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RESEARCH ARTICLE

E-LEARNING AND MATHEMATICS IN SECONDARY SCHOOL: WHAT STUDENTS WITH PHYSICALLY HANDICAPPED SAY IN KENYA

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ABSTRACT

Physically Handicapped (PH) learners may lack in education if there are no environmental and instructional adaptations to enable them compete on equal footing with their non-disabled peers. Mathematics subject trains learners to think in quantitative terms. Performance in this subject has been the worst among the PH learners in the Kenya Certificate of Secondary Education as indicated in the results of the years 2008 to 2013. Conventional instruction has been the only method of teaching these learners. There is need to device new ways to enable the PH perform better in learning mathematics. Computer based learning had been reported to be effective in the teaching and learning of complex concepts in physics and accounting and could provide a solution in the teaching of mathematics to learners with physical disabilities. The purpose of this study was to establish the effect of CBL on Secondary school Physically Handicapped students' on their academic achievement in Mathematics. Pre-test-posttest quasi experimental research designs were employed. The conceptual framework was adopted from Winnie and Butter model. Saturated sampling was used to get 128 form three students. Purposive sampling to get 5 mathematics teachers for the physically handicapped was used. The instruments used were Computer Assisted Statistics Text (CAST), student interview guide (SIG) and teacher interview guide (TIG). Validity of instruments was established by experts in special needs education. Reliability coefficient of the instruments was established by test re-test method whereby coefficient of 0.70 and above at p value of 0.05 was considered reliable. The findings indicated that there was statistically significant difference in using CBL method [F (2, 125) =33.14, p=.000] on academic achievement. The study found that there was significant difference in final examination scores of students receiving instruction through conventional methods and those learning through CBL. Study found that teachers should understand the needs of PH and also provision of diversity of mathematics software tailored towards the needs of learners with PH and modifying the input systems in computers to suit learners with PH.

INTRODUCTION

Computer based learning (e-learning) is a new technology applied during instruction E- learning is reported to offer several advantages over conventional teaching. Computer based learning is alleged to help a lot in improving the teaching methodologies of the physically handicap but although the field of computer based learning for disabled group has witnessed a huge progress, there is yet more to be done (Johnson and Johnson, 1995). Unfortunately, there is a great number of the physically handicap learners who cannot study because of their physical conditions. This modern system of learning is alleged to provide them with an equal opportunity to study, as their regular friends and relatives.

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While proper access to buildings and facilities is generally of primary concern, access to the curriculum and learning is of equal importance to children with physical disabilities (Kagan, 1990). CBL include the use of head pointers or head mice (particularly optical); keyboard/mouse accessibility utilities and key guards; overlaid keyboards; predictive word processors; switches and scanning systems; touch pads; tracker balls and speech recognition, (Johnson and Johnson, 1995). The availability of Information and Communication Technology (ICT) tools and programs spread all over the world. Instructors are supplementing the traditional lecture with teaching strategies that emphasize understanding of concepts, active learning, and relevant applications (Armington, 2003; Kinney, 2001). It is widely accepted that solely addressing the math skills of students is not sufficient (Hall and Pontoon, 2005). Math anxiety, negative attitudes, poor study skills, and lack of responsibility for learning are also being addressed. Standards developed by the American

Mathematical Association of Two-Year Colleges call for a greater use of technology in the classroom (AMATYC, 1995). Emphasis should be on high-quality technology that enhances student learning but does not become the main focus of instruction. AMATYC emphasizes that just the presence of computers or other technology does not improve learning. In 2000, the National Council of Teachers of Mathematics published Principles and Standards for the purpose of improving student learning. The Technology Principle states that "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" Computers, when used effectively, can support fundamental characteristics of learning: active engagement, participation in groups, frequent interaction and feedback, and connections to real-world contexts (Roschelle et al., 2000). For instance, in a recent report by the World Bank (2008), it is made clear that the Jordanian educational system, like other educational systems in the Middle East and North Africa (MENA region), depends heavily on memorization, definition, knowledge of facts and concepts. It fails to concentrate on learning and the usage of new approaches or techniques that reinforce creative and critical thinking among students.

