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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

There is need to use computers in the teaching and learning process in order to improve performance in Mathematics. 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. Descriptive survey research design was adopted. The target population was teacher trainees of Mathematics at Kenyan universities. The accessible population was 200 teacher trainees from four Kenyan universities (three public and one private) that offer Bachelor of Education degree courses. Stratified and simple random sampling procedures were employed. The instruments for data collection were a pre-service teacher questionnaire, and interview schedule. The data collected was 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. I therefore recommend that Mathematics teacher trainees be given professional development training in the use of computers as a teaching tool.

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Introduction

While efforts have been put in place by the Ministry of Education, Science and Technology (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 such as lectures dominate the classroom. However, computers are perceived to have overwhelming potential in the teaching and learning of Mathematics since they support constructivist pedagogies and

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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 attitude of pre-service teacher trainees towards the use of computers in Mathematics instruction in secondary schools in Kenya. The main aim was to determine whether the pre-service teachers of Mathematics at Kenyan universities perceive the use of computers in teaching of Mathematics as a possible booster of performance in Mathematics and whether the teachers' attitudes determine computer use. This study was important because its findings would enable the Ministry of Education (MOE) officials, book authors, and curriculum developers such as Kenya Institute of Curriculum Development (KICD) to put in place modalities that would enhance effective use of computers in Mathematics instruction. This could bring about good performance in Mathematics in KCSE hence enabling students to have a bright future.

Conceptual Framework

The study was conducted within a conceptual framework that indicates the interplay between the independent variable (attitudes) and the outcome (the computer use).The study was guided by the input-output conceptual framework based on the systems approach theory. In this framework, the independent variable is the input and is composed of the teacher trainees' attitudes towards the use of computers in the teaching of Mathematics. The teacher trainees' background may influence the attitude and forms another set of independent sub-variables. The independent variable influences the dependent variables which include the general use of computers on one hand and the use of computers in teaching Mathematics on the other hand. These independent variables in turn influence students' performance in Mathematics in some way. In this set up, there are intervening variables which may affect the output; these include computer availability and accessibility, school facilities and infrastructure and teachers' workload. The interrelationship of these variables is indicated in Figure 1. It is evident that there is interplay between the independent variable (attitude) and the dependent variable (computer use).

