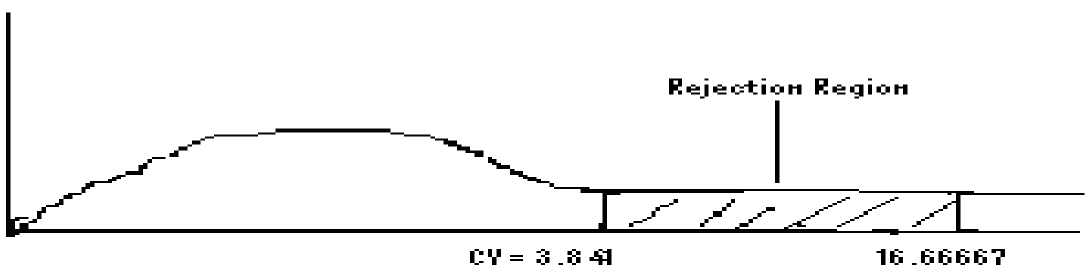

Fig 7 Standard Normal Distribution

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is enough evidence to reject the claim that all Technical stakeholders have access to ICT facilities.

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	3.841	1	16.66667	0.05

4.5 ACCESS TO WIDE AREA NETWORK (WAN)

In order to investigate further ICT literacy, respondents were asked to provide their opinion on access to wide area network (WAN).Their responses are denoted in table 3 (b) and chart 2 (b)

Table 8: Access to Wide Area Network (WAN)

ACESS TO WAN	YES	NO	NO COMMENT	TOTAL
FREQUENCY	30	70	50	150
% FREQUENCY	20	46.66667	33.33333333	100

Table 9: Chi Square Test for Goodness of Fit

RESPODENTS	OBSERVED	EXPECTED	O-E	(O-E)2/E
YES	30	50	-20	8
NO	70	50	20	8
NO COMMENT	50	50	0	0
TOTAL	**150**	**150**	**0**	**16**

Step 1: Stating the Hypothesis:

H_o: All the respondents have access to WAN.

H_1: Not all the respondents have access to WAN

Step 2: Finding the critical value:

The critical value (CV) =

d.f= (R-1) x(C-1)

d.f = (3-1) (2-1) = 2x1= 2

At α = 0.05 C.V= 5.991

Step 3: Test value = 16.000

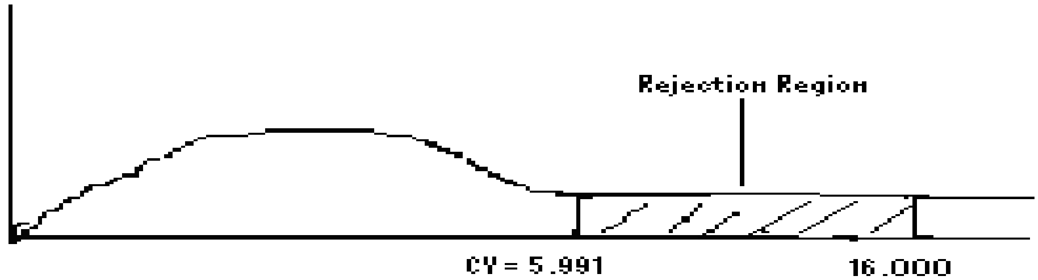

Fig 8 Standard Normal Distribution

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is enough evidence to reject the claim that all the respondents have access to WAN.

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	5.991	2	16.000	0.05

4.6 ICT LITERACY IN TECHNICAL FIELD

In order to find ICT literacy in technical field, the respondents were asked their opinions with regards to ICT literacy in technical field. Table3 (d) and chart 2 (c) summarizes the respondents opinions.

Table 10: ICT Literacy in Technical Field

GROUP OPINION	**POOR**	**FAIR**	**GOOD**	**V.GOOD**	**TOTAL**
FREQUENCY	60	50	28	12	150
% FREQUENCY	40	33.33333	18.66667	8	100

Table 11: Chi Square Test for Goodness of Fit

COMMENT	**OBSERVED**	**EXPECTED**	**(O-E)**	**$(O-E)^2$**	**$(O-E)^2/E$**
POOR	60	37.5	22.5	506.25	13.5
FAIR	50	37.5	12.5	156.25	4.166667
GOOD	28	37.5	-9.5	90.25	2.406667
V. GOOD	12	37.5	-25.5	650.25	17.34
TOTAL	**150**	**150**	**0**	**1403**	**37.41333**

Step 1: Stating the hypothesis:

H_o: There exists no difference in ICT literacy with regards to technical field.

