

**PREDICTORS OF EXTENT OF INTEGRATION OF COMPUTERS IN
CLASSROOM TEACHING AND LEARNING AMONG SCIENCE AND
MATHEMATICS TEACHERS IN PUBLIC SECONDARY SCHOOLS IN KWALE
COUNTY, KENYA**

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Investment in ICT infrastructure to improve teaching and learning in schools have been initiated by many governments globally with the effects being anticipated more in sciences and mathematics, subjects in whom students have continued to register poor performance year in year out. Despite all these investments, developing countries such as Kenya still report minimal rates of integration of ICT tools such as computers in classroom practice due to varied reasons. This study set out to review the extent to which demographic characteristics, attitude, self-concept and computer anxiety predict science and mathematics teachers extent of integration of computers in the teaching and learning of their subjects. Data were collected from 83 science and mathematics teachers purposively sampled from 24 public secondary school in Kwale County with ICT infrastructure for integration using a self-report questionnaire adapted from the Teachers Attitude towards Computers Scale (Gattiker & Hlavka, 1992), the Teachers Computer Anxiety Scale (Barbeite & Weiss, 2004) and self-concept instrument developed by Cambra and Silvestre (2003). The study findings revealed that though almost all the teachers had some basic training in ICT, they reported very low levels of utilisation of computers in classroom teaching. Further, it was observed that while teachers' qualification and computer attitude were significant predictors of the extent of their integration of computers into classroom practice ($p < 0.05$), their self-concept and computer anxiety were insignificant predictors ($p > 0.05$). Lastly, the study established that teachers' qualification and computer anxiety had a positive influence on extent of integration though attitude towards computer and self-concept had a negative influence. It is recommended that school administrators and Ministry of Education officers enhance supervision of the integration process to ensure that the ICT infrastructure already in schools are adequately utilised.

Key words: ICT Infrastructure, Computer Integration, Self – Concept

Introduction

Most governments, Kenyan included, recognizing that attainment of qualitative education requires improving teaching, learning and educational system in general, have made several attempts to effectively integrate ICT into the educational system. For the government of Kenya, the enactment of the 2006 National Information and Communication Technology Strategy for Education and Training (KESSP, 2006; MOE, 2006), which was to provide policy framework marked an important milestone in digitization of the classroom. The policy opened up a window of opportunity that enabled the coming together of various stakeholders to support digitization process. Their concerted effort since the early 1990 is seen in the ICT tools including computers, Internet connectivity and other peripherals available to schools (Ayere, Odera & Agak, 2010; Makau, 1990; Wambui and Barasa, 2007; Wanjira, 2009). Most notable contributors include the Agha Khan foundation, International Development Research Centre (IDRC) and the Rockefeller Foundation, Computer for Schools program, New Partnership for Africa Development (NEPAD), Bill Gates foundation and the Constituency Development Fund (CDF) (Ayere, Odera & Agak, 2010; Keengwe & Onchwari, 2008; Makau, 1990; Wambui & Barasa, 2007). The CDF in conjunction with the Ministry of

Education have lately specifically equipped at least eight schools in each sub-county in the entire republic with ICT infrastructure specifically meant for integration (MOE, 2012). Reports also show that some individual schools through the efforts of their Board of Managements (BOM) have also endeavored to equip themselves with ICT infrastructure in an attempt to modernize their learning environment (Farrell, 2007). Thus, through the concerted efforts of these contributors and others, a number of secondary schools in the republic have acquired adequate ICT infrastructure for use in classroom teaching and learning.

In doing this, the government and the stake holders aimed at improving accessibility of educational opportunities and fostering proficiency among students and youths with the main aim being able to meet the human resources requirements of the nation for attaining and enhancing sustainable socio-economic development, global competitiveness as well as the individual's ability to survive in a contemporary competitive environment (Agbatogun, 2010). Nowhere else is the interest more pronounced than in mathematics and sciences; subjects in which students have continued to post poor results year in year out in most countries, Kenya included (Albirini, 2004; Ogembo, 2012; Twoli, 1986).

