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Attitude of Pre-Service Teacher Trainees towards the Use of Computers in Mathematics Instruction in Secondary Schools in Kenya

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Abstract: ***The need to use computers in the teaching and learning process in order to improve performance in mathematics is critical and needs urgent address. The purpose of this study was to investigate the attitude of pre-service teacher trainees towards the use of computers in mathematics instruction in secondary schools in Kenya. A descriptive survey research design was adopted for this study. The target population was teacher trainees of mathematics at Kenyan universities. The accessible population was 200 teacher trainees of mathematics from four Kenyan Universities that offer Bachelor of Education degree courses. Stratified and simple random sampling procedures were employed in this study. The instruments for data collection were the pre-service teacher questionnaire, and face to face interview schedule. The data collected were analyzed using descriptive and inferential statistics. The findings indicated that teacher trainees of mathematics at Kenyan universities have positive attitude towards computers and they believe that computers can be an effective tool in supporting the teaching and learning of mathematics. To exploit the positive attitude of the pre-service teachers towards the use of computers, it is recommended that pre-service teachers of mathematics in universities be given professional development training in the use of computer technology in classroom instruction while on the other hand the Ministry of Education should roll out programs in schools that would enhance use of computers in mathematics instruction in secondary schools in Kenya with a view of improving performance in mathematics.***

Keywords: Attitude, Use, Computers, Instruction

1. Introduction

While efforts have been put in place by the MOEST to improve the performance of mathematics in secondary schools, Kenya National Examination Council (KNEC) report (2008), indicate that the National mathematics mean scores have over years fallen below 40% on average. In almost all Kenyan schools, traditional methods of teaching dominate the classroom. However, computers are perceived to have overwhelming potential in the teaching and learning of mathematics since they support constructivist pedagogies and help students discover or construct ideas (International Society for Technology in Education, 2002). The use of computer therefore constructs a larger learning environment for the learner. This makes the learner good at encoding and storing information and retrieving it in a short time. Studies have indicated that use of computers for teaching topics such as algebra, statistics, geometry, calculus and trigonometry has had fundamental changes in teaching and learning (Abrahamson & Wilensky, 2007).However, majority of Kenyan teachers are not using computers in the teaching of mathematics and yet poor performance is persistently registered in KCSE as indicated by the KNEC Report (2008). The purpose of this study was therefore to investigate the perception of pre-service teachers towards the use of computers in mathematics instruction in secondary schools in Kenya.

2. Methodology

A descriptive survey research design was adopted in this study with a target population of 610 (391 male and 219 female) teacher trainees of mathematics in twelve Kenyan universities. Accessible population was 299 (198 male and 102 female) teacher trainees from three public universities and one private university which offer Bachelor of Education degree courses in mathematics. This represented 33.3% of the total universities in Kenya that offer education courses. The participants were 200 (128 male and 72 female) teacher trainees representing 32.8% of the total pre-service teacher trainees completing their respective courses in the year 2011. Stratified sampling was used to select universities which offer Bachelor of Education degree courses in mathematics and with at least 50 pre-service mathematics teacher trainees. Stratified sampling was further used to get representative samples for female and male respondents from the selected universities. Simple random sampling was then used to select representative samples from each stratum. A total of 72 female and 128 male participants were selected. Furthermore, simple random sampling was used to pick 50% of the pre-service teachers in each stratum to be interviewed. The sample size for this study therefore was 200 pre-service teachers from three public universities and one private university. Fifty pre-service teacher trainees were selected from each university. The researcher used questionnaires and face to face interview schedules to collect data. The analysis of the piloted data yielded results which were reliably used to test content validity after the face validity and construct validity was established. Split–half method was used to obtain two sets of data before the scoring process was done. The two halves were marked separately then using Statistical Packages for Social Sciences (SPSS), correlation of the scores was done to establish reliability of the instruments by use of Spearman Brown formula whose results gave r=0.915 (above 0.8) which confirmed that the instruments were reliable to be used as data collection tools.

3. Results and Discussions

Gender of Pre-service Mathematics Teachers

The researcher found it important to know the gender of the respondents so as to be in a clear picture of the pre-service teachers under study. Table1 gives a breakdown of the respondents by gender.