H_1: There exists no difference in ICT literacy with regards to technical field.

Step 2: Finding the critical value:

African Journal of Education and Practice
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Vol.4, Issue 1, pp 1 - 28, 2019

The critical value (CV) =d.f= N-1, = (4-1) =3.

At α = 0.05 C.V= 7.815

Step 3: Test value = 10.38687

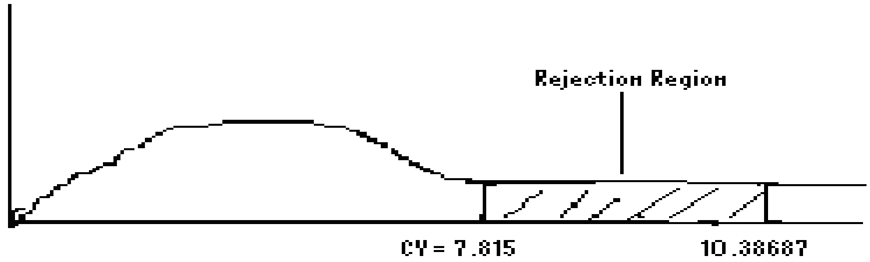

Fig 9 Standard Normal Distribution

Step 4 : Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is enough evidence to reject the claim that there exists no difference in ICT literacy with regards to technical field.

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	7.815	3	10.38687	0.05

4.7 RELATED CONTENT

The respondents were asked to give their opinions relating ICT and current technical education content on how they rate technical education content with regards to emerging ICT solutions. Their views are denoted in table 3(d) and chart 2(d).

Table 12: Technical Education Content With Relation To Emerging ICT

GROUP OPINION	POOR	FAIR	GOOD	V.GOOD	TOTAL
FREQUENCY	62	52	32	4	150
% FREQUENCY	41.3333333	34.66667	21.33333	2.666667	100

Table 13: Chi-Square Test for Goodness of Fit

COMMENT	OBSERVED	EXPECTED	(O-E)	(O-E)2	(O-E)2/E
POOR	62	37.5	24.5	600.25	16.00667
FAIR	52	37.5	14.5	210.25	5.606667
GOOD	32	37.5	-5.5	30.25	0.806667
V. GOOD	4	37.5	-33.5	1122.25	29.92667
TOTAL	**150**	**150**	**0**	**1963**	**52.34667**

Step 1: Stating the hypothesis:

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019

H_o: There is no significant difference relating ICT and technical Education.

H_1: There is significant difference relating ICT and technical Education. (Claim)

Step 2: Finding the critical value:

The critical value (CV) = d.f=N-1, d.f = (4-1) = 3

At α = 0.05 C.V= 7.815

Step 3: Test value: = 16.000

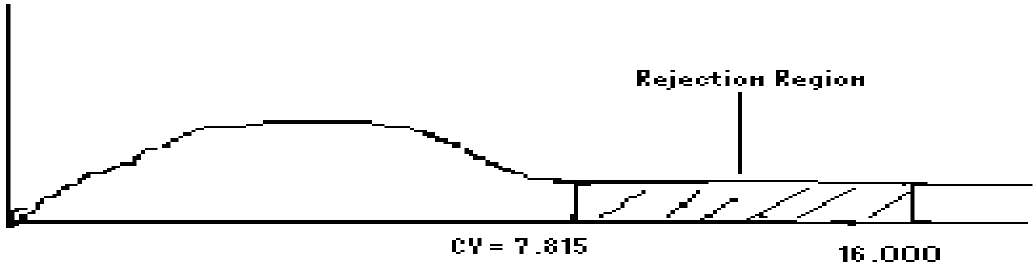

Fig 10 Standard Normal Distribution

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is enough evidence to support the claim that there exists significant difference relating ICT and technical Education

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	7.815	3	16.000	0.05

The second objective of the study was**: To investigate the incorporation of ICT into technical training programs with regards to quality.** To achieve this objective, the respondents were asked questions relating to Research and Development, Monitoring and Evaluation, Training, Partnerships & Resource Mobilization.