A study of the mathematical achievement of high school students in Nigeria who were randomly assigned to CBL or TI revealed a significantly higher mean for the computer-assisted group (Olusi, 2008). Computer Aided Instruction (CAI) has also had positive effects for calculus students, psychology students, and low-ability students (Hannafin and Foshay, 2008). In Kenya, the history of the learners with physical handicaps date back to post Second World War period, when those who had been injured in wars were put together to facilitate the provision of treatment services (Christensen, 1997). Some of the earliest schools that were started in Kenya to cater for the education of the children with PH include Dagoretti Children's Home that was started in 1961 by the Red Cross Society and the Joy Town School for the Physically Handicapped in Kisumu that was started in 1962 by the Salvation Army. Mathematics is one of the science based core subjects which has existed in the secondary school curriculum for a long time and plays an integral role in education, (Government of Kenya, 2002).

The Kenya National Examination Council reports have shown that few of the PH students perform above the grade C in their Kenya Certificate of Secondary Examination. This could be due to the fact that the curriculum has not been modified in the way it is presented to the learners with physical handicaps or in the way it is taught and examined (Christenten, 1997). With the advent of internet, a new learning approach has come up as a perfect solution for these special groups (Ogunyi and Kiboss, 2010). The reality of learning and educational use of ICT is its perceived strength of encouraging active classroom participation between the teacher, the students and the content rather than the passive intake and rote memorization prevalent in most traditional classes (Eraut, 1991; Fisher, 2000). This falls in line with the current theories of instruction that recommends that teaching should be related to the socio-cultural environment of the learner (Kagan, 1990; Lerman, 1997). This therefore, brings out the need to design a collaborative CBL programme that emphasizes peer interaction in the context of cooperative goals and to investigate its effects on cognitive and affective domain in the learning of mathematics among the students with physical disabilities (Ogunyi, 1998; Johnson and Johnson, 1995; Kiboss, 1999). CBL in Kenya may be classified as instruction that does not only present information just like a book, video tape or television but also controls information during the teaching-learning process. It is interactive in that the learner interacts with the hardware, software, and the subject matter (Gavora and Hannafin, 1995; Crawford, 2000; Kiboss, 2002). The focus of the study is on the use of CBL that is able to present lesson content and offer guidance to students in the acquisition of knowledge and skills in the classroom. Learners with physical disabilities are not just those on wheelchairs and those with mobility problems. The study specifically focused on those with no or weaker upper limps due to disability. They have poor co-ordination or degenerative disorders, affecting their learning ability and reducing their degree of concentration in studies.

Statement of the problem: Mathematics subject in the present 8:4:4 curriculum has been a compulsory subject and have not been offering room for adaptations in the way it is presented either as a subject or in examinations to suit the learners with physical handicaps. Form three class is a crucial stage that require the students to master the concepts of the subject if they are to perform well in form four examinations and in life thereafter. However, it was the worst performed subject among the PH learners in the Kenya Certificate of Secondary Education (KCSE) as indicated in the 2013 to 2018. The means score in 2013 was 1.102; in 2014 it was 1.502; in 2015 it was 1.409 and 2018 it was 1.303. This is way below the national average of 3.155 over the same period. The maximum expected national mean is 12.00; hence the need to determine the reasons behind this discrepancy in the mathematics performance among learners with PH. Conventional mode of instruction had been the only method of teaching these learners. There was therefore, need to device ways to enable them to participate in learning with ease. Computer based learning was reported to be effective in the teaching and learning of complex concepts in physics and accounting to normal learners. This could provide a solution in the teaching of mathematics to students with physical handicaps.

