

Influence of Trainers' Competence on Ict towards Integration of Information Communication Technology in Teaching and Learning Engineering In National Polytechnics in Kenya

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ABSTRACT: The vibrant transformations in the education sector and the constant pressure for skilled workforce have necessitated the use of Information Communication Technology (ICT) as an innovative and important component of learning instruction. The purpose of this study was to determine the status of ICT integration in the TL of engineering courses in National Polytechnics (NP) in Kenya. The research objective was to investigate the level of ICT knowledge, skills and the application in respect to instructional process in engineering courses in NP. The study was anchored on the constructivist learning model and guided by technology, organization and environment (TOE) theory. Constructivists learning puts forward that knowledge is constructed through an interactive activity that transforms trainers to adapt to the digital state of affairs. The study employed mixed method research approach and descriptive survey research design. The study population comprised of chief administrators and trainers in engineering departments in the NPs. The study respondents comprised 48 trainers selected by simple random sampling from mechanical, electrical and electronic, automotive and civil engineering departments. Questionnaire was used as research tools for data collection. The findings revealed that over 75% of the trainers were competent in ICT basic knowledge and internet skills. Conversely the study revealed that 66% of the trainers were skilful in multimedia and advanced ICT skills; however the use of ICT for TL both theory and practical was significantly low at an average of 20%. The study recommended that to accommodate several modes of interaction and free access as well trainers must be well trained in ICT and be capacity build on pedagogical approaches and digital content development skills. The study provides basic framework for adopting ICT in teaching and learning by Institutions.

KEY WORDS: ICT integrations, Teaching and learning, Trainers' competence

I. INTRODUCTION

The economy of the 21st century is aggressive in all dimensions and ICT makes this knowledge economy competitive and reliance on competent brains railing on lifelong learning strategy. In the early 1990s writing and calculation skills were considered as literate, however they are no longer considered adequate for an individual to effectively participate in this era. The objective of integrating ICT in the instructional delivery process is to improve quality, relevance and provoke the desire of learners to continuously seek knowledge hence lifelong learning. According to the researchers' Gülbahar (2007), Kim and Hannafin (2011) concluded that use of technology in educational settings benefits students. Practical skills can be delivered virtually via a well organized ICT set up. The approach where practical skills were taught using hands-on learning only has changed over time. There is great need for ICT integration in TVET as the world of work according to Rojewski (2009) 'requires knowledgeable workers skilled in information technologies. In this century of knowledge economy ICT plays an important role of equalization of knowledge across individuals and Nations. According to Zarini et al. (2009) ICT facilitates the development and the strengthening of TVET around the world by enhancing networking and knowledge sharing opportunities. In light of these facts, TVET institutions need to set up and strengthen their commitment towards training and produce ICT operation compliance graduates or products that will match up with industry trends in the modern workplace. According to Moeller and Reitzes (2011) generally the trainers that use technology do so primarily to present information rather than to provide hands-on learning for students trainees.

The report of Inan and Lowther (2010) identified trainers' proficiency with technology as a key factor associated with restricted use of technology in the instruction rooms. For trainers to use technology effectively for educational purposes, not only should they be familiar with how to operate equipment, but also understand how these tools are effectively used in their teaching and training fields and how to incorporate ICT resources into classroom activities that accomplish important learning goals. Zhao and Frank (2003) proposes that the

process of technology integration evolve as the teacher's beliefs, pedagogy, and technology skills slowly build upon each other as the technology is introduced and assimilated into the institutions culture. This study sought to establish this affirmation in the Kenya National Polytechnics context. In order to integrate ICT in classroom as defined by Lloyd (2005) as ICT use in classroom, trainers must be knowledgeable and skilful in ICT. The trainers being the agents of change need to be conversant with how to use the instructional software during the course, make presentations, or set and carry out practical activities in virtual laboratories or workshops. According to Cavas et al (2009) there are significant positive relationship between trainers' ICT skills and the frequency of the Technology use in instruction rooms. It is confirmed by Agyei and Voogt (2011) that ICT skills are exclusively important for effective application of the technology is the strongest predictor of ICT integration in the classroom or instruction rooms.

II. RESEARCH METHODOLOGY

This study used a mixed method research approach which is an integration of quantitative and qualitative research. This is a method that involves broader or wider aspects of data collection through questionnaires, interviews and observation. The goal of mixed methods research is to draw on the strengths and minimize the weaknesses of both types of research approaches asserts Connelly (2009). The research study evaluated the level of ICT knowledge and skill of the trainers' and the application of the competences to teaching and learning (T-). The study used a multi-stage sampling procedure involving purposive and stratified simple random sampling method to select the research sample units. This study used purposive sampling to select the three National Polytechnics based on their geographical location, year of existence and size in terms of infrastructure and student population. The national polytechnic selected are Kenya Technical Trainers College in Nairobi County, The Kisumu National Polytechnic located in Kisumu County and The Eldoret National Polytechnic located in Uasin-Gishu County. The engineering courses were grouped based on the areas of specialization which included Mechanical Engineering, Automotive Engineering, Electrical Engineering and Building and Civil Engineering. In choosing the respondents simple random and stratified sampling techniques were applied. Stratified sampling was used to select the trade areas and simple random sampling was applied for the trainers. This gave a total of 48 trainers and according to Ary et al, (2002) a study sample of between 10% -20% representatives is appropriate for any study. The sample size in this study was 44% way above the threshold. The questionnaires and the interview schedule were prepared in close consultation with experts in the field of research instrument preparation. The interview approach adopted what Stuckey (2013) put forward as semi-structured format in which the interviewer used a list of guiding questions and the interviewee is allowed to speak more widely on their experiences of the questions raised by the researcher as noted by Descombe (2010). The reliability test was run through SPSS and reliability coefficient was found to be 0.873 over 39 items that used to measure user response using likert scale. This suggested that the tool developed by the researcher was reliable.