However, anecdotal reports show that a majority of teachers to a large extent still do not integrate computer and other ICT tools in classroom teaching (Miima, Ondigi & Mavisi, 2013). Oredo (2008) in his report of a study of quantity and quality of computer use in Kenya by teachers and students in primary teacher colleges noted low rates of usage (22% for teachers and 6% for students). Similarly, Unwin (2004) laments that computer laboratories in most educational institutions in Africa are underutilized. Specifically, the researcher noted that the overall quantity of computer use in sampled schools stood at 14%. Further, Kiptalum and Rodrigues (2010) laments that opportunities for realizing the benefits of using ICT in education face a number of challenges in the developing countries.

Studies have linked teachers' reluctance to integrate ICT tools in general and computer in particular to several factors including access (MOE, 2006), teachers' biases or stereotypes (Sabszian & Gilakjani, 2013), internal factors such as teachers ICT competencies and teachers' computer attitude. Part of the blame has also been apportioned to external factors like teachers' in-service education about ICTs, lack of appropriate hardware and software, having Internet connection troubles, lack of infrastructure, and insufficient teaching materials (Taneri & Seferoglu, 2013). Other researchers posit that teachers' confidence in utilizing technology, their beliefs about the value of technology and student learning are internal factors that prevents teachers from using technology (Dexter, Seashore & Anderson, 2002; Newhouse, 2001; Zhou, Pugh, Sheldon & Byers, 2002). Further, Keengwe and Onchwari (2008) holds that teacher's negative attitude is responsible for the slow pace of acceptance of modern technology in the educational environment. Tanneri and Seferoglu (2013) on their part posit that lack of personal confidence in using learning technologies such as computer, and the nature of pre-service teacher education courses are some of the factors responsible for teachers' resistance to the use of these tools in classroom teaching.

Similarly, an assessment of teachers' computer attitudes has shown that there exists a direct link between the tendency to understand and determine their technology adoption and integration capabilities in the education system. According to Agbatogun (2010), successful integration of computers in educational environments do not only depends on students' attitudes towards them, but also that of their teachers. The researcher is categorical that attitudes are precursors of behavior and behavioral intents. Therefore, positive disposition towards computers is a prerequisite as well as a catalyst to acquiring a high level of computer literacy and successful pedagogical use of the technology (Francis, Katz, & Jones, 2000). Computer anxiety levels of teachers are significant in the consideration of the integration of computer technology into teaching and learning. Anxiety is a long-term physiological construct.

There exist contradictory research findings on the influence of various factors on computer integration in classroom teaching. For instance while Alazzam, Bakar, Hamzah and Asimiran, (2012); Norris, Sullivan, Poirot and Soloway (2003) found no link between teachers demographic factors including gender, age and teaching experience and their extent of integrating computer in classroom teaching, Blankenship (1998); Lau and Sim (2008) have found differences in the extent of integration on the basis of the demographic factors. Specifically, Lau and Sim, (2008) found that teachers' age influences their extent of integrating computer and that older teachers frequently used computer technology in the classrooms more than the younger teachers. Likewise Jamieson-Proctor, Burnett, Finger and Watson (2006) indicated that male teachers were more willing users of computers. This assertion is however refuted by Blankenship (1998) who found female teachers to be more willing users than male teachers.

