

Effect of Programmed Instruction on the Academic Achievement of Students in Introductory Technology

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Abstract: This research investigated the effect of programmed instruction on the academic achievement of students in introductory technology. To this end 3 hypotheses were formulated and samples of 80 JSSII students were involved in the study. The t-test statistic method was used for the analysis of the data collected. When the analysed data were compared with the standard students t-distribution table (table D), for a degree of freedom (df) of 78, at the significance level of 0.05 with 2-tailed test has a critical t-value of 1.960, it revealed a significant difference in all the tested hypothesis, confirming that Programmed Instruction is effective on students academic performance. It helps the students to be creative, develop new learning ideas and skills independently. It promotes active participation of the learner. Both methods of instructions contribute to high academic achievements as the mean scores were above average.

Key words: Programmed instruction, academic achievement, introductory technology, Nigeria

INTRODUCTION

Naturally every nation has God's given natural resources and the extent to which each nation utilizes this gift of nature depends on the nation's technology. In other words a nation with a well-developed technology makes maximum use of its gifts for the benefits and comfort of its people. On the other hand, a country with an under-developed technology cannot make adequate use of its resources. A well-developed technology can create a home in the desert place by irrigation system, while an under developed system can make people starve in a "Garden of Eden". A wise man once said, a child wrongly trained is a lost child". That is `a good education system with comprehensive and technology-orientated curriculum creates a sound base for technological development.

One of the main objectives of the current national policy on education Federal Republic of Nigeria is developing self-reliance citizens. That is the reason for the introduction of Introductory Technology, into our Educational System at Junior Secondary School (JSS) level.

That aspect of technology development in our school system that is designed to give basic orientation to beginners in technology at the JSS level of education in

Nigeria is called Introductory Technology. Introductory technology is an integrated subject with component parts derived from Technical Drawing, Metalwork, Electricity, Electronics, Plastics, Ceramics, Woodwork, Automobile, Building, Water flow, Airflow, Chemistry, Physics, Food preservatives and so on. Introductory technology is prevocational and seeks to expose students at this level to technology through exploration. In the teaching of Introductory Technology a number of instructional methods are utilized. It is more appropriate to teach students how to learn; to have them acquire the skills that will enable them learn on their own and to provide them with the foundation of skills and attitude for acquiring knowledge so that they will be adequately prepared to deal with future challenges.

Programmed instruction sometimes referred to, as programmed learning is a process or techniques of teaching in a sequence of controlled steps. It is a method of presenting new subjects matters to students in a graded sequence of controlled steps. In most cases, students work through the programmed material by themselves and at their own speed. And after each step, they test their comprehension by answering set questions or fill-in missing terms. They are immediately shown the correct answer or given additional information. Some programmed instructions are linear in concept, allowing

advancement only in a particular order as the answer is given. Others are branching giving additional information at the appropriate level, whether a correct or incorrect answer is given, teaching machines such as computers, are often used to present the materials, textbooks can also be used (Skinner, 1958; Emurian, 2003). This technique of instruction is designed to test students' abilities and as well mark their progress along the line. It helps the students to be creative, develop new learning ideas and skills independently. It promotes active participation of the learner.

PROGRAMMED INSTRUCTION AND ACADEMIC ACHIEVEMENTS OF STUDENTS

In the previous years many researchers have carried out studies on programmed instruction and its effect on student's achievements. Uwameiye (1990) investigated the effect of programmed instruction on achievements of students in vocational electronics. From his finding he reported that both methods of teaching contributed to high academic achievements of students as revealed in the mean scores of both groups. However, since students enter the school with different learning ability they should be encourage to use programmed instruction textbooks when available, to help them build their interest and understanding. According to Burton *et al.* (1996), several studies compared found no differences in the type of response, overt or multiple choices in the performance of the learner. Skinner applied this training technique, known as operant conditioning, in numerous contexts including bringing up his own children. He built a playpen for his children with toys designed to promote learning and creative behaviour through operant conditioning.

Operant conditioning has been widely applied in clinical settings (i.e., behavior modification) as well as teaching (i.e., classroom management) and instructional development (e.g., programmed instruction). Ellen (2003), emphasis the need for programmed instruction in nursing education, with the aim of assisting nurses to meet the challenges present in today's health care environment. From his experiment educators have an important role to play in assisting students to acquire the necessary skills of programmed instruction and to do this the educators or teachers need to understand the concept of programmed instruction. Ellen using CINAHL, Medline and others database programme and the key word: Several organizations like Edutopia, computer in human behaviour (2003), the North Central Educational Lab (NCREL) and the Center for Applied Research in Educational Technology (CARET) are documenting

research studies that link technology to increases in academic achievement. Two studies are reflective of the growing body of research on technology's role in academic achievement, for example "A programmed instruction tutoring system for Java™: consideration of learning performance and software self-efficacy" (Emurian and Durham, 2003). Observation has also shown that many developing nations of the world are noting appreciable improvement in the performance of students in school subjects with the aid of programmed instruction (Aigbomian and Momoh, 1991). The question being asked is "will the uses of programmed instruction in the teaching of students in Introductory Technology yield appreciable results?" The researcher expectations is that this study will expose student to self-learning and discovery habit and as well truly promote their individual's God's given talent and creativity that will eventually make them useful to themselves and as well become good citizens to the society. Programmed instruction allow students to learn at their own paced, with immediate feedback and as well help to awaken, develop the individual's self-concept, confidence to face future challenges and interest towards learning, teacher's job is also made easy and interesting.

