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Binary Numbers as Enhancement of Achievements in Computer Education in Nigeria

Dr Nsikak-Abasi Udofia & Martins Johnson
Department of Educational Foundations, Guidance & Counselling, University of Uyo,
P.M.B. 1017. Akwa Ibom State, Nigeria.

Abstract
It is an undisputable fact that we are now in the Computer age. The computer system as used now is based on the digital technology. The digital technology is based on the use of 0 and 1 which are the principle digits of the binary digits. Many people are finding it difficult to reconcile this fact. This must be the reason the number system is not given its right of place in today's school curriculum. This study investigated the inculcation of the knowledge of the binary numbers by student and its effect on the acquisition of computer skills. The sample size was 120 students from JSS1 who were on vacation programme in a Private secondary school in Uyo in Akwa Ibom State in Nigeria which was purposively sampled for the study because they had enough computer systems needed for practice. The sample was divided into experimental and control groups. The experimental group was taught binary numbers and its application in digital system for two weeks while the control group was taught the mathematic topic for the week. For another 4 weeks both groups were taught computer applications. The research instrument used in this study was a 50 multiple choice question test and some practical works on computer research. The study adopted pretest-posttest controlled group design. Results obtained indicated a significant difference between the mean performance scores of the two groups in favour of the experimental group showing that the teaching of binary numbers to students enhanced their knowledge and use of computer. It was recommended that proper attention should be paid to the teaching of the binary based system as it enhances the inculcation and application of the computer technology.
Keywords: Binary Numbers, Computer technology, Computer Education, Computer skills acquisition

Introduction

One thing that has changed the pattern of life in this twenty-first century man is the computer technology. Even within this present century there is still demarcation between developed and under-developed world based on computer literacy. What put the developed world ahead is their wisdom in exploiting the power of computer science and technology (Ikekeonwu, 1991). The quest for knowledge by man and the giving of immediate and efficient solution to envisaged and contemporary needs and problems through computer technology application has reduced the world from once upon a time a large Universe to a global village. Initially the computers were analog. The primitive and analog computers era has gradually giving way to a digital world. This has paved way for lots of discoveries, innovations and inventions (Hess & Tenezakis, 1973; Eboh, 2002).

Thousands of years ago, human beings began to count with the use of fingers, from there came numbers or digits which were in tens(Antonio & Percival, 2010) reported about an Indian writer who developed advanced mathematical concept for describing prosody and in doing so presented the first known description of a binary numeral system. Francis Bacon had in 1605 discussed a system by which letters of the alphabet could be reduced to sequence of binary digits, which could then be encoded. He observed that this method could be used with any object at all; provided those objects are capable of a twofold, difference only (Himanshu & Hamid, 2006).

According to Brown & Vranesic (2003) the modern binary numbers system was fully documented by Gottfrey Leibr iz in 1679 in his article Explication de I' Arithmetigue BinaIire. He first realized that two digits 0 and 1 were all that were really needed for a positional number system. He noted with fascination its hexagrams binary numbers from 0 to 111111 and included that this mapping was evidence of major Chinese accomplishment in the philosophical mathematics. The 1 Ching is a system where coins .are used to randomly generate hexagrams a group of six lines where each lines represent either 'yin' or 'yang'. British mathematicians George Boole in 1854 published a land mark paper describing in details an algebraic system of logic which is now known as Boolean algebra. His logical calculus was to become instrumental in the design of digital electronic circuitry (Gross, 2002)

In 1937, Claude Shann, developed his Master thesis on Boolean algebra and binary arithmetic using

electronic relays and switches for the first time. In his work entitled, *A Symbolic Analysis* of *Relay and Switching Circuits,* Shannon thesis essentially' founded practical digital circuit design(Richards & Nostrand ,1955). November 1937, George stibitz working at bell labs completed a relay based computer and called the 'model k' (for **I** Chen, .where he assembled it) which processed calculation using binary addition. This work gave a full research program in late 1938 with Stibitz at the helm. Their complex number computer, completed on January1940 was used to calculate complex numbers in a demonstration the American mathematical society conference Dartmliege on September 11, 1940 according to Georgin & Fazhahi(2006). Stibitzs was able to send the complex numbers calculator remote command over telephone line by a teletype: was the first computing machine ever used remotely over telephone lines. An excerpt from *enwikipedie.orq/wiki/bit* reveals that the first programmable compute built by Konrad used binary notation or numbers (White, 1999 & Erdman, 2010).