4.8 Responses towards Present Technical Education System

Table 14: Responses towards Present Technical Education System

COMMENT	**Extremely Dissatisfied**	**Diss atisfi ed**	**Neutral**	**Satisfied**	**Extremely satisfied**	**TOTA L**
FEQUENCY	28	51	35	28	8	150
% FREQUENC Y	18.66666667	34	23.333333	18.66667	5.333333333	100

Table 15: Chi Square Test for Independence

COMMENT	OBSERVED	EXPECTED	(O-E)	(O-E)2	(O-E)2/E
EXREMELY SATISFIED	28	30	-2	4	0.133333
DISSATISFIED	51	30	21	441	14.7
NEUTRAL	35	30	5	25	0.833333
SATISFIED	28	30	-2	4	0.133333
EXTREMELY SATISFIED	8	30	-22	484	16.13333
TOTAL	**150**	**150**	**0**	**958**	**31.93333**

Step 1: Stating the hypothesis:

H_o: The respondents show no preference towards present technical field.

H_1: The respondents show preference towards present technical field. (Claim)

Step 2: Finding the critical value:

The critical value (CV) = d.f= N-1, d.f = (5-1) = 4

At α = 0.05, C.V= 9.488

Step 3: Test value = 16.000

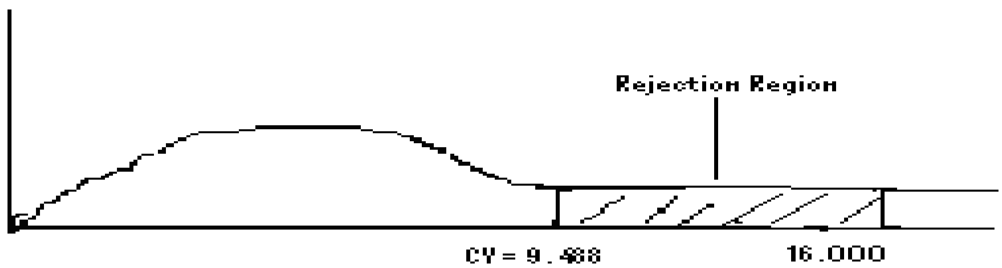

Fig 4 (a) Standard Normal Distribution

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis results above, there is enough evidence to support the claim that respondents show preference towards present technical field.

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	9.488	4	16.000	0.05

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019

4.8 ICT UTILISATION IN TECHNICAL EDUCATION

Table 15: ICT Utilization in Technical Education

RESPONDENTS	YES	NO	NO COMMENT	TOTAL
FREQUENCY	30	108	12	150
% FREQUENCY	72	20	8	100

Table 16: Chi- Square Test for Independence

ICT UTILISATION	OBSERVED	EXPECTED	O-E	(O-E)2/E
YES	30	50	-20	8
NO	108	50	58	67.28
NO COMMENT	12	50	-38	28.88
TOTAL	**150**	**150**	**0**	**104.16**

Step 1: Stating the hypothesis:

H_o: There is no current utilization of ICT in technical education. (Claim)

H_1: There is current utilization of ICT in technical education.

Step 2: Finding the critical value:

The critical value (CV) =

d.f=N-1, d.f = (3-1) =2

At α = 0.05, C.V= 5.991

Step 3: Test value = 104.16

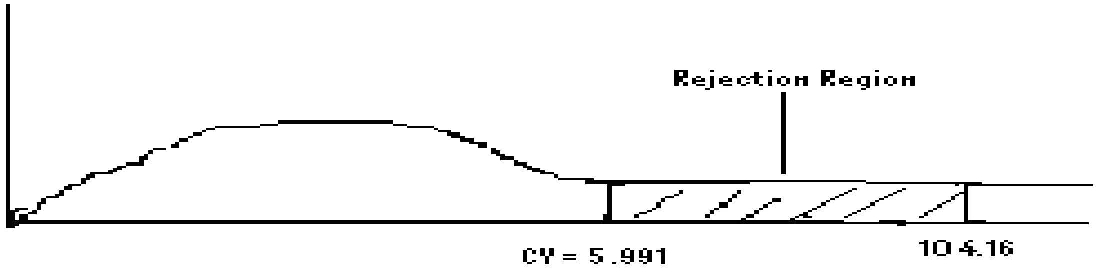

Fig 11 Standard Normal Distribution

Step 4: Decision

From the statistical analysis results above, we reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on infrastructure development	150	5.991	2	104.16	0.05

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019

4.9 PLANS TO INDUCT TECHNICAL TEACHERS

The respondents were asked to give their opinions relating plans to induct technical teachers in ICT usage. Their views are summarized in Table 4 (c) and Chart 3(c).