Relative to influence of computer anxiety, Russell and Bradley (1998) in a study among 350 primary and secondary school teachers in Australia found that teachers' perception of computer usefulness is associated with individual's level of computer anxiety. Likewise, in a study on computer achievement, attitude and anxiety among 75 Taiwanese computer students, Tsai and Tsai (2003) found a significant association between students' meta-cognitive skills, computer achievement and their level of computer anxiety. Studies have also shown that there is a relationship between computer anxiety and some other variables such as age (Namlu & Ceyhan, 2002); frequency of computer use (Necessary & Parish, 1996); computer experience (Yaghi & Ghait, 2002); neuroticism (Anthony, Clarke & Anderson, 2000) and individual's appraisal of computing situation (Crable, Brodzinski, Scherer & Jones, 1994). Self-concept which is an individual's internal representation of who he/she is (Malle, 1999) is the product of all an individual's self-belief and self-evaluation (Hattie, 1992). It is the universal understanding a sentient being has of oneself. Self-concept has been emphasized as a key indicator of an individual's attitudes, behaviour, and coping abilities. A positive self-concept is equated with positive evaluation, while negative self-concept is associated with negative evaluation (Huitt, 2004). With regard to its relevance in predicting computer integration, it was found to be the second most portent predictor (Agbatogun, 2010). These studies though providing a much needed insight on the dynamics of use of computer in classroom setting lacks the specifics of Kenyan secondary school classroom set up which if available could provide avenues of assessing the progress of integration thus mitigate the massive investments that has so far been undertaken to date by the stakeholders. Since inception of most of the programs of enhancing IT infrastructure accessibility in secondary school classrooms, empirical data that could help provide an insight on the extent and effect of their usage including the attendant factors that could be impacting the process of integration are sparse. This study therefore set out to assess the extent to which science and mathematics teachers' demographic factors, computer attitude, computer anxiety and self-concept could be predicting the extent of integration of computer in classroom teaching.

Objectives

The study specifically sought to:

1. Determine the extent to which science and mathematics teachers' background characteristics predict their extent of integration of computers in classroom teaching.
2. Establish the extent to which science and mathematics teachers' attitude predict their extent of integration of computers in classroom teaching.
3. Establish the extent to which science and mathematics teachers' computer anxiety predict their extent of integration of computers in classroom teaching.
4. Determine the extent to which science and mathematics teachers' self – concept predict their extent of integration of computers in classroom teaching.

Conceptual Framework

The study conceptualizes the interrelationship between factors presumed to predict teachers to integrate ICT tools in classroom teaching by teachers as is illustrated in figure 1.

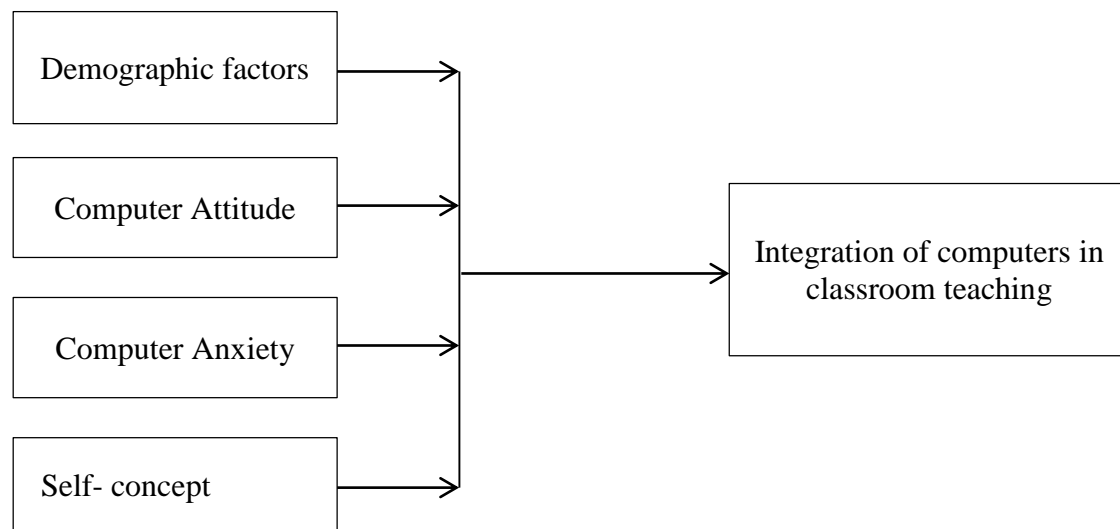


Figure 1: Hypothesised interrelationships of variables influencing computer integration

Figure 1 shows the hypothesized relationship of the elements that are perceived to predict science and mathematics teachers' integration of computer in classroom teaching. Integration of computer in classroom teaching involves a number of independent variables that include teachers' demographic factors, computer attitude and computer anxiety and teachers self-concept.