The philosophy of ICT integration in teaching and learning : The application of ICTs in TVET has initiated a major paradigm shift, from the dependence on the objectivist paradigm to fast developing cognitive and constructivist paradigms. The goal of constructivism is to cultivate learners thinking and knowledge construction skills. In this approach, the learner has a lot of control of her own learning and is given opportunity to control learning pace and deadlines; the learner is the expert, whereas objectivists believe in sequencing learning experiences with prescribed expected outcomes with the teacher as the authority and transmitter of knowledge. According to Wonacott (2001) the use of Information Communication Technologies in distance education has prompted a pedagogy, which is constructivist, collaborative and interactive. Learning that is supported by technology; a central role in the evolution of a lifelong learning philosophy and creating the capacity to empower learners by providing them with plentiful corridors that present alternatives and means to meet their education and training needs (Human Resources Development Canada, 1998).

On the words of Driscoll (1994) constructivist learning theory is grounded in Piaget's works on cognitive development as well as in Bruner's in Vygostsky's interactional and cultural perspectives. This Constructivist theory of learning assumes that the knowledge we acquire about the world is constructed through instructional processes but not just reproduction of the outside world. Knowledge is significantly constructed by the individual, as part of a process of creating meaning, in socially, culturally, historically and politically mirrored contexts. In a constructivist learning environment, learners construct their own knowledge and apply it to new tasks, contexts and situation, integrating the new knowledge into their already existing knowledge structures. In the views of Albayrak and Yildirim (2015) ICT is a precious endowment in a lifelong and distance learning and digital technology are capable of setting up a context-free environment where trainees can be able to take part in constructive learning and knowledge building

According to Muianga et al (2013) trainee centred learning motivates trainers to exploit a range of methods that consent to active learning such as collaborative learning, open ended assignment, critical thinking exercises, simulations and problem solving activities. It was observed by Muganga (2015) that institutions of higher learning preference on trainee centered learning approach to provides a foundation for the continued development of alumnae in terms of competence, skills and knowledge. The majority of the developing countries, Kenya included, Muriithi (2005) views the use of ICT as limited to computer literacy training and the digital divide. The study asserts that the current ICT curriculum merely deals with 'Teaching about Computers' for most of the courses undertaken and not how the computers can be used to transform teaching and learning in institutions. This study seeks to determine the status of ICT integration in teaching and learning in national polytechnics.

Trainers' ICT Knowledge and Skills : Majumdar (2006) observed that to obtain the integration of ICT into the teaching-learning process, trainers, who are the agents of knowledge transfer, should acquire operational skills and understand how such educational technology can support pedagogy. For trainers to use technology effectively for educational purposes, not only should they be familiar with how to operate equipment, but also understand how these tools are effectively used in their teaching and training fields and how to incorporate resources into classroom activities with a view to accomplishing learning goals. According to Williams (2002) trainers can incorporate new technologies into existing practices by experimenting technology to teach in new ways and observe learning changes in their subjects. In order to use technology effectively for educational purposes, teachers must not only be familiar with how to operate equipment, but also understand how these tools are effectively used in the subjects they teach and how to incorporate resources into classroom activities that accomplish important learning goals. While many teachers use technology in their private lives and know how to operate it, they often lack some knowledge and skills required to support teaching and learning. Moreover, research into teacher learning in northern hemisphere contexts suggests that traditional, one-off external in-service workshops tend to be of limited value in developing sustained transformation of practice as observed by a team of researchers' Glazer and Hannafin (2006) and Muijs and Lindsay (2008).

Trainer's ICT Competence : The study by Venezky (2004) revealed that there are two important approaches that support ICT integration into teaching and learning; one being effective Initial Teacher Education (ITE) and secondly Continuing Professional Development (CPD). Computer competence is a major predictor of trainer's ability to integrate ICT in teaching and learning. This is the ability to handle a wide range of varying computer applications for a variety of purposes. The outcome of the research went further to note that the majority of teachers who reported to have negative or neutral attitude towards the integration of ICT into teaching and learning processes lacked knowledge and skills that would allow them to navigate the application of computer knowledge as well as guide its use. Teachers with more experience with computers have greater confidence in their ability to use them effectively. This study sought to establish the level of trainers' competence and the level of integration of ICT in Teaching and learning in Kenya's National Polytechnics, in order to make recommendation concerning the weak relationship between training skills and the industry skill demand. To this end, Aina (2009) and Sukri and Shu'aibu (2013) affirmed that the success of technology implementation for industrial development depends to a large extent on the ability of TVET to have competent and skilled human resource.