Table 17: Plans to Induct Technical Teachers

ACESS TO WAN	YES	NO	NO COMMENT	TOTAL
FREQUENCY	30	72	48	150
% FREQUENCY	20	48	32	100

Table 18: Chi Square Test for Goodness of Fit

RESPONDENTS	OBSERVED	EXPECTED	O-E	$(O-E)^2/_E$
YES	30	50	-20	8
NO	72	50	22	9.68
NO COMMENT	48	50	-2	0.08
TOTAL	150	150	0	17.76

Step 1: Stating the hypothesis:

H_o: There are no plans to induct technical teachers.

H_1: There are plans to induct technical teachers.

Step 2: Finding the critical value:

The Critical Value (CV) d.f= (R-1) x(C-1)

d.f =(3-1)(3-1)=2x2= 4

At α = 0.05 C.V= 9.448

Step 3: Test value = 10.38687

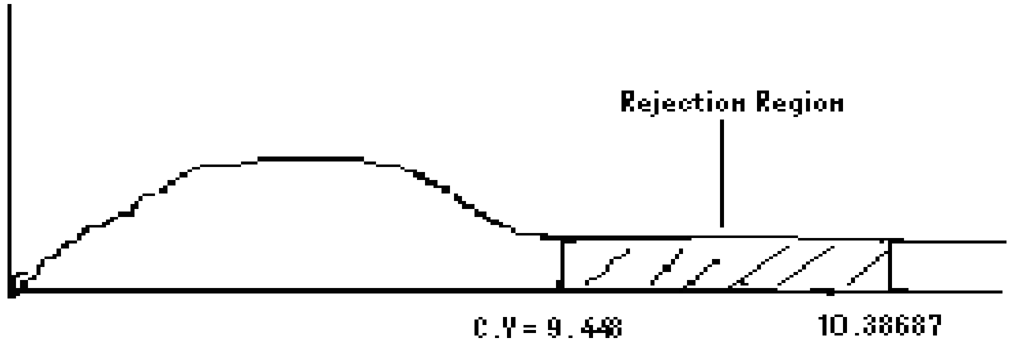

Fig 12 Standard Normal Distribution

Step 4: Decision

From the statistical analysis results above, we reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019
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Variable	N	C.V	df	χ^2	α =0.05
Respondents opinion on plans to induct technical teachers	150	9.448	2	10.38687	0.05

4.10 ICT INTERGATION

The respondents were asked to give their opinions relating ICT integration. Their views are summarized in Table 4 (c) and Chart 3(c).

Table 19: ICT Integration Approach to Technical Education

COMMENT	MULTIDISCIPLINARY	INTERDISCIPLINARY	TOTAL
FREQUENCY	48	102	150
% FREQUENCY	32	68	100

Table 20: Chi Square Test for Independence

RESPODENTS	OBSERVED	EXPECTED	O-E	$(O-E)^2/E$
MULTIDISCIPLINARY	48	50	-2	0.08
INTERDISCIPLINARY	102	50	52	54.08
TOTAL	**150**	**100**	**50**	**54.16**

4.11 ICT AS AN INSTRUCTIONAL TOOL

The respondents were asked to give their opinions relating ICT as an instructional tool their views are summarized in Table 5 (a) and Chart 4(a).

Table 21: Assessment of ICT as an Instructional Tool.

RESPONSE	POOR	FAIR	GOOD	V.GOOD	TOTAL
FREQUENCY	24	50	58	18	150
% FREQUENCY	16	33.33333	38.66667	12	100

Table 22: Chi Square Test for Independence

COMMENT	OBSERVED	EXPECTED	(O-E)	(O-E)2	(O-E)2/E
POOR	24	37.5	-13.5	182.25	4.86
FAIR	50	37.5	12.5	156.25	4.166667
GOOD	58	37.5	20.5	420.25	11.20667
V. GOOD	18	37.5	-19.5	380.25	10.14
TOTAL	**150**	**150**	**0**	**1139**	**30.37333**

Step 1: Stating the hypothesis

H_o: ICT is not a universal tool in technical education and training.