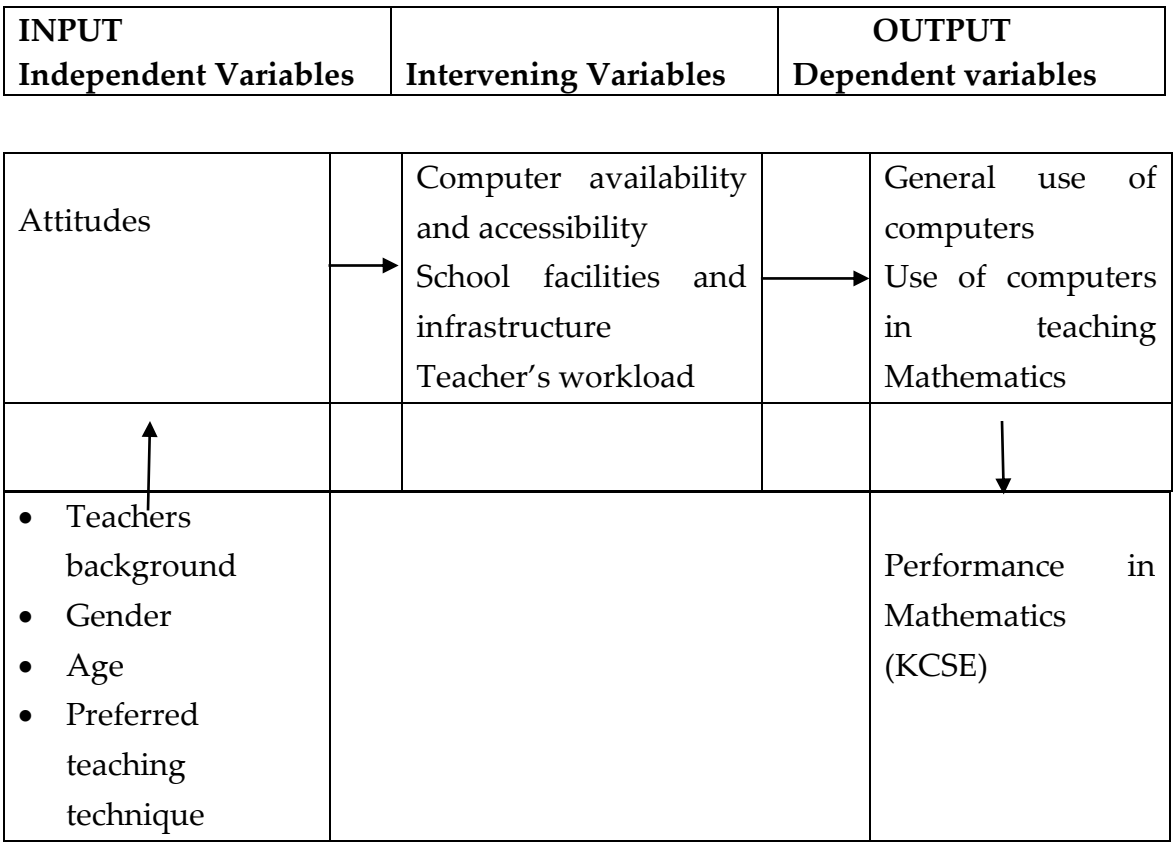

Figure 1. Conceptual Framework of Attitude of Pre-service Teacher Trainees towards Use of Computers in Mathematics Instruction.

Source: The Researcher (2012)

Teachers' Attitudes and Use of Computers

It has been found out by Ertmer (2001) that teacher's perception of the role of technology is closely related to how he or she uses the technology. If the teacher perceives that technology plays a minimum or no role in teaching and learning then he or she may not use it. Teachers with positive experience in using technology tend to teach their students with technology (Slough & Chamblee, 2000). It has been argued that teachers' beliefs have a strong impact on teaching and learning. Lack of implementation of instructional technology can be as a result of teachers' instructional

beliefs not matching the original goals of a particular innovation (Venkatesh *et al.,* 2003). If teachers' beliefs do not match these goals it is likely that resistance will be generated resulting in a low take-up. It is therefore, very important that prior to any educational innovation, teachers' instructional beliefs are explored, identified and dealt with to determine whether they are appropriate or not. Otherwise, teachers can be obstacles to conveyance of change. Teachers' instructional beliefs therefore, reflect personal theories of knowledge and can influence teachers' curriculum decisions.

Studies have shown that the successful implementation of educational technologies depend largely on the attitudes of educators who eventually determine how they are used in the classroom. Bullock (2004) found out that teachers' attitudes are a major enabling/disabling factor in adoption of technology and those teachers who have positive attitude towards technology feel more comfortable with using it and usually incorporate it into their teaching. The development of teachers' positive attitude towards ICT is therefore, a key factor not only for enhancing computer interaction but also for avoiding teachers' resistance to computer use. According to Bullock, teachers' attitudes towards computers affect not only their own computer experience, but also the experiences of the students they teach.

Positive attitude encourages less technologically capable teachers to learn the skills necessary for the implementation of technology-based activities in the classroom (Yuen

& Ma, 2001). This study had sought to find out if there was any significant relationship between the pre-service Mathematics teachers' attitudes towards the use of computers and computer use in the teaching of Mathematics.

Research approach

A descriptive survey research design was adopted for the study. The target population was 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 Mathematics in the year 2012.

Sampling methods and sample

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 was 200 pre-service teachers from three public universities and one private university. Fifty pre-service teacher trainees were selected from each university.

Data collection tools and procedures

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) 12 version, correlation of the scores was done to establish reliability of the instruments by use of Spearman Brown formula whose results gave r = 0.915 which confirmed that the instruments were reliable to be used as data collection tools.