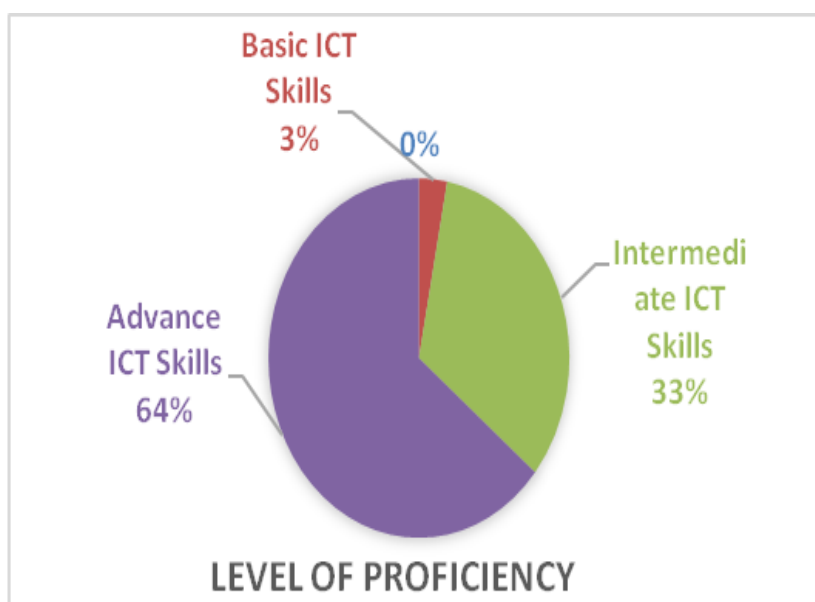
Trainers ICT Background Training : The experience of a trainer refers to the duration a teacher has in practicing teaching in the regular classroom. Studies conducted by Wong (2008) and Giordano (2007) showed that teaching experience influences the successful use of ICT in classrooms. In a similar reference, Giordano (2007) affirms that teachers' perceptions of instructional technology integration in classrooms revealed that teacher experience is significantly correlated with the actual use of technology. The study went further to explain that the effective use of computer technology was related to technological comfort levels and the autonomy to shape instruction to teacher-perceived student needs. However, a study on, what facilitates teachers use of technology in the classroom, found that experienced teachers are less ready to integrate ICT into their teaching.

Trainers ICT pedagogy competence : A researcher HanneleNiemi (2003) described teacher competence as the nucleus in developing information society, while spellings (2005) observed that teachers are crucial for student's comprehension. In this context teachers play a fundamental role in integration of ICT asserts Zhao (2003). Zhao (ibid) asked significant questions regarding what goes into guaranteeing the competence of teachers to be able to handle ICT in an enriched learning environment. In reference to International society for technology education (ISTE) and the National for Accreditation of Teacher Education (NACTE) Gillingham et al (1999) described teacher competence as the understanding of the content and pedagogy needed to use computer based

technologies for personal and professional productivity. However, Pearson (2003) affirmed that apart from learning ICT topics, the focus is to enable the teacher to use these tools, skill related to the pedagogical use of ICT to support learning and teaching experiences. In the views of Li (2002) teachers need a significant level of ICT skills to be able to use it for their instruction and learning, otherwise it is bound to cause unwillingness to use it. A- Panel of researchers Granger et al (2002) argued that teachers require empowerment with a level of autonomy and confidence in using ICT in classroom. The views expressed by Sabieh (2001) states that it is easy to teach how to use technology but relatively challenging to learn how to use technology as a pedagogical tool. It is clear from this argument that teachers need basic ICT skills, but on top of that they need knowledge and skills to enable them use ICT as pedagogy.

III. RESULTS AND DISCUSSIONS

The findings on the evaluation of trainers competencies in the three categories of computer proficiency; Basic, Intermediate and advanced computer proficiency, revealed that 64% were highly skilful. The competencies are shown in the Venn diagram below.



The chart indicates the level of computer proficiency comprising of three levels advance, intermediate and beginner. The displays shows that (27) 64% of the engineering trainers were proficient in advance ICT skills reported that they their computer proficiency was good while (14) 33% reported to be moderately proficient in computer Intermediate ICT skills. Computer proficiency is the ability to use digital technology networks, and to define access, manage, integrate, evaluate, create, and communicate information ethically and legally in order to function in a knowledge society. This implies that for every 100 trainers in engineering courses, 64 have computer literacy Computer skills is the knowledge and ability which allows one to use computers and related technology. The proficiency skills were categorized into three specific ICT levels namely Basic ICT Competency Skills, Internet Skills, Multimedia Skills and Advanced ICT Skills. Basic ICT Competency Skills are a group of ICT skills in the most widely used applications such as word-processing, spreadsheets, and presentation. They are skills necessary for generating textual, organization and presentation of digital information. Internet Skills would refer to a group of skills related to transmitting and exchanging ideas and working with others remotely through technology while Multimedia Skills are group of skills that involves creating and manipulation of digital images and videos which involves creating, editing, and publishing them. Advanced ICT Skills on the other hand are skills that relate to creating ICT software, database management, and analysis of research data. Trainers ICT skills levels comprised of the ability to use: word processor, Microsoft Excel, power point Presentation and internet to research and communicate.