H_1: ICT is a universal tool in technical education and training. (Claim)

Step 2: Finding the critical value

The critical value (CV) = d.f=n-1, 4-1=3

At α = 0.05 C.V= 7.815

African Journal of Education and Practice
ISSN 2519-0296 (online)
Vol.4, Issue 1, pp 1 - 28, 2019

Step 3: Test value = 30.37333

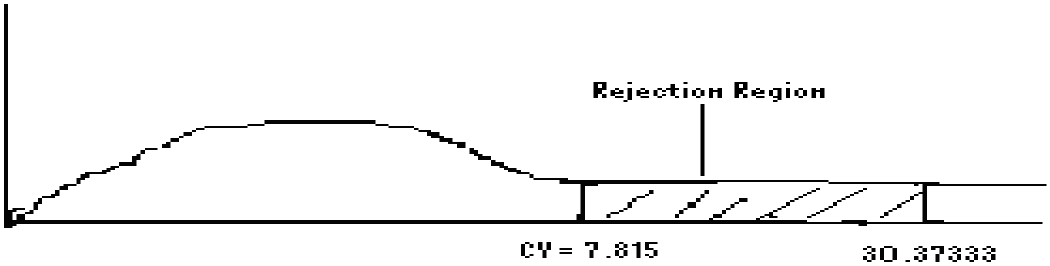

Fig 13 Standard Normal Distribution

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis above, there is enough evidence to support the claim that ICT can be a universal tool in technical education.

Variable	N	C.V	df	χ^2	P=0.05
Respondents opinion on infrastructure development	150	7.815	3	30.37333	0.05

4.12 PREFERENCE OF ICT AS AN INSTRUCTIONAL TOOL

The respondents were asked to give their opinions relating their preference of ICT as an instructional tool. Their views are summarized in Table 5 (b) and Chart 4(b).

Table 23: Preference for ICT as an Instructional Tool

GROUP	Prefer ICT Procedure	Prefer Old Procedure	No Preference	Total
ICT Illiterate	68	45	37	150
ICT Literate	87	38	25	150
Total	155	83	62	300

Table 24: Chi Square Test for Independence

GROUP	Prefer ICT Procedure			Prefer Old Procedure			No Preference		
	O	**E**	**(O-E)2/E**	**O**	**E**	**(O-E)2/E**	**O**	**E**	**(O-E)2/E**
ICT Illiterate	68	77.5	1.16451613	45	41.5	0.29518072	37	31	1.16129
ICT Literate	87	77.5	1.16451613	38	41.5	0.29518072	25	31	1.16129
Total	155	155	2.32903226	83	83	0.59036145	62	62	2.32258

$$E_{11} = \frac{R_{11} X C_{11}}{T_{RC}}, \quad E_{11} = \frac{155 X 150}{300} = 77.5, \qquad E_{12} = \frac{R_{12} X C_{12}}{T_{RC}}, \qquad E_{12} = \frac{83 X 150}{300} = 41.5,$$

$$E_{13} = \frac{R_{13} X C_{13}}{T_{RC}}, \; E_{13} = \frac{62 X 150}{300} = 31.0 \; E_{21} = \frac{155 X 150}{300} = 77.5 \; E_{22} = \frac{83 X 150}{300} = 41.5$$

$$E_{23} = \frac{R_{23} X C_{23}}{T_{RC}}, \; E_{23} = \frac{62 X 150}{300} = 31.0 \; E_{31} = \frac{R_{31} X C_{31}}{T_{RC}} \quad E_{31} = \frac{71 x 56}{150} = 26.507 \;, \; E_{32} = \frac{R_{32} X C_{32}}{T_{RC}}$$

$$E_{32} = \frac{55 x 56}{150} = 20.53 \; E_{33} = \frac{R_{33} X C_{33}}{T_{RC}}, \; E_{33} = \frac{24 X 56}{150} = 8.96$$

<u>Step 1: Stating the hypothesis</u>

H_o: ICT preference as instructional tool is independent of ICT literacy (Claim).