It is also important to emphasize that the study focused on the dynamics of the variables under study to support the theoretical assertions of the concepts under study in line with recommendations by other researchers. The reliability of the constructs was assessed using r-squared coefficient. The regression model indicated an r-squared of 0.716 and explained that 71.6% of the change in one variable is explained by a change in the related variable. The reliabilities of the studied variables were therefore above the acceptable standard (at least .60 or 60%) as prescribed by Nunnally (1978).

Data analysis

During data analysis, the raw data was sorted, edited, classified and tabulated ready for analysis. Data analysis involved the use of descriptive and inferential statistics computed by use of SPSS 12 version. Descriptive statistics used involved computation of frequencies and percentages from which interpretations and recommendations were made. Inferential statistics used was Pearson correlation and regression analysis which was used to make a prediction about the computer use based on its covariance with the independent variable namely the pre-service teachers' attitudes towards the use of computers in teaching. The research questions used to collect data about attitudes of pre-service teachers towards use of computers took a Likert scale format. The data was then summarized in form of frequencies and percentages.

Finally hypothesis' testing was done by use of Pearson correlation coefficients. The null hypothesis was tested at an alpha level determined by the computer. Furthermore, to make Prediction about Computer use based on its covariance with the independent variable, regression analysis was used to evaluate the relationship of the dependent variable (Computer use) and independent variable (attitude of pre-service teachers). The analysis revealed the influence the independent variables had on the dependent variable.

Results and Discussions

Demographic Information

Majority of the study participants were males (128, 64%) while females were slightly above a half of the males (72, 36%). From the findings in Figure 2, the age of the participants ranged between 20 to 49 years. Those aged 30 to 39 represented 22% of the respondents and only 36 (18%) were in the range of 40 to 49 years. Majority (120) of the participants were less than 30 years old (20 to 29 years). This represented 60% of the respondents. This shows that the respondents are mainly the youth who have the potential to provide the teaching service for the next 30 years.

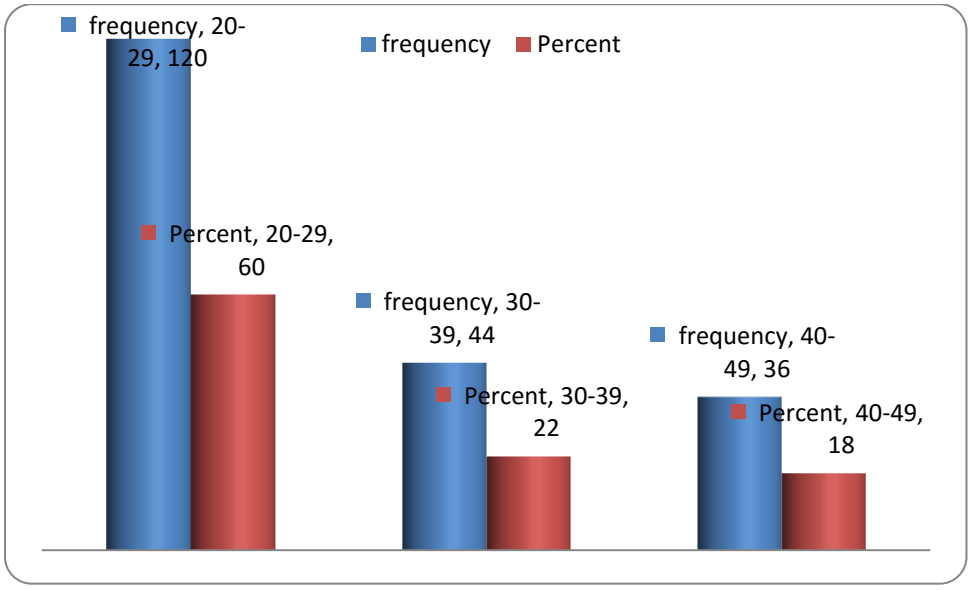

Figure 2. Ages of Pre-service Mathematics Teachers Trainees

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. Information on Table 1 summarizes the pre-service teacher preferred teaching techniques.