Theoretical framework: The study adopted information processing models by Tennyson Meta-learning Model of 1987. The model explains how computers influence the cognitive processes in the learner. Meta-learning information processing is represented as a linear process where information is passed from the source to the receiver (teacher to the learner). The message from the external source activates the receptors in the learner, which transmits them as information to the central nervous system. This information is briefly registered in one of the sensory registers and transformed into identifiable patterns to be encoded into STM through perception. E-learning is believed to extend on the senses of sight and touch in the learners and hence facilitate their learning, perception, and motivation. The use of computers involves children working in-groups. The presence of a number of children interacting around a computer offers an important social dimension to learning (Sewell, 1991; Benting, 1995). McConnel (in Davies and Selwyn, 1999) observes that computer-supported cooperative learning is largely about emphasizing social interactions as learning is not only about accumulation of

knowledge but is also part of a social context in which the students live. The learning is context-related, as well as a process that develops through culturally related activities. What is needed is a new conception of the mind, not an information processor (Rollinson and Broadfield, 1998).

METHODOLOGY

Quasi experimental research was used for this study. Pre-test-posttest design was used. Purposive sampling was used to select the schools for the study with PH learners. The researcher carried out the study using three Secondary schools; The Joy land Secondary School for the PH, (School 1), The Joy town Secondary School for the PH, (School 2) and Mombasa Secondary school for the PH, (School 3). Schools 1 and 2 had two streams each, herein named as Groups 1 and 2; in there form three classes while school 3 was a single stream and had no computers that could be used for All the 32 learners of Form three in Mombasa Secondary school for the physically handicapped, (school 3) were therefore used as control to experiment. The pre-test was administered in order to get the baseline information from the groups before the experiment. The study was carried out in Kisumu, Thika and Mombasa counties using the following schools, respectively: Joy land secondary school for the PH, Joy town secondary school for the PH and Mombasa secondary school for the PH in Kenya.

The population of the study comprised a total of 156 Form three students from the three secondary schools for the physically handicap in Kenya, namely Joy town, Joy land and Mombasa secondary schools for the PH. It also included a total of 5 teachers for mathematics from the named schools. Saturated sampling was used to get a total sample of 128 students and purposive sampling to get the 5 mathematics teachers from the three schools that participated in the study. From Joy land secondary school, only 52 students participated in the study because the available and serviceable computers to be used were 26 in number. A total of 44 students from Joy town Secondary School in Thika were used because only 22 computers were available for CBL. All the 4 teachers that teach mathematics from the named schools participated in the study. All the 32 Form three students from Mombasa Secondary School for the physically handicapped and their 1 mathematics teachers were used as control group in the study.

This was due to the fact that the school was a single stream and had no computers that could be used for CBL. Three instruments were developed and used in the data collection for this study namely; Computer Assisted Statistical Text (CAST), the student interview guide (SIG) and teacher's interview guide (TIG). To establish validity, the instruments were given to the researcher's two supervisors to critically evaluate the relevance of each item in the instruments to the objectives of the study and to rate each item on a scale of very relevant (4), Quite relevant (3), somewhat relevant (2) and not relevant (1) The consistencies of the instruments were done using the test re-test method where reliability coefficient of 70% and above at *p* value of 0.05 was considered reliable. This was guided by the degree of the consistency of the results. The researcher personally visited the area of study to experiment and collect relevant information. Letters were written to seek permission to carry out research through the head teachers of Joy town Secondary School in Thika county, Joy land secondary school for the physically handicapped in Kisumu County and Mombasa Secondary School for the physically handicapped in Mombasa county. Before administering the study, the researcher discussed with the head teachers of the named schools the purpose of the study and the general overview of the tools to be used. The same discussion was extended to heads of mathematics department, computer laboratory technologists and research assistant in respective schools. The students and teachers who participated in the study from Joy town Secondary School in Thika County and Joy land secondary school for the PH in Kisumu County were selected randomly while all the 32 Form three students from Mombasa Secondary School for the PH and their 2 mathematics teachers were used as control group in the study. The researcher discussed with the respective respondents the issues at hand and distributed the questionnaires after agreeing with them on how to be completed. The students completed in their respective classrooms while teachers did theirs in the departments. Data from CAST were personally collected by the researcher with the help of research assistant in the computer laboratories of the named schools. This was done after the students had been briefed on what was expected of them and the same process was repeated for the treated group after the exposure (post-test). The treated groups were then asked by the researcher to respond to questions at the end of CAST on their contributions about the use of CBL. Quantitative data analysis involved making sense of things or events intuitively, conceptual grouping and figurative grouping data, exploring "what is there", clustering and distinguishing observations, of variables and assembling a coherent understanding of events. Pearson's correlation coefficient, Analysis of variance and multiple regression analysis were used to determine the relationship and to compare students' performance in mathematics. Qualitative aspects of the study concerned with the "whats" and the "hows" of events explanation component [aimed] to provide answers to these questions; [for the purpose] descriptive statistics were used based on patterns and themes, seeing possibilities, clustering, making metaphors, counting, comparing, partitioning variables and subsuming of particulars by more general categories to determine relationships between variables. In this study the reporting is termed what the PH learners said about e-learning of mathematics.

