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Effectiveness of Self-Learning Instructional Material (Slim) in Elementary Statistics

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Abstract

This study was conducted during the first semester of SY 1994-1995 at the Davao Oriental State College of Science and Technology, Mati, Davao Oriental to provide empirical facts on the effectiveness of Self-Learning Instructional Material (SLIM) in teaching Elementary Statistics to second year college students. A modified non-equivalent pretest-posttest control group design was used. Data was analyzed by means of ANOVA, ANACOVA, LSD and UL Index method for item analysis. Three methods of teaching namely: TSI-A (teaching using Traditional System of Instruction) which served as -the control, SLIM-B (teaching using SLIM plus faculty supervision) and SLIM-C (teaching using SLIM). Findings showed that SLIM-B was the most effective method of teaching Elementary Statistics thus confirming that the teacher factor still play a very important role in the learning process of students.

Keywords: self-learning instructional material, academic performance, traditional system of instruction, elementary statistics

Introduction

Statistics is a daily necessity. Unfortunately, this subject is dreaded by students because of its inherent difficulty.

One contributory factor to this is the tragic fact that students the world over have not learned how to learn. They only know how to be taught (Harbit, 1990). This holds true under Philippine conditions. Filipinos have difficulty keeping Philippine education at par with international standards (Sibayan, 1984). Hence, the commission to survey Philippine Education was created because of the need to assess and improve the Philippine Educational System especially in its various curricula with emphasis on contents and methods (Alviar, 1989).

Meanwhile, the Davao Oriental State College of Science and Technology (DOSCST) has students with deficient academic background. This is evidenced by only 7% of the graduating high school students in the province passing the National

College Entrance Examination in 1992 (Governor's Report, 1992).

This has consequently become a challenge to work on an innovative method of teaching which could help -students upgrade their academic performance.

It was theorized that through Self-Learning Instructional Materials (SLIM), students could really learn because they would actively do the different learning activities. The teaching of Elementary Statistics using SLIM was hypothesized to be more effective than. teaching it utilizing the Traditional System of Instruction (TSI) characterized by the lecture method,,

Dewey's theory (Dewey, 1916) that no learning takes place without doing and concurred by Thorndike (1922) who Said that man learns best by doing underlies the theory of this study. Jansen (1989) also supported them with his theory stipulating those ideas can be internalized best if they are put into action.

The researcher tested the following hypotheses:

There are no significant differences among the pretest mean scores of the students in the experimental and control groups in each of the following areas:

a) Basic Concepts, b) Descriptive Statistics, and c) Inferential Statistics

There are no significant differences among the posttest mean scores of the students of the experimental and the control groups in the same areas.

There are no significant differences among the mean gain in scores of the students in the experimental and the control groups in the same areas.

There are no significant differences among the performances of students in the experimental and the control groups.

Research Questions. The following research questions were asked in testing the null hypothesis of the study:

1. Were there significant differences among the pretest mean scores of the control and the experimental groups?
2. Were there significant differences among the posttest mean scores of the experimental and control groups in each of the listed areas?
3. Were there significant differences among the mean gain scores of the experimental and the control groups in each of the listed areas?
4. Were there significant differences among the performances of students exposed to SLIM with faculty consultation (SLIM-B), SLIM alone (SLIM-C) and those unexposed to SLIM (TSI-A)?

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Methodology

Research Design. The design used in this research was a modified nonequivalent pretest-posttest Control Group Design (Design 10) of Campbell and Stanley (1963). Both the members of the control and the experimental groups were intact groups which were naturally assembled in classrooms.

The control group consisted of 15 sophomore students from the old campus of DOSCST at Barangay Sainz, Mati, Davao Oriental. The two experimental groups were in the new campus in Guangguang with 15 students each. All the three groups were enrolled in Elementary Statistics during the first semester of SY 1994-1995.

The treatments were as follows:

Treatment 1 — TSI-A — Teaching through Traditional System of Instruction by lecture method. This treatment served as the control.

Treatment 2 — SLIM-B — Teaching using Self Learning Instructional Material (SLIM) plus faculty supervision. The supervision was limited to answering clarifications.

Treatment 3 — SLIM-C — Teaching using SLIM

The data gathered were pretest and posttest scores in the three areas namely: Basic Concepts, Descriptive Statistics and Inferential Statistics. There were 25 items per area.

The overall performance consisted of the pretest and posttest scores in 75 items along with the number of days it took for each student to finish the module.

Statistical Treatments. Analysis of Variance (ANOVA) was used to analyze the pretest and posttest scores as well as the gain in scores in the three areas among groups. Analysis of Covariance (ANACOVA) was used to test whether the residual effect of Y (Posttest) after removing the effect of the covariate X (no. of days it took for each student to finish the module) still proved effective.

The Least Significant Difference (LSD) was used to test significant differences among means. The UL Index method (Gronlund and Linn, 1990) was used for item analysis.

Results and Discussion

Pretest. The pretest scores were the initial scores of each student before the start of the experiment. This determined the stock knowledge of each member of the experimental and control groups in Elementary Statistics. Table 1 shows the mean scores in all areas for the three treatments. Though the students subjected to TSI-A got

the highest mean scores both in the Basic Concepts (6.67) and Descriptive Statistics (2.13), these differences in pretest mean scores were not significant. The three groups were of the same level of knowledge before the start of the experiment.

