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Learners Skills' Improvement of Inverse Squared Matrix in Mathematics Using Computerized Instruction

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Abstract: The study centred on learners' skill improvement of inverse squared matrix in mathematics via 3 instructional methods which comprised of conventional, computerized formula and combination instructional modes. As an empirical research study, which made up 120 SS II students that were randomly selected into each group that contained 40 students each? Two research questions and hypotheses were raised and tested at a significant level of 0.05. Instruments used were developed questionnaires on students' attitudes towards mathematics (r = 0.65) and adapted one on computer (r = 0.69) and the computerized formula instructional mode. Data were analyzed through the use of descriptive statistics like mean and standard deviation, t-test, One-way ANOVA and Scheffe test. Findings revealed that students had poor attitudes towards mathematics and computers and had dismal performance in the pre-test achievement test in mathematics. However, findings revealed that students that were exposed to the Combination instruction mode (C_3) performed better than other two groups whose performances were at variance. The implication of these findings and recommendations were discussed in the study.

Key words: Computerized instruction, inverse squared matrix, mathematics, skill improvement

INTRODUCTION

A World Bank report placed Nigerian children at the bottom pack of 21 African countries in educational achievement. Performance in literacy, numeracy and life skills has been especially deplorable. Scholastic achievement at the secondary school level has not been any better, either, especially in mathematics, science and english in which less than a quarter of the candidates obtain credit level passes over many years (The Report, 2006). Many students would have loved to proceed more than elementary level in mathematics than it is being experienced; rather these students engaged themselves in it in order to satisfy the requirement of the course of their choice. This may not be unconnected with the tedious computational aspect of the subject coupled with cognitive task that mathematics has subjected them to, yet a fair interest could be sprang up in them to embrace mathematics more than they have inclined to it before.

Mathematics is a unique subject in the sense that its value can only be appreciated when one looks at various developments for which numbers have been able to solve. For instance, the recently adapted Global System of Telecommunication in Nigeria and Information Technology worldwide are conspicuous significant of the subject. In as much as no one could dispute the relevance of technological advancement in the contemporary period, so is the premium role of mathematics in the nation building. As a subject that has different aspect for solving the societal problems as highlighted in the nation curriculum the mathematics' stakeholders need to bring down students' problem to an exciting situation. The inclusion of topic like construction in mathematics is to internalize prospective learners on the area of civil engineering while the concept of simultaneous equations to a certain level improves the day-to-day business activities and make the learners understand the allocation of the available resources to them. Matrix is a branch of mathematics that involves computation of array of numbers with an aspect of inverse matrix. Though there is a method of computing inverse of a matrix but it seem to be tedious for the students compare to the computerized formula instruction mode that excite students in its computation particularly in a matrix of degree higher than 3.

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3C is synonymous to conventional teaching, computerized formula instructions and combination of the 2 methods approaches to the learning skills' improvement in the computation of the inverse of a matrix. Literarily, conventional teaching refers to traditional mode of instruction by which set of students are taught the topic under consideration by a teacher. On the other hand, computerized formula instruction mode refers to the teaching strategy using power point presentation that involves necessary formula in a stepwise manner to solve prescribed problem. Similarly, the combination of both methods refers to the teaching of the concept via the use of conventional teaching and computerized instruction mode to aid teaching and learning of a topic.

It is as a result of this invention that this study tries to see the efficacy of these methods on the learning outcome of students in some topic like inverse of a squared matrix. This computation is restricted to the square matrix of degrees 3 and 4 but it is believed that the higher degree ones will be less tedious so far the lower ones are attained through the use of mathematical induction.

Statement of the problem: The study was designed to examine the learners' skill improvement in inverse squared matrix via the 3C. Specifically, the study tried to examine the extent to which students could excel in the computation of the inverse matrix using the conventional, computerized formula instruction mode and combination of the two methods and as such seek information on the following research questions.

Research questions

RQ_1: What are the attitudes of students towards (i) mathematics (ii) computer?

RQ_2: What are the pre-test and posttest scores of students in the inverse squared matrix computation in mathematics?

Hypotheses

H_{01}: There is no significant difference in the posttest scores of students taught by conventional, computerized formula instruction mode and combination of the two methods.

H_{02}: There is no significant gender difference in the pre-test and posttest scores of students taught by conventional, computerized formula and combination instructional modes towards solving the inverse squared matrix.

MATERIALS AND METHODS

Study was an empirical research study, which made use of Senior Secondary Schools II students in the Nigerian schools, specifically in Lagos State.

Population: Population to the study included both private and public secondary schools in Lagos State of which the senior class were chosen due to the topic classification based as at that level.

Sample and sampling technique: One hundred and twenty students were randomly selected based on their school nominal rolls with every odd positioned student selected into the study and their mathematics teachers inclusive. Three schools used and labeled conventional group, computerized formula instruction group and combination instruction group. In the three public schools chosen there were 40 SS II students in each group but the total sample consisted of 67 males and 53 females.