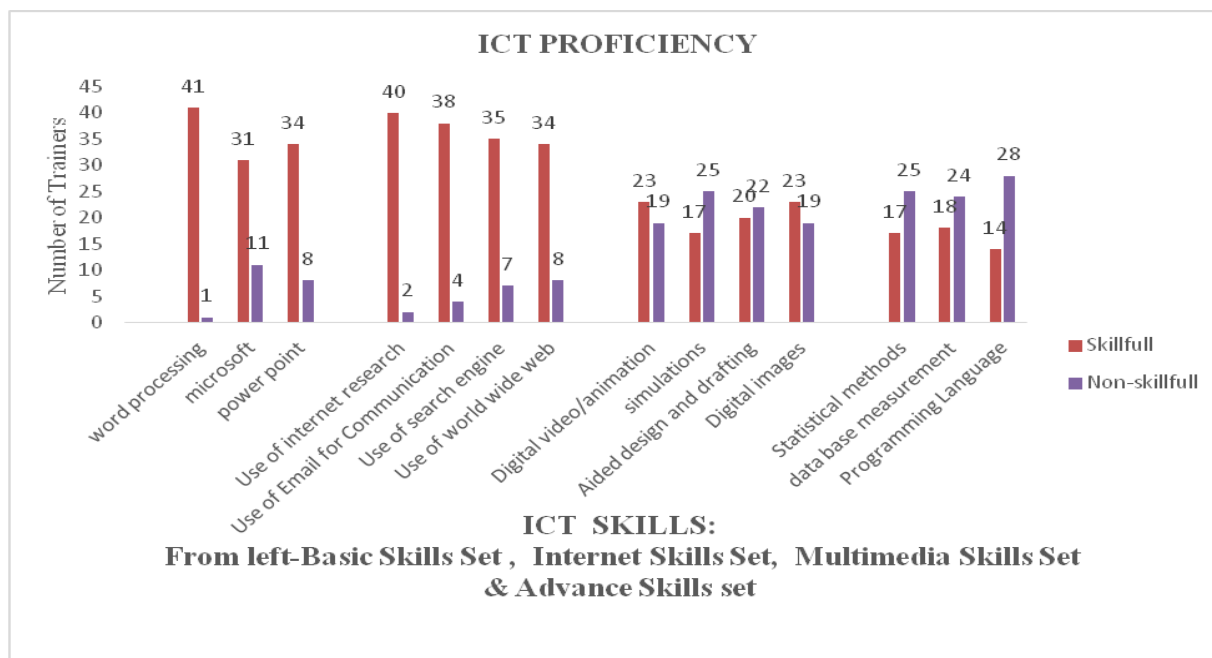


Figure 2: The levels of trainers' competency

The bars in figure 2 shows a total (41) 93% of the trainers reported that they are very skilful in using Word processor application and (31) 74% of the respondent reported that they are very skilful in using Spreadsheet application (Microsoft Excel) while (34) 81% Very skilful preparation and using power point Presentation application. This is an indication that averages over 70% of engineering trainers are knowledgeable and skilled in using this set of basic ICT applications. Skills in basic ICT applications are perceived to be minimum competence in computer basic applications. The implication of these results is that a majority of the trainers have got basic skills to perform common operations using a computer. This data reveals that the trainers have the capacity to use word processor to develop an excel sheet display and can carry out the presentation comfortably. A total of (40) 95% of the respondent reported that they are skilful using internet to search and communicate. These results give a clear indication that a majority of the trainers in the engineering have well developed skills in using and accessing internet resources. This implies that a majority of the trainers can effectively use ICT online tools to disseminate and access information. The trainers are not limited by technology to access new knowledge being developed in the global economy.

The multimedia skills comprised of the ability to use Digital Video and Animation, Computer Simulations, Computer Aided Design and Drafting and the use of digital images. Multimedia group of skills are the abilities necessary for generating and editing audio-visual objects that is videos and images using computer. The results in showed that a total of 54% of the respondent reported to be skilled in using digital video and animation. 43% of the respondents reported that they are skilled in using computer simulations. 47% of the respondents reported to be skilled in using Computer Aided design and Drafting software. 54% of the respondents stated that they skilled in using the digital images. On average the result indicated that slightly less than half (49%) of the trainers are skilled in using multimedia. This implies that more than half of the National Polytechnic engineering trainers are able to use digital images and video in the classroom or rather they are literate in multimedia skills. The multimedia skills are rated as specialized ICT skill which requires manipulations of computer operations. The Trainers Advance ICT Skill Level category included the ability to use statistical measurement, database and programming language being the fourth class.

The fourth category indicates three skill areas which can be considered technical in nature that require advanced skills of using computer. The results show 40% of the respondents are skilled in using statistical measurement, 43% in using database and 30% using programming language. In summary other than basic ICT and internet skills, all other ICT skill areas; Multimedia was less than 50% of the respondents reported to be skilled. In a study conducted by Mwangi (2013) in a tertiary institution found out that trainers' lack adequate knowledge and skills in both content and pedagogy. The limited knowledge and skills of the trainers' also limits the potentials to use the technology for teaching and learning asserts Nurse and Gaible (2002).

The outcome of this study shows that the trainers are averagely knowledgeable and skillful; status that does not empower one to efficiently and effectively use ICT in teaching and learning. In consideration of Sage and Rose (1985) chart on selection of the most convenient technology, the performance and the suitability of the media to be used would only be factored in the planning if the facilitator is competent and ready to perform the demonstration for purposes of transferring knowledge or skills. The semi-skilled or non skilled trainers 'have their competence compromised and according to the views of Peralta and Costa (2007) they lack confidence as competence relate directly to self-reliance. The interview investigated the level of ICT knowledge and skills of the trainers to use the technology to deliver the course content. The responses indicated that the trainers have the capacity to use basic skills they learnt, however they have reservations in using more specialized software such as programming, simulations and drawing and design. The responses were expressed as follows "The application of ICT as a tool for giving instruction and illustrative concept by use of specialized software such as simulations, computer programming requires deeper understanding of ICT infrastructure operations contrary the initial training of trainers or ICT awareness workshops on simple operations and basic skills." This statement from head of one institution portrays that the trainers do not have 'the practical know how to use ICT for teaching'; 'lacks ICT instruction skills for content delivery', though they 'use ICT for personal works', and that they require specialized focused courses for skill instruction. In this case it revealed that the trainers have had no training on the use of ICT for teaching and learning' but for individualized work. These therefore confirms the findings of Hashim (2007) that ICT integration in teaching and learning is a complex process that requires strategic planning by policy and decision makers. It was affirmed by Kitschier and Davis (2003) that trainers in ICT utilization instruction requires competence to use ICT in personal instruction, competence to understand a range of educational teaching model that make use of ICT in instruction, adequate aptitude to utilize ICTs as intelligence tools, competence to employ ICT in instruction as a tool for teaching.