RESULTS AND DISCUSSION

The study sought to find out the effects of CBL on PH students' academic achievement in mathematics in secondary schools in Kenya. To measure achievement, students in the treatment group were given a series of tests before the use of the software (pre-test) and after the use of the software (post-test).

Teaching of Mathematics: The teaching of mathematics was evaluated using the performance since form one, identifying mode of teaching mathematics since form one, interaction with computer, comparison of CBL with traditional method, whether CBL add value, basic information about CAST and information about student motivation. More than half of all the students, 72(55.6%) taught through conventional method performed fairly well. Majority of the students, 100 (77.8%) started interacting with computers while in form three; more than half 72 (55.6%) reported that it was easier to understand

Table 1. Teaching of mathematics (n = 128).

Teaching of mathematics	Frequency (%)
Performance in mathematics since form one	
Above average	28 (22.2%)
Average	28 (22.2%)
Fair	72 (55.6%)
Compare the use of computer based learning in mathematics with the teacher mode	
CBL is easier to understand	72 (55.6%)
CBL is time consuming	14 (11.1%)
CBL is encouraging	14 (11.1%)
CBL is not better than traditional method	28 (22.2%)

Table 2. Descriptive statistics on effect of teaching methods on students' academic achievement in mathematics

School		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Pre test	A	52	51.33	12.65	1.75	25.00	78.00
	B	44	50.39	9.00	1.36	25.00	70.00
	C	32	49.72	9.66	1.71	28.00	68.00
	Total	128	50.60	10.72	0.95	25.00	78.00
CBL Methods	A	52	67.92	11.99	1.66	40.00	96.00
	B	44	68.55	10.17	1.53	46.00	85.00
	C	32	50.38	9.22	1.63	32.00	72.00
	Total	128	63.75	13.18	1.16	32.00	96.00
Conventional method	A	52	58.46	10.84	1.50	30.00	80.00
	B	44	55.80	9.19	1.39	34.00	74.00
	C	32	53.88	8.84	1.56	36.00	70.00
	Total	128	56.40	9.92	0.88	30.00	80.00

Table 3. Analysis of Variance on students' academic achievement in mathematics

School		Sum of Squares	df	Mean Square	F	Sig.
Pre test	Between Groups	54.337	2	27.168	0.234	0.792
	Within Groups	14542.343	125	116.339		
	Total	14596.680	127			
CBL Methods	Between Groups	7641.899	2	3820.949	33.140	0.000
	Within Groups	14412.101	125	115.297		
	Total	22054.000	127			
Conventional Methods	Between Groups	441.098	2	220.549	2.288	0.106
	Within Groups	12051.582	125	96.413		
	Total	12492.680	127			

Table 4. Post hoc tests (LSD).