Table 1: Gender of Pre-service Mathematics Teachers

Gender	*Number of Pre-service teachers*	*Percentage (%)*
Female	72	36
Male	128	64
Total	200	100

As shown in Table1, majority of the pre-service mathematics teachers in the Kenyan universities were males (64%) while females were slightly above a half of the males (36%). These percentages show that only about one third of the pre-service teachers of mathematics at Kenyan universities are females. Therefore there were more male respondents in this study as compared to females.

Age of Pre-service Mathematics Teachers

Ages of the pre-service mathematics teachers studied presented by use of a bar graph in Figure1 shows a clear picture of the age of the pre-service teachers under study.

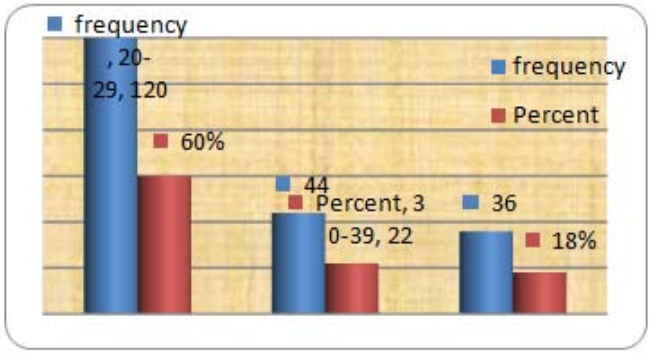

Figure1: Ages of Pre-service Mathematics Teachers

From the findings in Figure1, the participants ranged between 20 to 50 years of age. Those aged 30 to 40 were 44 participants who represented 22% of the respondents and only 36(18%) were in the range of 40 to 50 years. Majority (120) of the pre-service teachers studied were less than 30 years old. This represented 60% of the respondents. This shows that the study has findings from mainly the youth who have the potential to provide the teaching service for the next 30 years or more before retirement age catches up with them. These is consistent with findings of Smerdon et al, (2000) that overwhelmingly, high users of computers in mathematics were a group made up of teachers with fewer years of teaching experience.

Pre-service Teacher Preferred Teaching Technique

There was need for the researcher to know the teaching techniques commonly used by the pre-service teachers of mathematics in the course of delivery of mathematics instruction. The attitude of the pre-service teachers could be known from that. Similarly, accessibility to computers by the pre-service teachers would be gauged. Information on Table 2 summarizes the pre-service teacher preferred teaching techniques.

Table 2: Pre-service Teacher Preferred Teaching Technique

Teaching Technique	*Number of pre-service mathematics teachers*	*Percentage (%)*
Computer assisted	12	6
Lecture	48	24
Hands-on learning	28	14
Demonstration	40	20
Discussion	72	36
Total	200	100

The findings in Table2 reveal that among the five teaching techniques, discussion (36%) was most popularly used by 72 pre-service teachers out of the 200 participants. The second most patronized was lecture (24%) which was used by 48 participants. Third position was taken by demonstration (20%) with 40 pre-service teachers using it. The second last popular technique was hands-on learning (14%) which was used by 28 participants. The least use technique was computer-assisted instruction used by only 12 pre-service teachers out of the 200. This represented a paltry 6%. Information on Figure2 clearly represents the same information for easy comparison of the teaching techniques at a glance.

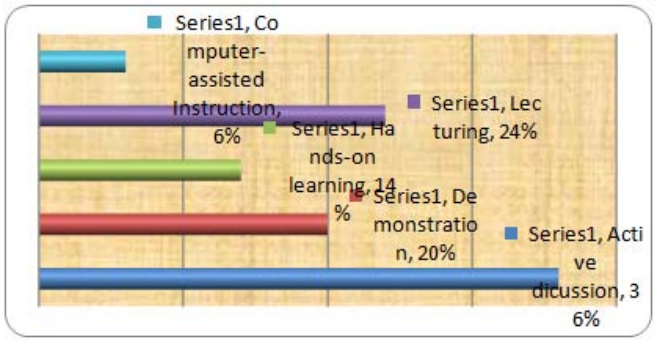

Figure 2: Pre-service Teacher Preferred Teaching technique

Information on Figure 2 shows that the common teaching technique is active discussion (36%), followed by lecturing (24%), demonstration (20%), hands-on learning (14%) and lastly computer assisted instruction (6%). The findings revealed that computer-assisted technique of teaching was least preferred by the pre-service teachers who participated in this study.