This study is based on Skinner theory of motivation-operant conditioning, on which programmed instruction is based; Skinner from his experience in his experiment with a hungry pigeon believed that learning is deliberate and purposeful and that it involves response to stimuli. He further posited that these responses or behaviour, which he called operant, are observable since they are externally manifested. According to Daniel (2001), the study of training methods that promote the mastery and skilled use of technology is an important topic for researchers in technology and for managers who must decide on the most active training techniques to adopt in the workplace. Van Merriënboer (2000) examined trends in software training in particular and concluded that such training is now encompassed within the general framework of professional skills development, to include competency-based education. However, Lee *et al.* (2001) observed that information technology professionals show transitions in their career trajectories from early reliance on technical skills to later reliance on managerial and strategic planning skills, many of which are acquired in an incidental fashion as a function of time spend in the workplace. Prominent theme in reviews of training models for targeted skill development, which focus their present work, on the important impact of feedback and the learner structured engagement (that is practice), with the material or task that is to be mastered to a specific performance criterion or level of competency (Salas and Cannon-Bowers, 2001).

Research design: This study make used of quasi-experimental design, since it make use of pre-test and post-test equivalent groups design. The researcher designed a randomized pre -test and post-test for the experimental group and control group design. Selected topics in introductory technology were used in each group, linear method of programmed instruction teaching technique for the experimental group and the normal conventional method for the control group, respectively. This study was conducted in 2007 in Edo State Nigeria, as a further study on the author’s unpublished M.Ed. thesis in 2006, but in a different local Government area in the state.

RESULTS

Research question 1: Do students exposed to programmed instruction and those exposed to conventional method differ significantly in their academic performances as determined by the achievement test in Introductory Technology?

HO₁: There is no significant difference between the mean achievement scores of students exposed to programmed instruction method of teaching and those exposed to the conventional method of teaching Introductory Technology.

Hypothesis one was analyzed using the performance of students in the experimental and control groups post-test scores in the 30-item multiple choice Introductory Technology Achievement Test (ITAT). The test was administered to both groups after the treatment; and scores were recorded for the groups. For each test, SPSS was used to determine the mean scores, variance, the standard deviation and were recorded as shown in the

Table 1. And a t-test was used to determine the level of significant difference between the experimental group students’ performance and the control group students’ performances in the post-test mean achievement scores in Introductory Technology. The calculated t-value and the critical t- values are compared at 0.05 percentage level of significant (2- tailed).

Looking at the standard students t-distribution (table D), for a degree of freedom (df) of 78, at the significance level of 0.05 with two-tailed test has a critical t-value of 1.960. Since the computed t-value must be equal or exceed a t-value of 1.960 in order to reject the null hypothesis, the calculated t-value of 3.096 is greater than the value required for the acceptance of HO₁. Therefore, we have to reject the null hypothesis, in other words there is significant difference between the mean achievement scores of students exposed to programmed instruction and those exposed to conventional method of teaching Introductory Technology.

Research question 2: Is there any significant difference in the post-test mean achievement scores and pre-test mean achievement scores of students exposed to programmed instruction in Introductory Technology?

HO₂: There is no significant difference between the post-test mean achievement scores and pre-test mean achievement scores of students exposed to the programmed instruction method in Introductory Technology.

Hypothesis two was analyzed using the performance of students in the experimental group in the 30-item multiple choice Introductory Technology Achievement Test (ITAT). Two tests were administered pre-test and post-test, 2 different scores were recorded for the same group.

Table 1: Difference between the mean achievement scores of students in the experimental and the control group in the post-test in introductorytechnology achievement test (itat)

| Methods | N | Mean \bar{X} | Variance S^2 | Standard Deviation (SD) | df | Cal. t | Crt. t | P- value |
|-------------------------------|----|----------------|----------------|-------------------------|----|--------|--------|----------|
| Programmed instruction method | 40 | 64.15 | 63.58 | 7.96 | 39 | | | |
| Conventional method | 40 | 56.10 | 55.60 | 7.45 | 39 | | | |
| | | | | | 78 | 3.096 | 1.960 | 0.05 |