H_1: ICT preference as instructional tool is dependent of ICT literacy

<u>Step 2: Finding the critical value:</u>

The critical value (CV) =

d.f= (R-1) x(C-1)

d.f = (2-1) (3-1) = 1x2= 2

At α = 0.05 C.V= 5.991

<u>Step 3: Test value:</u> =2.329032 + 0.59036145 + 2.322581 = 5.241975

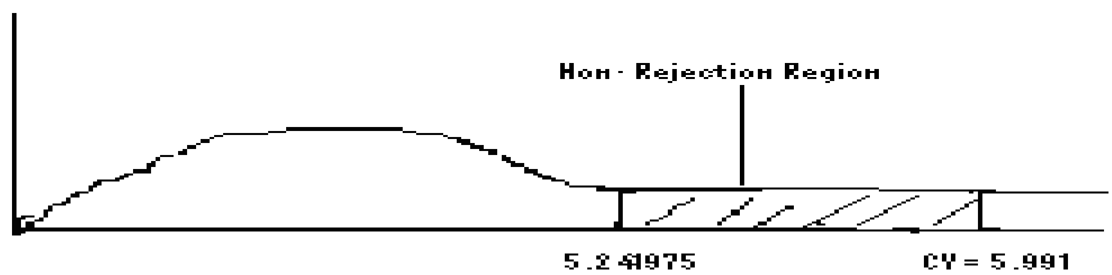

Fig 14 Standard Normal Distribution

<u>Step 4: Decision</u>

We do not reject the null hypothesis because the test value is smaller than the critical value.

<u>Step 5: Summary</u>

From the statistical analysis above, there is enough evidence to support the claim that ICT preference as instructional tool is independent of ICT literacy

Variable	N	C.V	df	χ^2	P=0.05
Respondents' opinion on ICT as instructional tool.	69	5.9914	2	5.241975	0.05

The third objective was: **To find out ICT as a requisite tool of the technical programs instruction**. To achieve this objective, respondents were asked their preference on ICT as a requisite tool in technical training and their responses are denoted in table 6(a) and chart 5 (a).

4.13 Preference of ICT as a Requisite Tool in Technical Training.

Table 25: Preference of ICT as a Requisite Tool In Technical Training.

Group	**Prefer** ICT **As A Requisite**	**Prefer Current Procedure**	**No Preference**	**Total**
ICT Illiterate	54	76	20	150
ICT Literate	86	35	29	150
Total	140	111	49	300

Table 26: Chi Square Test for Independence

GROUP	**Prefer** ICT **As A Prequisite**			**Prefer Current Procedure**			**No Preference**		
	O	E	$(O-E)^2/E$	O	E	$(O-E)^2/E$	O	E	$(O-E)^2/E$
ICT Illiterate	54	69	4.695652	76	57	7.736842	20	24	0.375
ICT Literate	86	69	4.695652	35	57	7.736842	29	24	0.375
Total	140	138	9.391304	111	114	15.47368	49	48	0.75

Step 1: Stating the Hypothesis

H_o: ICT is not a requisite tool in technical training

H_1: ICT is a requisite tool in technical training (claim).

Step 2: Finding the Critical Value

The critical value (CV) =d.f= (R-1) x(C-1)

d.f = (3-1) (2-1) = 2x1= 2

At α = 0.05, C.V= 5.991

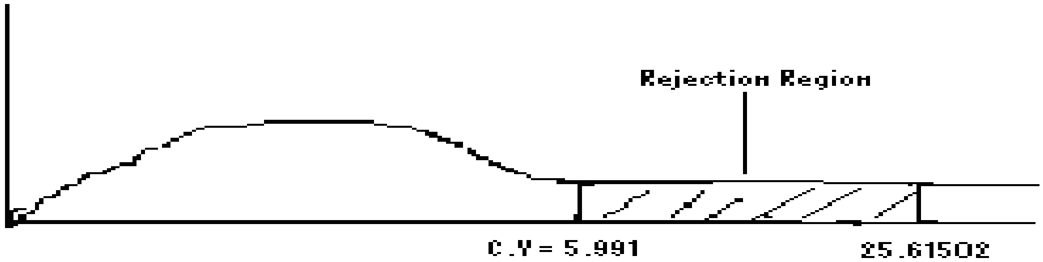

Fig 15 Standard Normal Distribution

Step 3: Test value: = 9.391304 + 15.47368+ 0.75 =25.61502

Step 4: Decision

We reject the null hypothesis because the test value lies in the rejection region.

Step 5: Summary

From the statistical analysis above, there is no enough evidence to support the claim that Preference of ICT as a requisite tool in technical training.

Variable	N	C.V	df	χ^2	P=0.05
Respondents opinion on infrastructure development	150	5.991	2	25.61502	0.05

4.14 Institutional ICT Preference

Respondents were asked about their opinions about Institutional ICT Preference and their responses are summarized in table 6(a) and chart 5 (a).