Instruments: The instruments used for the study included developed questionnaires on students' attitudes towards Mathematics and adapted questionnaires on students' attitudes towards computer (Thomas and Emereole, 2002) that were used by researcher to seek for the students' attitudes and each contained a-13 items each.

Validation: The questions measured the content validity of the instrument as attested-to by two experts, who happened to be senior colleagues in mathematics and computer.

Reliability: All the instruments were trial tested on similar groups of students outside the main study within an interval of 2 weeks and correlation coefficients of 0.65 and 0.69 were obtained for the two instruments on mathematics and computer, respectively.

Procedures: Each group of students was taught the concept of matrix as a topic in which inverse of a squared matrix was extensively discussed for four weeks by the trained mathematics teacher on the mode of instructions to use, having administered the attitude questionnaires on every student. At the end of the 5th week test was administered on the same questions via the teachers who had instructed the students the mode of instruction through which they had been taught. The entire exercise lasted 6 weeks. The computerized formula instruction mode of an inverse is given by $(-)\ i^{+j}$ cofac $(A^T)/|A|$ where (i+j) = positive if (i+j) = even and negative if (i+j) = odd with |A | as determinant.

RESULTS

Research questions

RQ_1: What are the attitudes of students towards (i) mathematics (ii) computer?

Table 1 describes the attitude of students towards Mathematics with the mean score and standard deviation (χ,σ) of (35%, 2.99), (36%, 4.03) and (36.7%, 3.78) to the conventional, computerized formula and combination instructions groups, respectively and Computer with the mean score and standard deviation (χ,σ) of (28.13%, 9.18), (21.75%, 12.68) and (29.63%, 9.95) to the conventional, computerized formula and combination instruction groups, respectively. The findings showed a dismal attitude of students to the 2 subjects in spite of the compulsory nature of the former. There were varying degrees of attitudes of students to these two subjects as the case of gender was concerned and due to students' group involved in the study. What could be attributed for this might not unconnected with vast majority of students who neither practiced computer use nor solve mathematical problem through it. They were only been taught theoretical aspect of computer and not the practical and as such the attitude was not a new expectation.

RQ_2: What are the pre-test and posttest scores of students in mathematics?

Table 2 describes the pre and posttest scores of students in mathematics with the mean score and standard deviation (χ,σ) of (35.93%, 3.02), (37.78%, 5.03) and (35.03%, 6.22) to the conventional, computerized formula and combination modes, respectively and posttest scores with the mean score and standard deviation (χ,σ) of (37.98%, 8.53), (48.00%, 11.00) and (75.38%, 8.50) to the conventional, computerized formula and combination modes, respectively. The findings showed a dismal performance of students in the pre-test scores at a varying point though the computerized formula instruction's group attained the highest mean score than the other 2 groups. On the other hand, findings showed an improved performance of students in the posttest scores at varying mean score and standard deviation (χ,σ) of (37.98%, 8.53), (48.00%, 11.00) and

Table 1: Students' attitude scores in mathematics and computers

	Dependent											
	Attitudes towards mathematics						Attitudes towards computers					
	Methods						Methods					
	Conventional		Computerized		Combination		Conventional		Computerized		Combination	
	Gender						Gender					
	M	F	M	F	M	F	M	F	M	F	M	F
Mean	36.1	33.4	36.8	35.2	36.5	35.8	28.5	27.6	16.8	26.2	27.4	33.3
σ	2.74	3.45	4.54	4.02	4.27	4.41	9.35	9.54	6.50	15.48	10.62	8.16
Count (n)	23	17	19	21	25	15	23	17	19	21	25	15
Count (n)		40		40		40		40		40		40
Ground mean		35.0		36.0		36.3		28.13		21.75		29.63
σ		2.99		4.03	3.78		9.18		12.68			9.95

Table 2: Students' pre and posttest scores in mathematics

	Dependent											
	Pre test scores in mathematics						Posttest scores in mathematics					
	Methods						Methods					
	Conventional		Computerized		Combination		Conventional		Computerized		Combination	
	Gender						Gender					
	M	F	M	F	M	F	M	F	M	F	M	F
Mean	35.8	36.1	37.2	38.3	34.90	35.27	35.83	40.88	43.68	51.90	75.0	76.0
σ	3.52	2.56	3.59	6.26	7.54	3.75	8.70	7.95	10.39	10.54	9.79	6.60
Count (n)	23	17	19	21	25	15	23	17	19	21	25	15
Count (n)		40		40		40		40		40		40
Ground mean		35.93		37.78		35.03		37.98		48.00		75.38
σ		3.02		5.03		6.22		8.53		11.00		8.50

Table 3: ANOVA of students' posttest scores

Source	df	SS	MS	F-cal	F-value	Significant
Between	02	29.982	14991			
Within	117	10.686	91			
Total	119	40.668	342	165	3.07	p<0.05*