Research Methodology

Participants and Procedure

Participants were 82 (21 females and 61 males) science and mathematics teachers drawn from public secondary schools in Kwale County with ICT infrastructure for integration. The study was quantitative and employed descriptive survey method in which respondents were purposively sampled from public secondary schools with ICT infrastructure for integration. The respondents were told that the study aimed at obtaining information useful in improving their teaching in schools. They completed a questionnaire comprising of items adapted from the Teachers Attitude towards Computer Scale (Gattiker & Hlavka, 1992), the Teachers Computer Anxiety Scale (Barbeite & Weiss, 2004) and self-concept instrument developed by Cambra and Silvestre (2003).

Measures

Teachers' attitude towards computer. Eight items measured teachers' attitude towards computer based on the perceived ease of use and the perceived usefulness of computers. Sample items included "I believe working with computers is very difficult, is very complicated' and makes a person more productive in his/her job. The ratings were made on a 5-point scale.

Teachers' computer anxiety. Nine items measured the extent to which teachers' computer anxiety influenced their integration of the ICT tool in classroom teaching. Sample items included 'Working with a computer makes me nervous, I get a sinking feeling when I think of trying to use a computer and Computers make me feel uneasy '. The ratings were made on a 5-point scale and a mean score was computed for the items some of which were reverse coded.

Teachers' self-concept. Ten items measured the extent to which respondents' self – concept could be influencing their integration of computers in classroom teaching. Sample items included 'My colleagues think I'm unfriendly, others want to work with me and I'm happy the way I am'. Mean scores of the items were computed.

Extent of integration of computer in classroom teaching. Teachers rated their perceived of integration of computer in classroom teaching. The scale consisted of 2 items (e.g. 'I integrate computers in my classroom teaching' and 'If yes please what is the frequency of use) the first rated on a 2 – point scale while the other on a 4-point scale (1 = Rarely, 4 = always).

Findings

Predictors of Extent of Science and Mathematics Teachers' Integration of Computer

A hierarchical regression analysis was conducted to establish the respective contributions of demographic factors, attitude, computer anxiety and self – concept on extent of integration of computers in classroom teaching. Table 1 displays the means, standard deviations and Pearson correlations among all the variables and Table 2 reports the results of the regression analysis. Teachers self – concept was positively and significantly correlated with attitude towards computer, teachers' workload and area of specialisation. It was also negatively and significantly correlated with gender. Computer anxiety was significantly and positively correlated with teachers' qualification, area of specialisation and training in IT while teachers' attitude towards computers was positively and significantly correlated with gender and teachers' area of specialisation.

The first objective of the study was to determine the extent to which science and mathematics teachers' demographic factors predicted their integration of computer in classroom teaching. Findings of the study indicate that more of the respondents, 59 (72%) integrated computer in their classroom teaching as compared those who did not (28%). Qualitatively, 17 (20.7%) reported using the ICT tool in classroom teaching rarely, 22 (26.8%) used it once per week, 16 (19.5%) twice per week while a paltry 7 (8.5%) reported their rate of use to be always. Further analysis showed that on specific demographic factors, more males, 51 (62.2%) as compared to females were active users while graduate teachers, 42 (51.2%) reported the highest extent of use based on education qualification. Similarly, teachers with less than 5 years of teaching experience were more active users, (47.6%) and those with over 20 years of teaching experience reported the lowest tendency to integrate computers in classroom teaching. Teachers qualification reported high mean ($M = 4.52$ and $SD = 1.21$). ANOVA results show a significant effect of level of education on tendency to integrate computer in classroom teaching $F(5, 53) = 5.45, p < .001$. Regression analysis showed that except for qualification which was found to be a significant predictor of science and mathematics teachers extent of integration of computer in classroom teaching, $F(1, 57) = 4.04, p < .001$, gender, teaching experience, area of specialisation, workload and training in IT were insignificant predictors, $F(1, 58) = -.128, p = .899$, $F(1, 56) = .074, p = .941$, $F(1, 55) = 1.28, p = .206$ $F(1, 54) = .534, p = .596$ $F(1, 57) = .029, p = .977$ respectively. The findings concerning the significant effect of demographic factors on extent of integration of computer in classroom teaching largely reflects those of Blankenship (1998); Lau and Sim (2008) but contradicts the assertions of Alazzam, Bakar, Hamzah and Asimiran, (2012); Norris, Sullivan, Poirot and Soloway (2003) who found no link between teachers demographic factors including gender, age and teaching experience and their extent of integration of computer.