Dependent variable	(I) School	(J) School	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower bound	Upper bound
Pre test	A	B	0.94056	2.21	0.67	-3.43	5.31
		C	1.60817	2.42	0.51	-3.19	6.40
	B	A	-.94056	2.21	0.67	-5.31	3.43
		C	.66761	2.51	0.79	-4.29	5.63
	C	A	-1.60817	2.42	0.51	-6.40	3.19
		B	-.66761	2.51	0.79	-5.63	4.29
CBL Methods	A	B	-.62238	2.20	0.78	-4.98	3.73
		C	17.54808*	2.41	0.00	12.77	22.32
	B	A	.62238	2.20	0.78	-3.73	4.98
		C	18.17045*	2.49	0.00	13.23	23.11
	C	A	-17.54808*	2.41	0.00	-22.32	-12.77
		B	-18.17045*	2.49	0.00	-23.11	-13.23
Conventional method	A	B	2.66608	2.01	0.19	-1.31	6.65
		C	4.58654*	2.21	0.04	0.22	8.95
	B	A	-2.66608	2.01	0.19	-6.65	1.31
		C	1.92045	2.28	0.40	-2.59	6.44
	C	A	-4.58654*	2.21	0.04	-8.95	-0.22
		B	-1.92045	2.28	0.40	-6.44	2.59

*. The mean difference is significant at the 0.05 level.

Table 5. Model Summary on pre-test performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square change	F Change	df1	df2	Sig. F Change
1	0.660[a]	0.436	0.431	9.26006	0.436	97.234	1	126	0.000

a. Predictors: (Constant), CBL Methods.

Table 6. Analysis of variance on treatment group 9.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8337.668	1	8337.668	97.234	0.000[b]
	Residual	10804.332	126	85.749		
	Total	19142.000	127			

a. Dependent Variable: pre-test performance, b. Predictors: (Constant), CBL Methods.

Table 7. Coefficients of pre-test performance

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	26.381	3.964		6.656	0.000
	CBL	0.756	0.077	0.660	9.861	0.000

a. Dependent variable: pre-test performance.

Table 8. Model summary on pre-test performance

Model	R	R Square	Adjusted R Square	Std. Error of the estimate	Change Statistics				
					R square change	F Change	df1	df2	Sig. F Change
1	0.754[a]	0.569	0.565	7.06914	0.569	166.093	1	126	0.000

a.Predictors: (constant), traditional method.

Table 9. Analysis of variance on CBL methods.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8300.119	1	8300.119	166.093	0.000[b]
	Residual	6296.560	126	49.973		
	Total	14596.680	127			

a. Dependent variable: pretest, b. predictors: (constant), traditional.

Table 10. Coefficients of pre-test performance.

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.165	3.428		2.090	0.039
	Traditional	0.782	0.061	0.754	12.888	0.000

a. Dependent variable: pretest.

mathematics with computers than with the conventional methods of teaching and only 14 (11.1%) of them said that CBL was time consuming. More than three quarters 100 (77.8%) were in agreement that computers added value to their motivation to learn and improved their achievement in mathematics. The information is as indicated in Table 6. The participants listed the following as success in using CAST; accessibility of the software and ability of the software to make students enjoy calculations.

Computer Assisted Statistical Text (CAST): The Computer Assisted Statistical Text (CAST) included; success in using the software, problems faced during use, helpfulness of the software, ability of the software to perform the tasks, ability of the software to make students enjoy the class and whether the software added value during its use. From the study with problems notwithstanding, the respondents were in agreement that the software was helpful 96 (100%) as indicated in Table 2. It was up to task 85 (88.2%), it made students enjoy the class 86 (90%) and it added value to student's education 92 (95%). However, the participants suggested that the software need still be improved by introducing new methods, modifying the input method to suit the learners with varied physical disabilities and also connecting the computers to the internet when using the software. Problems faced during the lesson included; inadequate computers, the software could not open the page for some questions and difficulty in drawing graphs. Analysis of

Variance (ANOVA) was used occasions to compare students' academic achievement in Mathematics. One-way analysis of variance was conducted to explore the students' academic achievement in Mathematics as shown in (Table 4). There was a statistically significant difference at the p<.05 level in CBL method [F (2, 125) =33.14, p=.000]. Since the effects of CBL method was found to be significant, it implies that the means differ more than would be expected by chance alone and despite reaching statistical significance, the actual difference in mean scores between the groups was quite small.