Teaching and Learning Activities

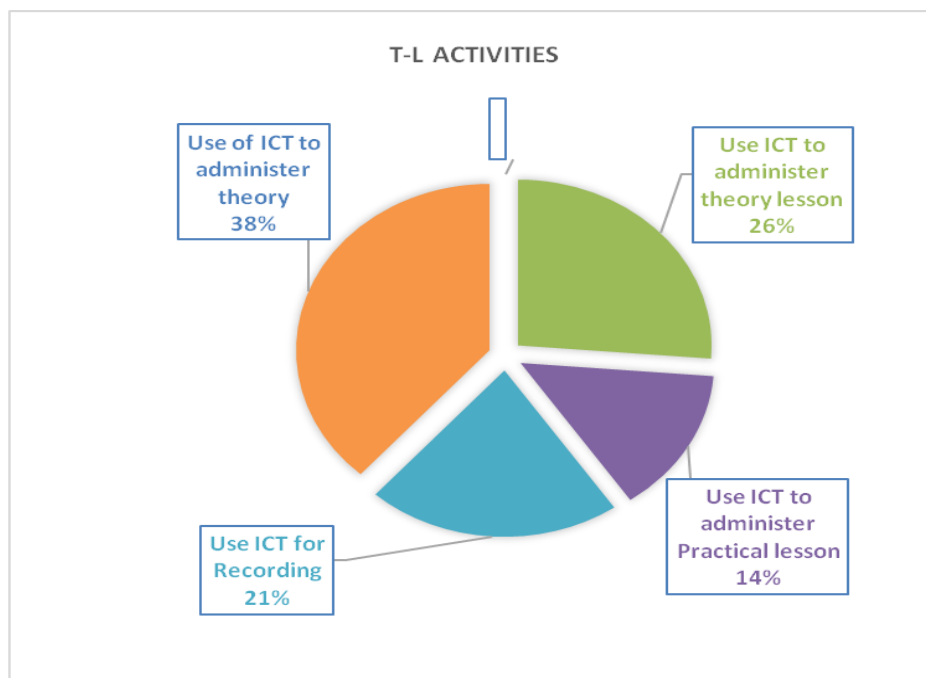


Figure 3: The levels of Teaching Activities.

Figure 3 shows results of trainers' ICT capacities to utilize various ways in teaching and learning activities. The results revealed that across all the teaching and learning activities, the application of ICT tools is significantly low. 26% of the respondent use ICT in theory lesson, 14% in practical lesson, 21% for recordkeeping and 38% for lesson preparation. This is an indicator that there is observed low use of ICT in teaching and learning in the National Polytechnic. The level of ICT competency and confidence encourages and motivates trainers as observed by Tasir et al (2012) to apply the knowledge and skills in lesson preparations and also inspires them in slides preparation and searching the internet declares Zafarullah and Pertti (2017). The associate researchers further stated that adoption of ICT in teaching and learning is only achievable with sound understanding of principles and ideas therein.

The outcome of this enquiry indicates the general impact of ICT integration on its application in the implementation of TVET curriculum has remained at the foundation phase. Trainers' generally understood to be agents of educational change, the adoption of technology globally at this age of knowledge economy tackles the challenges of globalization and the fast development worldwide knowledge economy affirms by Abuhmaid (2011). The quality of teaching and learning in tertiary institution according to Galbreath (2000) is improved by use of ICT. In view of this the trainers needs to be comfortable with the use of ICT in class; a situation in this case calls for deeper understanding of the root cause of the low uptake of technology. According to Tasir et al (2012) for teachers to be effective in the teaching and learning process they should have sufficient ICT skills and knowledge and create trust that the technology shall meet their needs; making them comfortable with the use of ICT without any apprehension or nervousness. During the interview with administrators of the engineering department and the institution leadership, the research results revealed the trainers who use ICT consistently stated that it has made their work easier especially teaching nonfigurative content in their area of specialization. Learning concepts that were delivered through ICT were well received and understood by trainees noted one head of department. The research results are in-line with the findings of Postman (2000) that integrating technology in classroom is commonly not accepted among scholar because of lack of competence. TVET trainers in engineering section have limited skills on how to integrate technology in teaching and learning. The result also supports finding of Zhao and Frank (2003) that trainers are willing to develop their skills in the use of technology to increase their confidence in integrating the ICTs in their lessons. The conventional form of teaching considered as face-to-face approach; considered a straight forward form of knowledge transfer still popular with the trainers as illustrated by the pie chart; fig 2.

The interview of the leadership of the department and the institutions observed in a broad spectrum that the computers in the laboratory were only used to teach the course content related to computer operations; in specific terms basic ICT skills. Generally the managers interpreted the thoughts and the general approach to ICT

integration as summarized by the statement: -

‘The provision of computer laboratories is for purposes of training on the basic computer applications; to carry out simple operations such as word processing techniques and simple elements of excel techniques.. ...the use of computers for content delivery in technical skilled subject areas has not been part of the schedule in the institution or neither the department nor any emphasizes has been laid on that’

The technology which could play the role of connecting the learning concepts to real life situations is generally left at the peripheral of teaching and learning. This agrees with the findings of Moeller and Reitze (2007) that the trainers' use technology to present information rather than to provide hands- on teaching and learning.

The trainers' were asked about some of the ICT equipment the institutions have acquired for purposes of enhancing teaching and training. Generally the response was that every institution had received smart boards. The numbers were limited as each institution had at least two instruction rooms with the equipment; however the facility was being shared by the departments.