The findings in Table 1 reveal that among the five teaching techniques, *discussion* (36%) was popularly used by 72 pre-service teachers out of the 200 participants. The second most utilized method was *lecture* (24%) which was used by 48 participants. Third position was taken by *demonstration method* (20%) with 40 pre-service teachers reporting using it. The second last popular technique was *hands-on learning* (14%) which was used by 28 participants. The least used technique was Computer-Assisted Instruction. Only 12 pre-service teachers out of the 200 reported using it. This represented a paltry 6%.

Table 1. 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

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

The purpose of this study 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. 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 2.

Table 2: Pre-services teachers' attitudes

No.	Statement	Agree	Neutral	disagree
1	Computers save time and effort	150 (75%)	2(0.01%)	48(24%)
2	Schools would be a better place without computers	51 (25.5%)	5(2.5%)	144 (72%)
3	Students must use computers in all subject matter	114 (57%)	11(5.5%)	75 (37.5%)
4	Learning about computers is a waste of time	30 (15%)	6(3%)	164 (82%)
5	Computers would motivate students to do more study	156 (78%)	7 (3.5%)	37 (18.5%)
6	Computers are a fast and efficient means of getting information	16 (81%)	1 (0.5%)	37 (18.5%)
7	I do not think I would ever need a computer in my classrooms	17 (8.5%)	3 (1.5%)	180 (90%)
8	Computers can enhance students' learning	158 (79%)	9 (4.5%)	33 (16.5%)
9	Computers do more harm than good	42 (21%)	10 (5%)	148 (74%)
	Average	98 (49%)	6 (0.67%)	9 (48%)

Results from Table 2 show that majority (75%) of participants stated 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 declared that students must use computers in all subject matters while a paltry 15% stated 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%) 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%) were for the opinion that computers were necessary in the classroom. Majority of the respondents (79%) agreed that computers can enhance students' learning. This implied that majority felt 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 are perceived to do include: rendering many people jobless, are 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. Wozney *et al.,* (2006) argued 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. 170 (85%) were willing to adopt use of computers in Mathematics instruction while only 30 (15%) were unwilling. This information reinforced the fact that the respondents had a positive attitude towards the use of computers in the teaching and learning of high school Mathematics.

Pearson Correlation Coefficient tests were run at significance levels given by the computer for the pair of variables. The results show Pearson Correlation Coefficient at respective significance level.

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 implied 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. This

indicate that the attitude of pre-service Mathematics teachers towards the use of computers influence computer use.

Summary of the Findings

The findings revealed that majority of the pre-service teachers agreed with the positive statements in the following proportions: Computers save time and effort (75%), students must use computers in all subject matters (57%), computers would motivate students to do more study (78%), computers are a fast and efficient means of getting information (81%) and finally that computers can enhance students' learning (79%). On the other hand, very few respondents agreed with negative statements as shown in the following proportions: schools would be a better place without computers (25.5%), learning about computers is a waste of time (15%), they would not ever need a computer in their classroom (8.5%), and finally that computers do more harm than good (21%).

The hypothesis sought to establish the relationship between pre-service teacher trainees' attitudes towards the use of computers and computer use in the teaching of Mathematics. According to the correlation results, there is a strong relationship between computer use and the attitude of the respondents towards the use of computers in Mathematics instruction. This indicates that the attitude of pre-service Mathematics teacher trainees' towards the use of computers influence computer use.

Conclusion and Recommendations

These results established that the pre-service teachers of Mathematics in the Kenyan universities have a positive attitude towards use of computers in the teaching of Mathematics. From the findings, the following recommendations are made:

a) Mathematics teacher trainees need professional development training in the use of computers for classroom instruction.

b) The Ministry of Education should implement programs that would enhance use of computers for Mathematics instruction in secondary schools in Kenya with a goal of improving performance in Mathematics.

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