There was no statistically significant difference p>.05 in pre-test [F (2,125) =.234, p>005] and conventional methods [F (2,125) =2.29, p>005]. Since the effects of traditional method were found to be not significant, it implies that the means do not differ much. Thus, the adoption of CBL methods influenced the students' academic achievement in Mathematics among the physically handicapped as shown in Table 3. The current study found significant difference in final exam scores of students receiving control group and those receiving CBL. This agreed with Fletcher et al. (1990) that a third and fifth graders in Canada who used the computer to supplement classroom instruction scored significantly higher on a standard test of mathematics achievement than those receiving conventional instruction. Also concurs with Olusi (2008) that the mathematical achievement of high school students in Nigeria who were randomly assigned to computer-assisted instruction or traditional instruction revealed a significantly higher mean for the computer-assisted group. The findings support Bialo and Sivin-Kachala (1996) that educational technology had a positive impact on achievement for all subject areas from preschool through higher education. The achievement of students using computer-based instruction was significantly related to the amount of technology-related training the teachers had received and whether the technology was being used appropriately. The results concurs with Cotton (1991) that a computer-based learning and student outcomes concluded that computer-assisted instruction as a supplement to classroom- instruction produced higher achievement than conventional instruction. Post-Hoc test was carried out on the results also.

Post Hoc Tests (LSD): The Post Hoc Tests (LSD) multiple comparisons were used to establish the effect of teaching method as summarized in Table 6. The findings showed that there was significant effect between school A and C in the pre-test. The CBL method was found to be significant in school B as compared to C. Also, school C was negatively significant different to school A and B. Finally, school A was significant different to school C. The conventional method was found to be negatively significant difference in school C and A. This implies that the adoption of e-learning affect the students' academic achievement in Mathematics among the PH. Summary given in Table 4. The conclusion of this agrees with these previous results as it found significant difference in the mathematical performance of students, although the mean score of the computer-assisted group was higher. The findings agree with Liao (2007) that that computer-assisted instruction produced higher academic achievement, especially when combined with and not replacing conventional instruction methods. Relationship between the Students Exposed To E-Learning and Those without That Exposure in Their Performance in Mathematics. The performance was measured based on test results of pre-test, CBL method and conventional method of learning.

Treatment Group- Relationship between Post-test and Pre-test Performance

A linear regression analysis was used to explore interrelationship among the variables using a model. R^2 represents the values of linear correlation coefficients between the predictors used in the model. From the model, (R^2 = .436) shows that all the predictor account for 43.6% variation in pre-test performance (Table 7). The change statistics was used to test whether the change in adjusted R^2 is significant using the F ratio. The model caused adjusted R^2 to change from zero to .436 and this change gave rise to an F ratio of 97.23, which is significant at a probability of .05. The analysis of variance was used to test whether the model could significantly fit in predicting the outcome than using the mean as shown in (Table 8). The F- ratio represents the ratio of improvement in prediction that results from fitting the model, relative to the inaccuracy that exists in the model. The F- ratio was 97.23 which is likely to happen by chance and was significant (P<.05). The model significantly improved the ability to predict the pretest performance in mathematics. Thus the model was significant leading to rejection of the null hypotheses.