Table 27: Institutional ICT Preference

Institution	Prefer ICT Procedure	Prefer Old Procedure	No Preference	Total
Polytechnic	19	12	4	35
Technical Institutes	28	23	8	59
Secondary	24	20	12	56
TOTAL	**71**	**55**	**24**	**150**

Table 28: Chi Square Test for Independence

GROUP	Prefer ICT Procedure			Prefer Old Procedure			No Preference		
	O	E	$(O-E)^2/E$	O	E	$(O-E)^2/E$	O	E	$(O-E)^2/E$
Polytechnics	19	16.57	0.356361	12	12.83	0.008832	4	5.6	0.457143
Technical Institutes	28	27.93	0.000175	23	21.633	0.086381	8	9.44	0.219661
Secondary	24	26.51	0.23765	20	20.53	0.013682	12	8.96	1.031429
TOTAL	**71**	**71.01**	**0.594186**	**55**	**54.493**	**0.108896**	**24**	**24**	**1.708232**

$$E_{11} = \frac{R_{11} X C_{11}}{T_{RC}} \quad E_{11} = \frac{71 X 35}{150} \quad E_{12} = \frac{R_{12} X C_{12}}{T_{RC}}$$

$$E_{12} = \frac{55 X 35}{150} = 12.83, E_{13} = \frac{R_{13} X C_{13}}{T_{RC}} \quad E_{13} = \frac{24 X 35}{150} = 5.60$$

$E_{21} = \frac{R_{21} X C_{21}}{T_{RC}}$, $E_{21} = \frac{71 X 159}{150} = 27.927$ $E_{22} = \frac{R_{22} X C_{22}}{T_{RC}}$, $E_{22} = \frac{55 X 59}{150} = 21.633$

$E_{23} = \frac{R_{23} X C_{23}}{T_{RC}}$, $E_{23} = \frac{24 X 59}{150} = 9.44$, $E_{31} = \frac{R_{31} X C_{31}}{T_{RC}}$ $E_{31} = \frac{71 x 56}{150} = 26.507$, $E_{32} = \frac{R_{32} X C_{32}}{T_{RC}}$

$E_{32} = \frac{55 x 56}{150} = 20.53$ $E_{33} = \frac{R_{33} X C_{33}}{T_{RC}}$, $E_{33} = \frac{24 x 56}{150} = 8.96$

Step 1: Stating the hypothesis:

H_o: There is no significant difference in institutional ICT preference. (Claim)

H_1: There is significant difference in institutional ICT preference.

Step 2: Finding the critical value:

The critical value (CV) =d.f= (R-1) x(C-1)

d.f = (3-1) (2-1) = 2x1= 2

At α = 0.05, C.V= 5.991

Step 3: Test value: = 0.594186+ 0.108896+1.708232 =2.411314

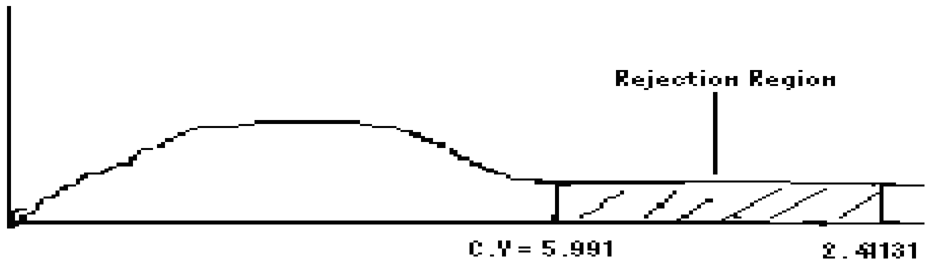

Fig 16 Standard Normal Distribution

Step 4: Decision

We do not reject the null hypothesis because the test value lies in the non-rejection region.

Step 5: Summary

From the statistical analysis above, there is enough evidence to support the claim that there is no significant difference in institutional ICT preference but they all basically feel the same about ICT procedure.