The second objective of this study was to establish the extent to which science and mathematics teachers' attitude predicted their extent of integration of computer in classroom teaching. The results indicated high mean (4.09) and standard deviation of 1.001 for science

and mathematics teachers' attitude towards computers. This could be interpreted to mean that the Kwale County science and mathematics teachers have a positive attitude towards computer, which could be a favorable attribute for integration. For instance, a significant proportion, 69 (84.2%) were categorical that working with a computer is not very difficult, 76 (92.6%) thought it was not complicated and 74 (90.2%) indicated that working with a computer makes one more productive in his/her work. ANOVA results show a significant effect of attitude on extent of integration of computers in classroom teaching $F(2, 62) = 5.125, p = .009$. Post Hoc Tukey's test showed a significant mean difference between the perception of respondents who thought that teachers attitude affected their extent of computer integration from those who were not sure ($M = 1.18, p = .009$). The regression equation used to test for the effect of attitude showed that it was positive and significant, $F(1, 60) = 3.227, p = .002$ and explained 14.8% of variance in extent of integration of computers in classroom teaching. This finding corroborates those of Keengwe and Onchwari (2007) who posits that teacher's negative attitude is responsible for the slow pace of acceptance of modern technology in the educational environment. Similarly, Agbatogun (2010) maintains that successful integration of computers in educational environments does not only depend on students' attitudes towards them, but also that of their teachers. Francis, Katz, and Jones (2000) on their part hold that positive disposition towards computers is a prerequisite as well as a catalyst to acquiring a high level of computer literacy and successful pedagogical use of the technology.

A further objective intended to assess the extent to which computer anxiety predicted science and mathematics teachers' integration of computer in classroom teaching. Results showed that the respondents had an average level of computer anxiety given an average mean rating of 2.640 and standard deviation of 1.09 of the elements of computer anxiety. Sample responses showed that though more respondents, 76 (92.7%) indicated that computer do not scare them at all, 74 (90.3%) said they do not feel threatened when others talk about computers and 69 (84.1%) maintained that they feel comfortable working with computer, 74 (90.3%) acknowledged that working with a computer sometimes makes them nervous and 55 (67.1%) admitted that it would bother them to take computer courses. ANOVA results $F(3, 58) = 4.020, p = .011$ showed that there is a significant effect of computer anxiety on teachers extent of computer integration with those for the effect scoring highly ($M = 2.67$) on the elements of perception. Regression analysis results confirmed that computer anxiety had a negative and insignificant effect on teachers' extent of integration of computer in classroom teaching, $F(1, 60) = -1.040, p = .303$. This finding partially supports that of Agbatogun (2010) who found out that computer anxiety is the single most portent predictor of teachers' tendency to integrate ICT in classroom teaching. It also conforms to the findings of Russell and Bradley (1998) as well as Tsai and Tsai (2003) who in separate studies on computer achievement, attitude and anxiety, found a significant association between students' meta-cognitive skills, computer achievement and their level of computer anxiety.