According to (Erdmat, 2010) the concept of binary numbers or otherwise called binary digits have placed our modern world in this great position. Binary numbers (binary bit) are nothing but digit of zero (0) and one (1) and are very significant in computer and digitization. A bit is the smallest unit of computer memory. A binary digit (a 1 or 0) is called a bit. A group of bits having a significance is a byte, word, or code, for example to represent the 10 numerals (0, 1, 2, 3 .... 9) and the 26 letters of the English alphabet would require 36 different combinations l's and D's. Since 2^5 are less than 36 which is also less than a minimum of 2^6. Bits per byte are required in order to cumulate all the alphanumeric characters. In this sense is sometimes referred to as a character and a group of byte or more character as a word." Obiofia (2007). In large - scale digital systems such as computers, or a microprocessor, or digital - communication systems" there are a few basic operations which must be performed. The five circuits most commonly employed in such are known as the OR, AND, NOT, NOR, and FLIP - . These are called logic gates and circuits, because they are used to implement Boolean algebra. This serves as character for the mathematical analysis of logic. In a D.C., logic system, a bit is implemented as one of two levels 0 and 1, the system is said to employ D.C. system(Obiofia, 2007). In a dynamic, or pulse-logic system a bit is recognized by the presence or absence of a pulse(Gorgin & Fazlali,2006). It is such discrete system that makes up the fundamentals of the digital technology of today.

If binary numbers are so important in the study of the computer then any child who is to learn the use of the computer should have a fair knowledge of the binary numbers before going to the study of the computer. Interestingly, the Nigerian curriculum introduces the study of computer in Primary 4 as a subject and the binary numbers come only later in the secondary school junior Secondary one(NERDC 2008). In the work of Ekeonwu (1991) and Eboh (2002) they see need to emphasis binary numeral as this was the basis of the use of the computer. This study assumes that Interactions between subjects cannot just be ignored hence a good knowledge of the binary numbers could enhance the study of the computer. The problem of the study therefore is can a good knowledge of the binary numbers effect the learning of computer? Gender is used as a modifying valuable.

Research Questions

1. To what extent do post-test mean scores of students taught binary numbers and those not differ in their performance in a computer test?
2. To what extent do post-test mean scores of male students taught binary numbers and those not differ in their performance in a computer test?
3. To what extent do post-test mean scores of female students taught binary numbers and those not differ in their performance in a computer test?
4. To what extent do post-test mean scores of male and female students taught binary numbers differ in their performance in a computer test?

Research Hypotheses

1. There is no significant difference in the post-test mean scores of students taught binary numbers and those not in their performance in a computer test?
2. There is no significant difference in the post-test mean scores of male students taught binary numbers and those not in their performance in a computer test?
3. There is no significant difference in the post-test mean scores of female students taught binary numbers and those not in their performance in a computer test?
4. There is no significant difference in the post-test mean scores of male and female students taught binary numbers in their performance in a computer test?

Research Method

The study adopted pretest-posttest experimental research design, the equivalence of the experiment and control groups are provided by random assignment of subjects to experimental and control treatment. The study was conducted in Uyo Local government Area of Akwa Ibom State, Students on vacation

programme in a private school where there were sufficient computer for practice was purposively chosen for this study In all there 120 students in the Junior Secondary one was used for the study. All the students were used for the study. However, 2 classes were created by random assignment as the experimental and control groups respectively.

The research instrument used in this study was achievement test. A 50 multiple choice questions assessed over 100% were drawn in the area of computer application taught during the experimental period. A test blue print was prepaid to cover the area of numeration (number base), applied Mathematics, Computer Science and Computer Technology. This was so designed so as to incorporate all areas needed in this Research for gainful knowledge.

The other test was on the use of the computer. The test was administered to students under strict supervision. The researcher initially subjected the' instrument to a thorough scrutiny by three experts in measurement and computer whose comments taken care by the researcher. To determine the reliability of the instrument and its consistency overtime, the test-retest reliability method was employed in the study. A reliability coefficient of 0.78 was obtained which was appropriate for the test.

The study lasted for 6 weeks in which learners (students) were taught for 3 periods per week with each period lasting 40 minutes. The sample was divided into experimental and control groups. The experimental group was taught binary numbers and its application in digital system for two weeks while the control group was taught the mathematics topic for the week. For another 4 weeks both groups were taught computer application. Both then took the post test

The data collected were analyzed using means, variance, standard deviation, independent t-test and analysis of variance. The t-test analysis was used to test the significance difference between the students subjected to the teaching of binary numbers and those who were not, between males of the experimental group and control group, between females of the experimental and control group. Analysis of variance was used to test between gender in experimental and control groups as well.