Table 2: Difference between the mean achievement scores of students in the experimental group in the post- test and pre-test in introductory technology

| Types of test | N | Mean \bar{X} | Variance S^2 | Standard Deviation (SD) | df | Cal. t | Crt. t | P- value |
|---------------|----|----------------|----------------|-------------------------|----|--------|--------|----------|
| Post-test | 40 | 58.10 | 57.63 | 7.59 | 39 | | | |
| Pre-test | 40 | 55.05 | 54.69 | 7.39 | 39 | | | |
| | | | | | 78 | 2.64 | 1.960 | 0.05 |

Table 3: Difference between the mean achievement scores of students in the control group in the post- test and pre-test in introductory technology

| Types of test | N | \bar{X} | Variance S^2 | Std. Deviation (SD) | df | Cal. t | Crit .t | P- value |
|---------------|----|-----------|----------------|---------------------|----|--------|---------|----------|
| Post-test | 40 | 56.13 | 55.54 | 7.45 | 39 | | | |
| Pre-test | 40 | 54.03 | 53.55 | 7.32 | 39 | | | |
| | | | | | 78 | 3.25 | 1.960 | 0.05 |

Table 4: Analysis of students response to the 20-item questionnaires on attitude towards programmed instruction

| Respondent | No of students | Mean score (\bar{X}) | Variance (S^2) | Standard Deviation (SD) |
|------------------------|----------------|--------------------------|--------------------|-------------------------|
| Programmed instruction | 40 | 60.45 | 58.69 | 7.66 |
| Conventional method | 40 | 47.60 | 46.35 | 6.81 |

From the standard students t-distribution table (table D), for a degree of freedom (df) of 78, at the significance level of 0.05 with two-tailed test has a critical t-value of 1.960. Since the computed t- value must be equal or exceed a t-value of 1.960 in order to reject the null hypothesis, the obtained t-value of 2.64 is higher than the value required for the acceptance of H_0_2 (Table 2). Therefore, we have to reject the null hypothesis, in other words there is significant difference between the mean achievement scores of experimental students performances in the pre-test and posttest scores in Introductory Technology Achievement Test (ITAT).

Research question 3: Is there any significant difference in the post test mean achievement scores and pre test mean achievement scores of students exposed to conventional method in Introductory Technology?

HO₃: There is no significant difference between the post-test mean achievement scores and pre-test mean achievement scores of students exposed to conventional method of teaching in Introductory Technology.

Hypothesis three was analyzed using the performance of students in the control group in the 30-item multiple choice Introductory Technology Achievement Test (ITAT). Two tests were administered pre-test and post-test, two different scores were recorded for the same group. For each test the mean scores, variance, as well as the standard deviation were recorded as shown in the Table 3.

From the standard students t-distribution table (table D), for a degree of freedom (df) of 78, at the significance level of 0.05 with two-tailed test has a critical t-value of 1.960. Since the computed t- value must be equal or exceed a t-value of 1.960 in order to reject the null hypothesis, the obtained t-value of 3.25 is higher than the value required for the acceptance of H_0_3 . Therefore, we have to reject the null hypothesis, in other words there is significant difference between the mean achievement scores of experimental students performances in the pre-test and posttest scores in Introductory Technology Achievement Test (ITAT).

Research question 4: What is the attitude of students towards programmed instruction?

Twenty item questionnaire was administered to the students after the ITAT post-test, the analysis of students' responses to the questionnaire determining their attitude towards programmed instruction was recorded. To determine the mean scores, numerical values were assigned to each point in the questionnaires these were done as follows:

- Strongly Agree (SA) = 4
- Agree (A) = 3
- Disagree (D) = 2
- Strongly Disagree (SD) = 1

The Table 4 revealed a mean score of 60.45 for the experimental group and 47.60 for the control group. The different in the mean score shows that the treatments has an element of positive effect on the experimental group students attitude, it is above average. For the control group though not directly exposed to the treatment, their response is reasonable it is a little below average.

DISCUSSION

The analysis of data revealed the following: Table 1-3 shows significant difference between the academic achievement scores of students exposed to programmed instruction and students taught with conventional method in the post -test in Introductory Technology Achievement Test (ITAT). Therefore, the null hypotheses were rejected. Both methods of instructions contribute to high academic achievements as the mean scores were above average. The findings are in agreement with Chanchan (1979) studies, which revealed that programmed instruction has been one of the most popular and effective innovations. And also with Ellen (2003) which emphasis the need for programmed instruction in nursing education with aim of assisting nurses to meet the challenges of in present today's health care environment.

CONCLUSION

Based on the findings the following conclusions are drawn: Programmed Instruction as a teaching method is efficient and effective. It can be used by developing nation like ours whose aim is to develop the mind of the youths technologically that is it will help them in their

technological pursuits. It can also be said that both methods are good but the fact that children enters school with different abilities they should be exposed to programmed instruction. The study revealed that the strength of the bond between stimuli and response depends on reinforcement. That is reinforcement is not only an important element in learning, but that learning is a consequence of reinforcement.

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