On the efficient and effectiveness use of the installation one manager observed that:-

“The Smart boards are special equipment for demonstration on the capacity of technology and it is reserved for use by those who are conversant with the technology; the most valued, knowledgeable and skilful in ICT. The cost of losing through mishandling and the fact that it was a donation makes us (institution leadership) nervous about allowing every trainer to be exposed to the equipment, for teaching and learning--- --- --the successive influence is as limited as the infrastructure and the enabling environment does not permit”

The views of Cavas et al (2009) that there are close connection between the trainers' ICT skills and the frequency use of technology in the instruction rooms, and according to this observation the trainers seen not to be conversant with ICT will not have a chance to learn or use the smart board classrooms. The findings of this study in view of the theoretical framework that integration of ICT in teaching is guided by the deep understanding of the technology is confirmed by the data in figure 3. Integration of ICT in teaching and learning is constrains by limited ICT knowledge of and skills of trainers'. In order to effectively integrate ICT in instruction rooms the trainers must be knowledgeable and skilful in the technology

IV. CONCLUSION

The findings of the study showed that many trainers have the basic ICT knowledge and skills, multimedia skills and limited advance ICT skills. The trainers have knowledge and skills to carry out ICT application in the four categories of skill areas. The skills gap is therefore very slim. This can be attributed to the fact that ICT skills are a necessity rather than a luxury in this era of economy.

The trainers are practically competent in the use of ICT, however there is low integration of ICT in teaching and learning among the trainers can be attributed to lack of pedagogical skills. The study revealed that integration of ICT is influenced by many factors some of which is incorporated in theory which guided this research study. However, literature review revealed that for effective integration of ICT in T-L the process is gradual because the agents of teaching and learning; the Trainers have limitations in getting opportunities to familiarize with new technologies such as the smart boards and AutoCAD. ICT Proficiency is only achieved through constant use of the technology; experience. The study revealed that integration of ICT in T-L is a change that cannot be achieved instantaneously, it requires continuous process of implementation and modification, and therefore the agents of change needs to be able to adopt the evolving pedagogy. Despite this high percentage of computer proficiency, there is still low integration of ICT in teaching and learning among the engineering trainers in National Polytechnics. The low integration could be because the computer literacy acquired by the trainers' have no relationship to their role of teaching in their respective area of specialization.

REFERENCES

1. Albayrak, D., & Yildiri, Z (2015) Using social networking sites for teaching and learning:
2. Students' involvement in and acceptance of face book as a course management system. Journal of educational Computing research, 52(2), 155-179
3. Doi.org<https://doi.org/10.1177%2F0735633115571299>.
4. Abuhmaid, A.(2011). ICT training courses for Teachers Professional Development in
5. Jordan. Turkish Online Journal of Educational Technology-TOJET, 10(4), 195-210.ERICNumber:EJ946628. Retrieved on September, 2019 6. Abuya T. (2014): Impacts of Adopting ICT Integration Technical Training Institutions of Kenya, International Journal of Research in Information Technology (IJRIT)
7. Ary,D. Jacobs, L. And Razavieh, A.(2002) Introduction to Research. 6th edition, Wadsworth, Belmont
8. Atieno, R. Ayere, M. & Rabari, J.A.(2016) Teachers preparedness in the pedagogical integration of communication technology (ICT) In Chemistry Among Public Secondary Schools In Kisumu County ,Kenya. Retrieved from: https://www.researchgate.net/publication/331772267_Teachers_Preparedness_in_The_Pedagogical_Integration_of_Communication_Technology_ICT_in_Chemistry_Among_Public_Secondary_Schools_in_Kisumu_County_Kenya
9. Agyei, D. D & Voogt, J. M. (2011). Exploring the potential of the will, skill, and tool model in Ghana: Predicting prospective and practicing teachers' use of technology. Computer & Education, 56 (1), 91-100 10. Aina, L. O. (2004). Library and information science text for Africa. Ibadan, Nigeria: Third World Information Services Limited.
11. Aina, O. (2009), Technical and Vocational Education in Nigeria: the way forward. A Paper Delivered at the Education Trust Fund Sensitization Workshop, Kano.
12. Ary, D., Jacobs, L., Sorensen, C., & Walker, D. (2013). Introduction to research in 13. Education Cengage Learning.
14. Babette Moeller & Tim Reitzes (2011), Education Development Centre, Inc. (EDC).Integrating Technology with Student-Centred Learning. Quincy, MA: Nellie Mae Education Foundation. The Nellie Mae Education Foundation 1250 Hancock Street, Suite 205N, Quincy, MA 02169
15. Benbasat, I., Goldstein, D. K., & Mead, M (1987) The case Research Strategy in studies of information system. MIS QUARTERLY, 11, 369-386 .<http://dx.doi.org/10.2307/248684>
16. Biehler F. R.,and Snowman J (1997).Psychology applied to teaching. Houghton Mifflin Company, 1997. 0395776856, 9780395776858
17. Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. Eurasia Journal of Mathematics, Science and Technology Education, 5(3), 235-245
18. Cavas, B., Cavas, P., Karaoglan, B., & Kislal, T. (2009). A study on science teachers' attitudes toward Information and Communication Technologies in Education. The Turkish Online Journal of Educational Technology – TOJET, 8(2), 20-32.
19. Connelly, L.M (2009), Mixed Methods Studies. MEDSURG, Nursing. Vol. 18, No. 1 20. Creswell, J. (2003). "Research Design: Qualitative, Quantitative and Mixed Method Approaches. 2th edition, Thousand oaks", CA: Sage publishers.
21. Creswell, J.W., Plano Clark, V.L.,Gutmann, M.L. and Hanson, W.E. (2003). Advanced
22. mixed methods research designs. In Tashakkorim A. & Teddlie, C. (eds.). Handbook of mixed methods in the social and behavioural research, pp. 209-240. Thousand Oaks: Sage.
23. Creswell,J.W., & Clark, V. L.P. (2007). Designing and conducting mixed methods Research. Thousand Oaks: Sage publications 24. Creswell,J. W. (2013).Qualitative Inquiry & Research Design:

- Choosing among five Approaches (3rd ed) Tousand Oaks, CA:SAGE 25. Descombe, M (2010). The Good Research Guide- For Small-Scale
26. Social Research Projects. Berkshire, England: Open University Press 27. Driscoll, M. P. (1994). Psychology; learning for instruction. Boston: Allyn and Bacon
28. Flick, U. (2014). An introduction to qualitative research (5th ed.). London: Sage Publications Ltd.
29. Fosnot, C. T. (1996) Constructivism: Theory, Perspectives and practice. New York: Teachers college press.
30. Galbreath, J. (2000). Knowledge management technology in education. An overview. Education Technology, 40(5), 28-33. Information Technology underused in Education. Retrieved January 3rd ,2017 .
31. Gillingham, M. G. & Topper .A.(1999).Technology in Teacher Preparations: Preparing Teachers for future Journal of Technology & Teacher Education 7(4),pp 303-321
32. Giordano, V. (2007) A professional development model to promote internet integration into p-12 teachers' practice mixed method study. Computers in schools Vol 24,No3/4 pp 111-123
33. Gonzalez, D., St. Louis, R. (2008). "The use of Web 2.0 tools to promote learner autonomy" Independence:[http://peoplelearn.homestead.com/MEdHOME2/Technology/](http://peoplelearn.homestead.com/MEdHOME2/Technology/WebToos.2.0.autonomy.pdf) WebToos.2.0.autonomy.pdf.
34. Granger, C. A. Morbey, M. L. Lotherington. H. Owston. R.D.& Weidman. H. H (2002). Factors Contributing to Teachers Successful Implementation of IT, Journal of Computer Assisted Learning 18(4) pp 480-488 35. GSMA (2016) The mobile Economy 2016. Retrieved from www.gsma.com. London, UK.
36. Gülbahar, Y. (2007). Technology planning: A roadmap to successful technology integration in schools. Computers & Education, 49(4), 943–956.
37. HanneleNiemi.(2003). Towards a learning society in Finland Information and communication Technology in Teacher Education. Technology, Pedagogy and Education,12(1) pp85- 103
39. Hashim, Y. (2007). Value literacy as conduit for managing change in higher 40. education institutions. The whirlwind in educational management and policy. Kuala Lumpur: UM Publication
41. Hermans, R., Tondeur, J., van Braak, J., &Valcke, M. (2008). The impact of primary School teachers' educational beliefs on the classroom use of computers. Computers and Education, 51(4), 1499-1509
42. Inan, F. A. & Lowther, D. L. (2010). Factors Affecting Technology Integration in K-12 Classrooms: A Path Model. Education Technology Research and Development, 58, 137-154.
43. Janczewski, L. J. (1992). Factors of information technology implementation in under-developed countries: Example of the West African nations. In S. Palvia, P. Palvia & R. M. Zigli (Eds.), The Global Issues of Information Technology Management (pp. 187-212). London: Idea Group Publishing
44. Kaplan, B. & Duchon, D (1988) Combining Qualitative and Qualitative Methods in 45. Information Systems Research: A case study. Retrieved from
46. https://www.researchgate.net/publication/236144008_combining_qualitative+and-Quantitative_Methods_In_Information_Systems_Reaerch_A_Case_Study. Retrieved on 20 th may, 2018,
47. Hannafin, M. J. Kim, M. C. (2011). Scaffolding problem solving in technology- Enhanced learning environments (TELEs): Bridging research and theory with practice. Computers & Education, 56(2), 403–417.
48. Kitschner, P. & Davis, N (2003). Pedagogic benchmarks for Information and Communication Technology in teacher education. Technology Pedagogy Educ, 1, 125-147
49. Lois, H.R. & Brown, G. T. L. (2010) Mixing Interview and Questionnaire Method, Practical Problems in Aligning Data. Practical Assessment and Evaluation: Vol 15, NO.1.
50. Li. N (2002). On educating the future. Rethinking the role of Teachers in the technology era of the new century'. Paper presented at the society for information Technology & Teacher Education international conference
51. Lloyd, M (2005). Towards a definition of integration of ICT in the classroom. In AARE 2005, AARE, Eds. Proceedings AARE '05 Education Research - Creative Dissent: Constructive Solutions, Parramatta, New South Wales.
52. Majumdar, S. 2006. Emerging Trends in ICT for Education & Training, MITA Korea Multimedia Society, pp. 521–532.