The last objective for this study intended to assess the extent and effect of teachers' self-concept on their extent of integration of computer in classroom teaching. Findings showed that generally, science and mathematics teachers' self-concept was high ($M = 32.60, SD = 2.449$). A significant proportion of the respondents, 63 (76.9%) denied that their friends think they are unfriendly, 68 (82.9%) thought their friends liked them, 73 (89%) thought others were happy to work with them while 82 (100%) were happy the way they were. ANOVA results, $F(10, 51) = 3.410, p = .002$ shows that there is a significant relationship between science and mathematics teachers' self-concept and their extent of integration of computer in classroom teaching with those for the effect scoring highly ($M = 3.000$) on the elements of perception. Regression analysis results indicated that teachers' self-concept has a negative and insignificant effect on their extent of integration of computer in classroom teaching, $F(1, 60)$

= 1.057, $p = .298$ (Table 2). This finding partially supports that of Agbatogun (2010) who in his findings stated that self-concept are the second most portent predictor of teachers' extent of computer integration in classroom teaching.

Implications, Limitations and Conclusions

Implications for the Innovation of Teacher Preparation

The findings have illustrated that the extent of integration of computer in classroom teaching is predicted by a mix of factors that include teachers' background factors such as level of education and experience, attitude towards computer, computer anxiety and teachers self-concept. Specifically, while teachers level of education, experience and attitude towards computers were found to predict their extent of integration positively, computer anxiety and teachers self-concept predict it negatively. This implies that keen interest needs to be taken in providing teachers with an environment that could help foster positive attitude and self-concept. This would enable them gain competence and confidence in using computers for teaching and learning (Teo, 2008) and as well develop real life experiences in using computer in classroom settings.

Limitations and Directions for Further Research

It should be noted that this study has a number of limitations. The quantitative research methodology is mainly based on self-report measures. Future studies could build on classroom observation of teachers' integration of computers or interviews with the teachers. Furthermore, longitudinal studies are recommended that might be helpful to track changes in thinking processes and related teaching practices with and without educational technologies. Since the potentials of ICT can differ according to specific curriculum goals and specific knowledge domains, more attention should be paid in future studies to the nature of the curriculum taught with or without ICT. It should also be noted that the findings of the present study have to be interpreted in a careful way since a convenience sampling procedure was applied. Respondents were drawn from secondary schools in the county with ICT infrastructure that the researchers could readily access which could have caused uncontrolled bias.

Conclusion

The study has provided an insight into the predictors of science and mathematics teachers' integration of computers in classroom teaching in a Kenyan context. The findings suggest that science and mathematics teachers' extent of integration of computers in classroom teaching is largely dependent on their level of education, attitude and experience. The results also showed that computer anxiety and self-concept were inhibitors of teachers' urge to integrate computers in classroom teaching. The study advocates for in servicing of teachers to enable them gain requisite knowledge, skills and confidence relevant for the innovation of classroom activities.

References

- Agbatogun, A. O. (2010). Self-concept, computer anxiety, gender and attitude towards interactive computer technologies: A predictive study among Nigerian teachers. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2010, Vol. 6, Issue 2, pp. 55-68
- Alazzam, A. O., Bakar, A. R., Hamzah, R. & Asimiran, S. (2012). Effects of demographic characteristics, educational background, and supporting Factors on ICT readiness of technical and vocational teachers in Malaysia. *International Education Studies*. 5(6).
- Albirini, A. (2004). "Teachers' attitude toward information and communication technologies: the case of Syrian EFL teachers". *Computers & Education*, vol. 47, no. 4, pp. 373-398.
- Anthony, L. M., Clarke, M. C., & Anderson, S. J. (2000). "Technophobia and personality subtypes in a sample of South African University student". *Computer in Human Behavior*, vol.16, no.1, pp.31-44.
- Ayere M. A, Odera F. Y. and Agak J. O. (2010). E-learning in secondary Schools in Kenya: A Case of the NEPAD E-schools. *Educational Research and Reviews* Vol.5 (5), pp. 218-223. Barbeite, F. G., & Weiss, E.