Results

Table 1: t-test analysis of the difference between post-test mean scores of those taught binary numbers and those who were not

Group	N	Mean	SD	df	t-cal	t-cri	Decision
Experimental	60	62.02	8.40	118	13.24	1.98	Reject The Null Hypothesis
Control	60	42.24	8.32				

From table 1 the mean of the experimental group was 62.02 which were greater than the mean of the control group of 42.24. Additionally, the calculated t-test value of 13.24 was greater than the critical t-value of 1.98 with 118 degree of freedom at 0.05 level of significant. Hence the null hypothesis is rejected, this implies that there was a significant influence in the teaching of binary number on the digital education in Akwa Ibom State.

Table 2: t-test analysis of the difference in the post-test means scores of males taught binary umber and males who were not taught.

Group	N	Mean	SD	df	t-cal	t-cri	Decision
Experimental	32	63.42	8.35	63	9.52	2.02	Reject The Null Hypothesis
Control	33	41.31	8.31				

From table 2 the mean of the experimental group was 63.42 which were greater than the mean of the control group of 41.31. Additionally, the calculated t- test value of 9.52 was greater than the critical t-value of 2.02 with 58 degree of freedom at 0.05 significant levels. Hence the null hypothesis was rejected. This shows that there was a significant difference in the teaching of binary numbers on digital education among the males.

Tables 3: t-test analysis of the difference in the posttest mean scores of females taught binary numbers and females who were not taught.

Group	N	Mean	SD	df	t-cal	t-cri	Decision
Experimental	28	61.45	8.23	53	9.52	8.25	Reject The Null Hypothesis
Control	27	41.76	8.16				

From Table 3 the mean of the experimental group was 61.45 which were greater than the mean of the control group of 41.76. Additionally, the calculated t-test value of 8.25 was greater than the critical t-value of 2.02 with 58 degree of freedom at 0.05 significant levels. Hence the null hypothesis was rejected. This implies that there was a significant difference in the teaching of binary numbers on digital education

among females.

Table 4: Summary of ANCOVA on performance in computer of sub-groups in the teaching of binary number

Sources of Variation	df	SS	MS	F-cal	Decision
Covariate	3	11013.46	3671.15	17.81	Reject The Null
Between	2	4004.45	2002.22	9.71	Reject The Null
Within	118	24321.02	206.11		
Total	119	28325.47			

P< 0.05; df 3 & 116; critical F. 2.68

As presented In Table 4, the obtained F-value (9.71) is greater than the critical F-value (2.68). Hence the result was significant and the null hypothesis rejected. Given the significant result, therefore means that treatment· effect was significant and that experimental groups members performed better as a result of teaching them binary numbers.

Discussion of findings

From the data analysis on table 4, the result is significant due to the fact that the calculated t-value (13.24) is greater than the critical t-value (1.98) at 0.05 level of significance. Result revealed that the treatment effect was significant and that males and females of the experimental group performed better than males and female of the control group. This shows that gender does not impede acquisition of computer knowledge but is a panacea to gainful knowledge, interactive, learning and motivation by Kelly 1981. In a nut-shell, the difference in the performance the post-test of the experimental and control groups teaching of binary numbers were significant as experimental group in all the hypotheses performed significantly better. This shows that teaching binary numbers was of great interest boaster thereby giving the awareness on the digital technology as opined Ekeonwu (1991) and Eboh (2002).

From the result of the study in Uyo Local government Area of Akwa Ibom State, it has been said that there is a rapid development in computer technology most especially has the government has put effort to making every Akwa Ibom person computer Illiterate. And we have also seen that the world had gone digital, virtually every technological piece is operated a digitally: digital cameras, digital radio/TV, digital handsets, digital traffic light, digital robot, digital cars digital clock, the list are endless. As such education for any technological to foster the concept of technological breakthrough is considered paramount. This is revealed in this research work as those who were given the opportunity to be taught binary number (experimental group) out-performed those were not taught binary numbers. It has also been seen that males and females of the experimental group equation performed well as compared to the males and females in the control group. This further shows that digital education is necessary for both males and females in society.

Conclusion

The conclusion that is drawn from this study is that knowledge of the binary numbers enhances knowledge and development of skills in the use of computer.

Recommendations

Arising from the findings of the study, the following recommendations were made.

1. Government should encourage the teaching of binary numbers in nursery and primary schools.
2. Curriculum developers and planners should introduce the teaching of binary numbers into the nursery and primary schools curriculum as a matter of urgency.
3. The government should give top priority look into other issues which would encourage computer education.
4. Workshops and seminars should be organized by Government, private sectors and appropriate agencies for teachers of mathematics and technology to inspire them on the knowledge of digitization.

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