Pre-service Mathematics Teachers' Attitudes towards Use of Computers and Computer Use in Mathematics Instruction

The first objective was to establish the attitudes of pre-service teachers towards the use of computers and computer use in the teaching of mathematics. Pre-service teachers were therefore asked to give their opinions about the use of computers in the teaching of mathematics so as to determine their attitudes towards the use of computers. The Likert scale was used. To take the course of Donald and Pamela (2006), the options provided by 'Strongly Agree' and 'Agree' were

merged to mean 'Agree' while the options provided by 'Disagree' and 'Strongly Disagree' were merged to mean 'Disagree'. The results were as summarized in Table 4.

Table 4: Pre-service Mathematics Teachers' Attitudes towards Use of Computers and Computer Use in Mathematics Instruction

Statement	*Agree*	*Neutral*	*Disagree*
Computers save time and effort	150(75%)	2(0.01%)	48(24%)
Schools would be a better place without computers	51(25.5%)	5(2.5%)	144(72%)
Students must use computers in all subject matter			
Learning about computers is a waste of time			
Computers would motivate students to do more study			
Computers are a fast and efficient means of getting information			
I do not think I would ever need a computer in my classrooms			
Computers can enhance students' learning			
Computers do more harm than good			
Average			

Results from Table 4 showed that majority (75%) of the pre-service teachers assert that computers save time and effort. When asked whether schools would be a better place without computers, only 25.5% of the respondents agreed. A proportion of 57% of the respondents assert that students must use computers in all subject matters while a paltry 15% assert that learning about computers is a waste of time. When asked whether computers would motivate students to do more study, 78% of the respondents agreed. Majority (81%) of the pre-service teachers under study agreed that computers are a fast and efficient means of getting information. When asked whether they thought they would not ever need a computer in their classroom, very few (8.5%) of the respondents agreed. This implied that majority (90%) of the pre-service teachers were for the opinion that computers were necessary in the classroom. Majority of the respondents (79%) of the respondents assert that computers can enhance students' learning. This implied that majority of the pre-service teachers feel that computers are an appropriate tool for enhancing students' learning. This result is consistent with other similar studies by Demetriadis et al (2003) who assert that teachers who feel that computers are an appropriate tool for promoting students learning also engage their learners in use of computers more than teachers who do not feel that computers are appropriate tools for student learning. Finally the opinion of respondents was sought on whether computers do more harm than good. Only 21% of the respondents agreed that computers do more harm than good. This implied that majority (74%) of the respondents shared the opinion that computers do more good than harm. The good computers do include: Saving time and effort, Motivating students to do more study, and providing information in a fast and efficient manner. The harm the computers do include: Rendering some people jobless, being expensive to buy and maintain, and wasting students' time especially when they use them for non-academic purposes.

In general, the results in Table 4 therefore show that the pre-service teachers appreciate computers as a good appliance worth using in mathematics instruction in secondary schools and therefore they welcome integration of computers in mathematics instruction in secondary schools. Wozney et al (2006) assert that teachers' personal characteristics like attitude have shown to predict computer integration in mathematics instruction. In addition it was necessary to gauge the pre-service teachers' willingness to adopt use of computers. Their opinions were collected and presented as summarized in Figure 4.

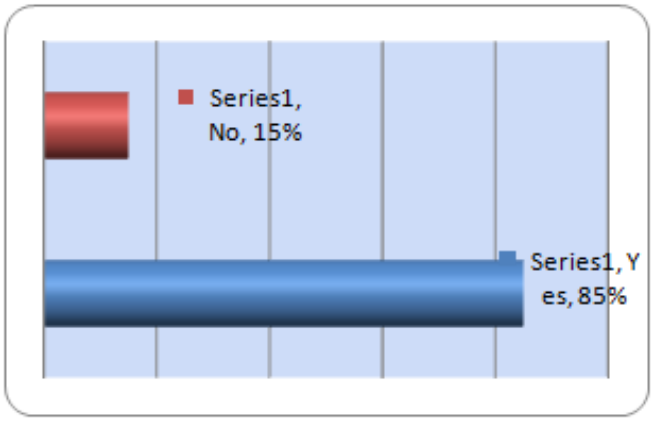

Figure 4: Pre-service Teachers' Willingness to Adopt Use of Computers

From Figure 4, its clear that 170 (85%) were willing to adopt use of computers in mathematics instruction while only 30 (15%) were unwilling. This information reinforced that the pre-service teachers had positive attitude towards the use of computers in the teaching and learning of high school mathematics.

Hypotheses Testing

This study's hypotheses were tested using Pearson correlation coefficient tests and regression analysis.