53. Moeller & Reitzes, (2011). Integrating Technology with student-centred learning. The Education Development Center, Inc (EDC). Quincy, manellie, Mae Education Foundation.
54. Muijs, D., & Lindsay, G. (2008). Where are we at? An empirical study of levels and Methods of evaluating continuing professional development. *British Educational Research Journal*, 34(2), 195-211,
55. Muriithi P., (2005). A framework for integrating ICT in the teaching and learning process in Secondary schools in Kenya. MSc. Thesis submitted at the University of Nairobi, School of computing and Informatics.
56. Mwangi, W. (2013) Lesson from the implementation of MDGs in Kenya options for a post 2015 framework. 57. Omwenga, E., Waema, T., & Wagacha, P. (June 2004). A model for introducing and implementing e-learning for delivery of educational content within the African context. *African Journal of Sciences and Technology* 5(1) 35-48.
58. Payne, g., & Payne, J. (2004). *Key Concepts in Social Research*. London Sage Publications 59. Paraskeva, F. Bouta, H and Papagianna, A., (2008) Individual characteristics and computer self-efficacy in secondary education teacher to integrate technology in education practice. Retrieved from: https://www.research.net/publication/220140817_individual_characteristics_and_computer_efficiency_in_secondary_education_teacher_to_integrate_technology_in_education_practice
60. Pearson J. (2003). Information and Communication Technology and Teacher Education in Australia *Technology, pedagogy and Education*, 12(1) 61. Peralta and Costa (2007). Teachers competence and confidence regarding the use of ICT *Education Science Journal*, Vol 3 pp75-84
62. Postman, N (2000) 'From the end of education' in Williams et al 4th editions *Reading for the 21st century: tomorrow's issues for today's students* 63. Rojewski JW (2009). A Conceptual framework for TVET. In R. Maclean, & D Wilson (eds). *International handbooks of education for the changing world of work 1863-1877* Springer science + Business media BV 64. Rupert, M. (2012) *Life in schools and Classrooms: Past, Present and Future* <https://books.google.com/books/about/-Life-in-schools-and-Classrooms.html?id=WLPDgAAQBAJ>
65. Sabieh. C. (2001). The use of information Technology in Higher Education in Arab Universities conference. A confident Arab scholar: A paper presented at Faculty Development and Technology (Beirut. Lebanon, march 12-14-2001
66. Sage, J. E., & Rose, G. A. (1985). Designing Technical and Skills Training Programmes. In H. Birnbrauer (Ed.), *The ASTD Handbook for Technical and Skills Training*, 3. (pp. 13-23). Alexandria: American Society for Training and Development
67. Sandholz, T. H., Ringstaff, C., and Dwyer, D. C., (1997) *Teaching with Technology: creating student centred classroom*. New York: Teachers college press.
68. Sang, G., Valcke, M., Van Braak, J., Tondeur, J., and Zhu, C. (2011). Predicting ICT Integration into Classroom Teaching in Chinese Primary Schools: Exploring the Complex Interplay of Teacher-Related Variables. *Journal of Computer Assisted Learning*, 27(2), 160-172.
69. Somekh, B. and Davis, N. (2005) Using Information Technology Effectively in Teaching and Learning: Studies in Pre-service and in service Teacher Education. Downloaded from: <https://www.semanticscholar.org/paper/using-information-technology-effectively-in-teaching-and-%3A-somekh-Davis/d466d28931373ed60be70cbb915d019236ff461e>
70. Spellings. M. (2005). A highly Qualified Teacher in every classroom, The secretary's office Fourth Annual Report on Teacher Quality, US Department of Education office <http://www.title2.org/titleireport05.doc>
71. Sukri, M. S. & Shu'aibu, B. (2013). Modeling the Determinants of ICTs Application in Internship in Technical and Vocational Education, *Australian Journal of Basic and Applied Sciences*, Vol. 7 No. 6 Pg. 38-45
72. Tasir, Z., Abour, K. M. E. A., Halim, N. D. A., & Harun, J. (2012). Relationship between Teachers' ICT competency, confidence level, and satisfaction toward ICT training programmes: A case study among postgraduate students. *Turkish Online journal of education technology*, 11(1), 138-144. ERIC NUMBER EJ976576
73. Venezky, R. (2004). Technology in the classroom: steps toward a new vision in education. *Communication and Information*, 4, 3-21 1 <http://manypossibilities.net/african-undersea-cables>, Accessed on August, 2016
74. Wonacott (2001) Wonacott, M. E. (2001). Keeping vocational/career-technical educators current. *Trends and Issues Alert*, 23. Retrieved January 2, 2003, from ERIC/ACVE Publications web site: <http://ericacve.org/ocgen.sp?tbl=tia&ID=145>.

75. Williams, P .J. (2002) Crises in technology education in Australia.2nd Biennial international conference on technology education research. Gold Coast, Australia.
76. Wong, E.M.L. & Li, S.C. (2008) Framing ICT implementation in a context of educational change: A multi-level analysis. School effectiveness and school improvement, Hong Kong. 77. Yildirim, S (2007) Factors Affecting Instructional Leaders Perception towards Education Media. Retrieved from: <http://books.google.co.ke/books?id=wkqxcgaaqbaj&pg=PA25&dq=yildirim>
78. Zafarullah S.,& Perti V.,(2017). Effects of ICT on job satisfaction of Teacher Educators: Evidence from University of the Sindh Province of Pakistan. URL: <http://doi.org/10.5430/ijhe.v6n4p122>. published by Sciedu press. Retrieved October, 4th 2019.
79. Zarini, M, Wilson D, Mar N and Varis Tapio (2009) The growing role of ICTs in education and training. In R. Maclean, & D. Wilson, eds. International handbook of education for the changing world of work, Springer science+ business media BV, pp1863-1877.
80. Zarini, M (2009) 'Switched on: International approaches to skills development through ICTs, 'In Maclean, DWR.eds. International handbook of education for the changing world of work, Springer science+ business media B.V, pp1935-1946.
81. Zhao. Y. (2003). What Teachers need to know about Technology: Framing the
82. Question. In Zhao (Ed) what should Teachers know about Technology perspective and practices. Greenwich Information Age Publishing
83. Zhao, Y. & Frank, K. A. (2003). Factors Affecting Technology Uses in Schools: An Ecological Perspective. American Educational Research Journal, 40 (4), 807-840
84. Muganga, L. (2015) Authentic learning in African post –secondary education and creative economy. Cultural and Pedagogical Inquiry, 7(2), 27-54.
85. Muianga, X., Hanson, H., Nilsson, A., Mondlane, A., Mutimucio, L., & Guambe, AQ. (2013). ICT in education in Africa-myth or reality. A case study of Mozambican higher education in institutions. The African Journal of Information Systems. 5(3),106-117
86. Stuckey, H. L (2013) Three types of interviews: Qualitative research methods in social health. Journal of Social Health and Diabetes, 1(2),56.