- M. (2004). Computer self-efficacy and anxiety scales for an Internet sample: testing measurement equivalence of existing measures and development of new scales. *Computers in Human Behavior*, 20(1), 1-15.
- Blankenship, S. E. (1998). Factors related to computer use by teachers in classroom instruction. Doctoral Dissertation, Virginia Polytechnic Institute and State University.
- Cambra, C., & Silvestre, N. (2003). "Students with special educational needs in the inclusive classroom: social integration and self-concept" *European Journal of Special Needs Education*, vol. 18, pp.197-208.
- Crable, E. A., Brodzinski, J. D., Scherer, R. F., & Jones, P. D. (1994). "The impact of appraisal, locus of control, and level of exposure on the computer anxiety of novice computer users". *Journal of Educational Computing Research*, vol. 10, no. 4, pp. 329-340.
- Dexter, S., Seashore, K.R. & Anderson, R.E. (2002) Contributions of Professional Community to Exemplary Use of ICT. *Journal of Computer Assisted Learning*. 18, pp. 489-497.
- Farrell, G. (2007). *Survey of ICT in Education in Kenya*. Washington, DC: infoDev/World Bank.
- Francis, L. J., Katz, Y. J., & Jones, S. H. (2000). "The reliability and validity of the Hebrew version of the Computer Attitude Scale". *Computers & Education*, vol. 35, no. 2, pp. 149-159.
- Government of the Republic of Kenya (GoK). (2006). *The Kenya Education Sector Support Program*. Nairobi: Government Printers.
- Hattie, N. J. (1992). Self-concept. Hillsdale, N.J: L. Earlbaum Associates, pp 23.
- Huitt, W. (2004). "Self-concept and self-esteem". *Educational Psychology Interactive*. Retrieved September 2, 2009, from <http://chiron.valdosta.edu/whuitt/col/regsys/self.html>
- Jamieson-Proctor, R. M., Burnett, P. C., Finger, G., & Watson, G. (2006). ICT integration and teachers' confidence in using ICT for teaching and learning in Queensland state schools. *Australasian Journal of Educational Technology*, 22(4).
- Keengwe, J., & Onchwari, G. (2008). Constructivism, technology, and meaningful learning. *Handbook of research on instructional systems and technology*, 51-64.
- Kiptalum G.K. & Rodrigues, A.J. (Internet Utilization: A Case of Connected Rural and Urban Secondary Schools in Kenya. *International Journal of Computing and ICT Research*, Vol. 4, No. 1, June 2010
- Lau, B. T., & Sim, C. H. (2008). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT Research*, 2(2), 19-36.
- Makau, B. M. (1990). Computers in Kenya's secondary schools. Case study of an innovation in education, International Development Research Centre (IDRC), Canada.
- Malle, B. (1999). "Self-concept: An introduction". Accessed September 15, 2009 from http://darkwing.uoregon.edu/~bfmalle/410/L1_99.html
- Miima, F. Ondigi, S.R. & Mavisi, R. (2013). Teachers' perception about integration of ICT in teaching and learning of Kiswahili language in secondary schools in Kenya. *International Journal of Arts and Commerce*, 2(3) (March 2013)
- Ministry of Education, Kenya, (2006). *National Information and Communication Technology (ICT) Strategy for Education and Training*. Nairobi: The Government Press.
- Namalu, A., & Ceyhan, E. (2002). "Computer anxiety: A study on university students". Eskisehir: Anadolu University Publishing.
- Necessary, J. R., & Parish, T. S. (1996). "The relationships between computer usage and computer-related attitudes and behaviours". *Education*, vol. 116, no. 3, pp. 384-388.
- Newhouse, C. P. (2001). Applying the concerns-based adoption model to research on computers in classrooms. *Journal of research on technology in education*, 33(5), n5.
- Norris, C., Sullivan, T., Poirot, J., & Soloway, E. (2003). No access, no use, no impact: snapshot surveys of educational technology in K# x2013; 12. *Journal of Research on Technology in Education*, 36(1), 15-27.
- Ogembo, J. O. (2012). Determinants of students' poor performance in chemistry in public secondary schools in Kwale County, Kenya. A Thesis submitted in partial fulfilment for the award of the degree of Master of Education in the School of Education, Kenyatta University, Kenya.
- Oredo, J. O. (2008). A framework for evaluating ICT use in teacher education. A case study of the primary teacher training colleges in Kenya. A dissertation submitted to Strathmore University in partial fulfilment of the requirement of the degree of Master of Science in Information Technology.
- Russell, G., and Bradley, G. (1997). Teachers' computer anxiety: Implications for professional development. *Education and Information Technologies*, vol. 2, pp.17-30. Sabzian, F. & Gilakjani, P.A., (2013). Teachers' attitudes about computer technology training, professional development, integration, experience, anxiety, and literacy in English language teaching and learning. *International Journal of Applied Science and Technology*, 3 (1); January 2013
- Taneri, P. O., & Seferoglu, S. S. (2013). Instructional use of information technologies teachers' resistance to the use of new technologies. *International Journal of Technologies in Learning*. 19(3). 60 – 68.
- Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal*