This represented the effect size of the regression model and was significant with a p-value of 0.000. Table 10 shows the estimates of β values and gives an individual contribution of predictor to the model. The β value explains about the relationship between CBL method and predictor. The positive β values indicate the positive relationship that exists between the predictors and the outcome. The β value for CBL method had a positive coefficient thus positive relationship with pre-test performance. The regression results in Table 11 show that each of the predicted parameters in relation to the independent factor was significant; β1= 0.756 ($p < 0.05$) which implies that we reject the null hypothesis stating that there is no significant relationship between CBL method and pre-test performance. This indicates that for each unit increase in the, CBL method there is 0.756 units increase in pre-test performance. Also the influence of CBL method is shown by the t-test value of 9.86 which implies that the effect surpasses that of the error by over 9.86 times.

Control Group-Relationship between Post-test and Pre-test Performance

From the model, (R^2 = .569) shows that the predictor account for 56.5% variation in pre-test performance (Table 12). The change statistics was used to test whether the change in adjusted R^2 is significant using the F ratio. The model caused adjusted R^2 to change from zero to 0.569 and this change gave rise to an F ratio of 166.09, which is significant at a probability of 0 .05. The analysis of variance was used to test whether the model could significantly fit in predicting the outcome than using the mean as shown in (Table 13). The F- ratio represents the ratio of improvement in prediction that results from fitting the model, relative to the inaccuracy that exists in the model. The F- ratio was 166.09 which is likely to happen by chance and was significant (P<.05). The model significantly improved the ability to predict the pre-test performance in mathematics. Thus the model was significant leading to rejection of the null hypotheses. This represented the effect size of the regression model and was significant with a p-value of 0.000. Table 14 shows the estimates of β values and gives an individual contribution of predictor to the model. The β value explains about the relationship between CBL method and predictor. The positive β values indicate the positive relationship that exists between the predictors and the outcome. The β value for conventional method had a positive coefficient thus positive relationship with pre-test performance. The regression results in Table 14 show that each of the predicted parameters in

relation to the independent factor was significant; $\beta 1 = 0.782$ ($p < 0.05$) which implies that we reject the null hypothesis stating that there is no significant relationship between traditional method and pre-test performance. This indicates that for each unit increase in the conventional method there is 0.782 units increase in pre-test performance. Also the influence of conventional method is shown by the t-test value of 12.89 which implies that the effect of conventional method surpasses that of the error by over 12.89 times. The research on the effects of computer-assisted instruction on the mathematical learning of students of various ages and ability levels suggests that computer-assisted instruction as a supplement to traditional classroom instruction is more effective than traditional instruction alone (Brothen and Wambach, 2000; Butzin, 2000; McSweeney, 2003; Nguyen, 2002; Olusi, 2008). The test scores of low-achieving students were higher with computer-assisted instruction combined with conventional methods than with conventional method of instruction alone (Hannafin and Foshay, 2008). The findings agree with Fitzgerald and Koury (1996) that students with mild and moderate cognitive learning disabilities learned as well or better with e-learning than without it.

Conclusion

The adoption of e-learning in the study showed that students' academic achievement in Mathematics among the physically handicapped improved. Students who had been using CBL throughout the learning period had a higher mean score in all the three tests compared to their counterparts who used conventional method to learn mathematics. Students said that they had interest in using e-learning for a variety of purposes including academics and entertainment. The PH students said in both word and action that e-learning opened to them new horizons in learning mathematics. The low performance in mathematics in the control group was associated with the conventional methods. This is because students said they were mainly passive participants as teacher dominated the activities in the class.

Recommendations

CBL must be modified and made available to all learners, relevant software for mathematics must be made available and the teachers must be trained on the use of the CBL in order for them to effectively handle the learners with physical disabilities. The area that still needs to be considered is introduction of the use of CBL in solving mathematical problems from form one in all the secondary schools of learners with physical disabilities. With the advent of intended introduction of free laptops to class one pupils in Kenya Public Primary Schools, the learners with physical disabilities need to be considered if this dreamed is to become reality in line with vision 2030 of the Republic of Kenyan goals. The input systems in the computers are modified to suit learners with physical handicaps right from the free laptops that are intended to be introduced for class one pupils. Training opportunities for regular classroom teachers should be geared towards equipping the learners with computer skills for application in their studies and their general lives.

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