* Significant

Table 4: Post Hoc analysis of Scheffe's values

Precedence instructional mode	Covariate instructional mode	Scheffe's values
Conventional	Computerized	11.0330109 *
	Combination	153.7098889 *
Computerized	Combination	82.38070263*

*Significant

Table 5: Gender t-test of pre-test scores of students

Gender	Count (n)	Mean	S.D.	df	t-value	t-cal	Significant
Male	67	35.9	5.02				
Female	53	36.7	4.99				
Total	120	36.2	5.39	118	-1.980	-0.870	p>0.05

Table 6: Gender t-test of posttest scores of students

Gender	Count (n)	Mean	S.D.	df	t-value	t-cal	Significant
Male	67	52.8	19.5				
Female	53	55.2	16.2				
Total	120	53.8	18.4	118	-1.980	-0.735	p>0.05

(75.38%, 8.50) to the conventional, computerized formula and combination groups, respectively, though the highest mean score point was attributed to the combination mode as compared to the other 2 modes.

Research hypotheses

H_{01}: There is no significant difference in the posttest scores of students taught by conventional, computerized instruction mode and combination mode.

Table 3 showed ANOVA of posttest scores of the three groups with F-cal greater than F-value, an indication that the null hypothesis 'There is no significant difference in the posttest scores of students taught by conventional, computerized formula instruction mode and combination mode' is rejected (F-cal > F-value, df = (2, 117); p<0.05). As a result post hoc analysis is necessitated to find the rationale behind the significant.

Table 4 described the Scheffe' s values of significance of the three modes of instructions where it was discovered that there was significant difference between the conventional and computerized formula instructional modes (F-value<Scheffe value, df = (2, 117); p<0.05), significant difference between the conventional and combination instructional modes (F-value<Scheffe value, df = (2, 117); p<0.05) and significant difference between the computerized formula and combination instructional modes (F-value<Scheffe value, df = (2, 117); p<0.05).

H_{02}: There is no significant gender difference in the pre-test and posttest scores of students taught by conventional, computerized formula instruction mode and combination mode towards solving the inverse squared matrix.

Table 5 showed the students' gender performance in their pre-test scores with male and female students' mean and standard deviation (χ,σ) of (35.9%, 5.02) and (36.7%, 4.99). The values which were significant (-t-cal>-t-value, df = 118; p>0.05) which showed that male students did not performed significantly than their female counterparts.

Table 6 showed the students' gender performance in their posttest scores with male and female students' mean and standard deviation (χ,σ) of (52.8%, 19.5) and (55.2%, 16.2). The values which were not significant (-t-cal>-t-value, df = 118; p>0.05) which showed that male students did not performed significantly better than their female counterparts.

DISCUSSION

Students are immersed in computational problem solving as they experiment with and overtly contemplate how things work and the series of manipulation-required. Study has demonstrated a Chinese provide which says 'Tell me and I forget, Show me and I remember, Involve me and I understand' with the appreciable performance of students exposed to the combination mode of instruction in spite of their poor attitude towards computer at the earlier stage. Students' computer- phobic appear minimal compare to Math-phobic ones when one noticed the rate of assimilation in the computerized and combination instructional modes as compared to the conventional one. Meanwhile the study revealed that students' enhancement and understanding of important mathematical concepts, improving their mathematical performance and making the subject more interesting to learn, especially in the computation of an inverse squared matrix. Moreover, it has corroborated with the findings of Vlachos and Kehagias (1998) that computerized instructional mode was useful improvement over the conventional instructional ones, but however, computerized instructional mode has to be complemented by the conventional ones as corroborated in the finding of Thomas and Emereole (2002) in order to assist students, particularly in developing countries, which had never had close contact with the computer. Furthermore, it was discovered that computers exert an appeal to students and eases the acceptance of the computation of inverse squared matrix in mathematics; a pointer to the fact that similar study could be carried out in solving students' perceived difficult topics in mathematics in particular and other science subjects in general. In fact, the study is a pointer for computer programme analyst to

come to a reality of the need to make learning of science, especially mathematics less tedious and non-phobic to the students. Furthermore, the issue of gender imbalance in the learning of mathematics could be minimized as both sexes found the learning of the inverse squared matrix exciting that there was no significant difference in their posttest scores, hence the panacea to low patronage of female students to science as a result of mathematics. Similarly, teacher education programmes in all ramifications should blend with the use of modern technology such as computer and power point presentation materials to enhancing teaching and learning and minimize too much rote learning. Meanwhile, teaching should not be examination centred rather it should be tailored towards mastery learning of concept. Also, in-service training programme must be continually organized for the serving teachers in the use modern instructional teaching aids in order to update their knowledge of contemporary teaching ethics, which has moved away from teacher alone does all and students arm twisted.

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