Variable	N	C.V	df	χ^2	P=0.05
Respondents opinion on institutional ICT preference	150	5.991	2	2.411314	0.05

4.15 VALIDITY AND RELIABILITY TESTS

By using the K-R (Kunder-Richardson) 20 formula in assessing the internal consistency, we have

$$KR_{20} = \frac{(K)(S^2 - \sum_s{}^2)}{(S^2)(K-1)}$$

Where

KR=reliability coefficient of internal consistency

K= number of items used to measure the concept

S^2=variance of all scores

s^2= variance of individual scores

K=150

S^2= 861.35 $\sum s^2 =$ (114.213+114.213+10.38687+16.6667+16.0+10.36887+16+16+104.16+10.3867+30.3733+5.241975+25.6152.411) = 475.388022

$$KR_{20} = \frac{(150)(861.35 - 475.388)}{(475.388)(150-1)} = 0.817333$$

Since the results give a high coefficient, this implies that the items correlate highly among themselves, that is, there is consistency among the items. Validity is the accuracy and meaningfulness of inferences, which are based on the research results. In other words, validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. Validity is largely determined by the presence of errors or absence of systematic errors on data. The construct, content and criterion related validity were all verified.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The government of Kenya is committed to enhancing quality education. It has formulated a dedicated national ICT policy that aims to make ICT an integral part of education and training at all levels. A number of initiatives are being implemented including adoption of e-learning systems in tertiary institutions, the rollout of ICT programmes in learning institutions including the NEPAD initiatives.

This study investigated ICT as a potential integral component of technical education through emerging ICT based solutions. This was based on assessment of ICT as a potential instructional tool for quality improvement in delivery of technical education. The key objective was to investigate ICT as a potential instructional tool in technical education. The challenge here is for TVET to innovate and modernize its curricula to focus on the moving target of technology. However, the research findings revealed that there are no adequate resources in place for teaching and learning and initiatives to develop such resources have been scanty.

On ICT infrastructure development, the research revealed that in many institutions, technology is not yet easily accessible to the teachers, trainers and learners or trainees. Resources, if any, require much effort in planning for the technology to be brought into the classroom to use it.

On Technical education content; the findings reveal that presently there is no adequate use of ICT in technical education in Kenya and what exists has made minimal impact. The opportunities to enhance learning using modern technology in the various TVET subjects at all levels of education and training system have not yet been fully embraced.

There is either a low level, or in some cases, a near absence of use of ICT education systems in general and in technical education systems in particular in order to induce learners in a technologically rich society. These, by no means, are easy tasks and technical institutions cannot go it alone without support from the rest of stakeholders. There is need for more effective national strategies to facilitate curriculum modernization, ICT infrastructural development, training, encouraging closer links and collaboration between TVET institutions and enterprises in strengthening and making TVET curricula more relevant.

However, funds should be made available for the 'hardware' side of creating modern technological rich classroom environment. The software appropriate for TVE training is also more of a problem. The power of sophistication of available ICT opportunities can be exploited to provide quality technical education training. While ICT use in technical education is an asset, learning to use technology effectively is difficult to an extent whereby many institutions are hardly aware of its potential as it is time consuming, expensive, requires a team of specialists and yet it is a necessity.

It is not only financial and human resource issues but also an initiative and commitment problem. Concerted efforts are therefore required from the government experts, TVET facilitators and ministry of higher education science and technology towards ensuring capacity building and quality in TVET delivery.

Technical education must therefore build a new and broader approach in terms of focus, concepts, methodologies and technologies, which must not be considered in isolation but in relation to ICT. While currently there is no proper documented curricula addressing this, ICT use in technical education is possible if good ICT infrastructure, well trained personnel and a curricula is available. This is possible through promoting ICT education at primary, secondary, tertiary and community levels by developing ICT curricula, promoting investment in the sector and ensuring that teachers/trainers possess the requisite skills for smooth training at higher level. However it is worth noting that although ICT as an instruction tool is an asset, it does not replace the conventional teacher and the practical hands-on skills.

Recommendations

For effective utilization of ICT in the instruction Process, measures must be put in place to encourage the provision of infrastructure for access to local, national and international information resources at or next to the institutions.

It is recommended that the Government should employ the following strategies: a) Promote the development of e-learning resources by facilitating Public - Private Partnerships to mobilize resources in order to support e-Learning initiatives. b) Promote the development of integrated e-learning curriculum to support ICT in education.

It is recommended that the government should support the creation of the necessary capacity by:

a) Integrating IT subjects in the curriculum at all levels of technical education training so as to prepare both teachers and students in a continuum. b) Establishing educational networks for sharing educational resources and promoting e-learning at all levels through computer society and other learning opportunities.

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