Pearson Correlation

Pearson correlation coefficient tests were run at significance levels given by the computer for each pair of variables. The results were as summarized in Table 5.

Table 5: Pearson Correlation Analysis

Correlations			
X_1	Pearson correlation Sig.(2-tailed)	1 .	
X_2	Pearson correlation Sig.(2-tailed)	0.45252 0.07182	1

KEY	
X_1	Computer use
X_2	Pre-service Teacher's attitude towards the use of computers

The information in Table 5 show results of Pearson correlation of the independent and dependent variables under study. The results show Pearson correlation coefficients at

respective significance levels given by the computer. These coefficients were used to test the hypothesis in this study discussed as follows.

The hypothesis'' There is no statistically significant relationship between pre-service teachers' attitudes towards the use of computers and computer use in teaching mathematics.'' The variables (teacher attitude and computer use) exhibited a correlation of 0.45252 significant at 0.0718. This implies that there is statistically significant relationship between pre-service teachers' attitudes towards the use of computers and computer use in mathematics instruction. The hypothesis was therefore rejected and should adopt the form ".There is statistically significant relationship between pre-service teachers' attitudes towards the use of computers and computer use in teaching mathematics". This indicates that the attitude of pre-service mathematics teachers towards the use of computers influence computer use.

Regression Analysis

To confirm results of Pearson correlation coefficient test already discussed, simple regression analysis was also used to test the hypothesis to evaluate the relationship of the dependent variable (Computer use) and independent variable (attitude of pre-service teachers).

The researcher adopted the following regression model;

$$\mathbf{Y=B_0 + B_1X_1 + E}$$

Where **Y** is the dependent variable (computer use)

$\mathbf{X_1}$ is the independent variable (attitude)
$\mathbf{B_0}$is the constant
$\mathbf{B_1}$is the regression coefficient or slope or change induced in Y by one unit change in X_1.
E is the error.

The regression analysis done yielded a coefficient of determination (R-squared) as shown in Table 6.

Table 6: Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.804(a)	.788	.764	.57403

Predictors: (Constant); Pre-service teachers' attitudes towards the use of computers.

According to the results in the Table 6, an R squared of 0.788 is an indicator of a strong correlation between the variables signifying the factor studied explains 78.8% of the factors that influence the use of computers in mathematics instruction.
The hypothesis in the study: ``There is no statistically significant relationship between pre-service teachers' attitudes towards the use of computers and computer use in teaching mathematics.'' Information on Table 6 shows regression results revealing the relationship between pre-service teachers' attitudes towards the use of computers and computer use in teaching of mathematics.

Table 7: Regression Analysis Results of Relationship between Pre-service Teachers' Attitudes and Computer Use.

Variables	Unstandardized Coefficients		Standardized Coefficients	T
Computer use (Y)	B	Std. Error	Beta	
Constant	32.564	.756		6.032
Teachers' attitudes towards use of computers (X_1)	2.531	.249	2.472	10.151

A Dependent Variable: Use of computers

According to regression results in Table 7, pre-service teachers' attitudes towards the use of computers had a regression coefficient of 2.531. This shows a strong relationship between computer use and the attitude of pre-service teachers. This implies that a change in attitude of pre-service teachers towards the use of computers significantly impacts on the Computer use. The above null hypothesis was therefore rejected. It should adopt the form, "There is statistically significant relationship between pre-service teachers' attitudes towards the use of computers and computer use in teaching mathematics''. This indicates that the attitude of pre-service mathematics teachers towards the use of computers influence computer use.

4. Conclusions

These results established that the pre-service teachers of mathematics in the Kenyan universities have a positive attitude towards use of computers in mathematics instruction. Both correlation and regression results indicated strong relationship between computer use and the independent variable namely the pre-service teachers' attitudes towards the use of computers. Therefore, a change in independent factor under study would significantly impact on Computer use.

5. Recommendations

From the findings outlined, it was recommended that specialized software and applications like UNESCO modules on ICT pedagogy integration could be adapted in teaching high school mathematics and in pre-service and in-service courses since teachers have desirable attitude to use computers in mathematics instruction. The researcher further recommends that the pre-service teachers take the initiative of learning the necessary skills for use in computer-assisted instruction. Those already with the professional skills on how to use computers in mathematics instruction should help the rest to develop the skills. In addition, the teacher training institutions to offer professional training required for application by pre-service teachers in mathematics instruction.

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