of *Educational Technology*, 24(4).

Tsai, M., & Tsai, C. (2003). "Students computer achievement, attitude and anxiety, the role of learning strategies". *Journal of Educational Computing research*, vol. 28, no. 1, pp. 47-61.

Twoli, N. (1986). Sex differences in science achievement among secondary school students in Kenya. Unpublished doctoral thesis. Flinders University, Australia.

Unwin, T. (2004). Towards a framework for the use of ICT in teacher training in Africa. *The Journal of Open and Distance Education*. Special issue on open learning in less developed countries pg. 8

Wambui, M., & Barasa, E. (2007). ICT: dawn of a new era. *Elimu News: a newsletter of the MoEST*(1).

Wanjira K. (2009). Educational development in Kenya and the role of information and communication technology. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2009, 5 (2), pp. 6-20

Yaghi, M., & Ghaith, G. M. 2002. "Correlates of computing confidence among teachers in international setting". *Computers in the Schools*, vol. 19, no. 1/2, pp. 81-94. Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *Teachers College Record*, 104(3), 482-515.

Appendix

Table 1: Means, Standard Deviations and Correlations between the Variables of the Study (N = 82)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1. Gender	-	-	-	-.093	.206	.331**	.233*	-.068	.263*	-.062	-.306**
2. Level of Educ.	4.52	1.21	-	-	-.005	-.132	-.018	-.054	-.245*	.305**	.051
3. Experience	1.76	1.12			-	.170	-.132	-.076	.152	.037	-.179
4. Area of specialisation	-	-				-	-.011	.097	.277*	.255*	.262*
5. Workload	1.67	1.20					-	-.091	-.099	.191	.262*
6. Training in IT	1.19	.393						-	.142	.233**	-.130
7. Computer attitude	19.30	3.38							-	.016	.477**
8. Computer anxiety	26.34	2.35								-	.006
9. Self – concept	32.65	2.44									-

Table 2: Summary of Results from Regression Analysis of Variables on Willingness to Integrate ICT

Variables	B	β	t	p	R ²	Adj.R ²	R ²
change							
Gender	-.043	-.017	-.128	.899	.000	-.017	.000
Qualification	.373	.472	4.041	.000	.223	.196	.223
Experience	.011	.009	.074	.941	.223	.181	.000
Area of spec.	.156	.171	1.279	.206	.245	.191	.022
Workload	.149	.067	.534	.596	.249	.180	.004
Training in IT	.022	.005	.029	.977	.249	.164	.000
Computer Att.	.587	.358	3.227	.002	.148	.134	-
Computer Anx.	-.144	-.133	-1.040	.303	.018	.001	-
Self – concept	-.031	.208	1.057	.296	.311	.187	-