Table 1. Pretest scores in the three areas in Elementary Statistics

AREA	PRETEST MEAN SCORE			
	TSI-A	SLIM-B	SLIM-C	CV (%)
Basic Concepts	6.67	6.47	5.87	18.00
Descriptive Stat.	2.13	1.60	1.20	16.00
Inferential Stat.	0.40	0.40	0.47	12.00

Posttest. The posttest was the instrument which measured the students' academic performance in Elementary Statistics. The summary of the posttest mean scores of the three groups in the three areas under study is shown in Table 2. In Basic Concepts, the F test in the ANOVA was highly significant. A highly significant difference was obtained in Basic Concepts. SLIM — B was found to be the best method of teaching Elementary Statistics. This result conforms with Daleon's (1993) conclusion that the non-conventional method was better than the traditional lecture method.

For Descriptive Statistics, SLIM — B also came out as the best method of teaching. This result is supported by Case (1980) who found that an innovative audio-tutorial approach in teaching biology was better than the conventional approach such as the lecture method.

Table 2. Posttest scores in the three areas in Elementary Statistics

AREA	POSTTEST MEAN SCORE				
	TSI-A	SLIM-B	SLIM-C	$LSD_{(0.01)}$	CV(%)
Basic Concepts	13.33^{b}	20.20^{a}	14.67^{b}	2.203	13.88
Descriptive Stat.	12.13^{b}	17.53^{a}	11.2^{b}	2.408	17.91
Inferential Stat.	18.87^{a}	18.80^{a}	10.27^{b}	2.499	15.83

All means in a row having the same letter are not significantly different using $LSD_{(0.01)}$.

In the area of Inferential Statistics, TSI — A and SLIM — B were not significantly different. Both methods of teaching were equally effective. This result conforms with the findings of research reviews of 100 educational research studies on programmed instructions which reported that about half of the studies were found to be equally effective as the traditional method of instruction (Encyclopedia of Educational Research, 1992).

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Gain in Score. Another way of testing the effectiveness of SLIM is by using the gain scores. This is the difference between the posttest and pretest scores of the subjects. This is also to check the consistency of the result using the posttest scores. The result was a replica of posttest ANOVA where SLIM-B proved to be the most effective method of teaching among the three methods tried (Table 3).

Table 3. Mean gain in scores in the three areas in Elementary Statistics

	GAIN IN SCORE				
AREA	TSI-A	SLIM-B	SLIM-C	$LSD_{(0.01)}$	CV
Basic Concepts	6.87^b	13.73^a	8.8^b	2.27	23%
Descriptive Stat.	10.00^b	15.93^a	13.13^b	2.16	18%
Inferential Stat.	18.47^a	18.4^a	9.8^b	2.32	16%

Scores in a row having the same letter are not significantly different using $LSD_{(0.01)}$.

Analysis of Covariance. Removing the effect of the covariate (X) was done by considering the number of days each student finished the module. Results showed that SLIM-B was still the most effective method of teaching (Table 4).

Table 4. Adjusted treatment means with number of days to finish the module as covariate (X) and posttest (Y) in Elementary Statistics

AREA	MEAN SCORE				
	TSI-A	SLIM-B	SLIM-C	$LSD_{(0.01)}$	CV (%)
Basic Concepts	14.56^b	19.02^a	15.51^b	3.21	9.50
Descriptive Stat.	13.42^b	16.18^a	11.25^b	2.56	15.87
Inferential Stat.	24.36^a	26.98^a	14.59^b	8.44	12.87
Over-all Performance	41.09^b	55.34^a	40.61^b	16.97	13.70

All adjusted treatment means in a row having the same letter are not significantly different using $LSD_{(0.01)}$.

All adjusted treatment means in a row having the same letter are not significantly different using LSD (0.01).

Overall Performance. SLIM-B was the most effective method of teaching. This implies that the teacher factor still plays a very important role in the learning process particularly among students.

Item Analysis. Findings based on the UL Index method (Gronlund and Linn, 1990) showed that out of 75 items, 7 (9.33%) were very easy questions, 81.33% (61

items) were moderately difficult and 9.33% (7 items) very difficult questions (Table 5).

Table 5. Distribution of the number of test items as to percentage and the equivalent interpretation of difficulty

Equivalent Interpretation	No. of Items	Percentage (%)
Very Easy	7	9.33
Moderately Difficult	61	81.33
Very Difficult	7	9.33
Total	75	100.00

Conclusions

1. There are no significant differences among the experimental and control groups in the three areas considered for evaluation. The groups were comparable at the start of the experiment.
2. There were highly significant differences among groups in their posttest scores.
   a) SLIM-B was found to be the most effective method of teaching in Basic Concepts and Descriptive Statistics.

   b) Both SLIM-B and TSI-A were equally effective in teaching Inferential Statistics.
3. After removing the effect of the covariate X (no. of days to finish the module by each student) on Y (Posttest), SLIM-B was found to be the most effective method of teaching both in Basic Concepts and Descriptive Statistics. However, in Inferential Statistics, both TSI-A and SLIM-B were equally effective methods of teaching. This implies that the teacher factor still plays a very important role in the learning process of students.
4. It is further concluded that a Self-Learning Instructional Material (SLIM) based on the theory "learning by doing" was confirmed to be true.

Recommendations

1. SLIM-B is highly recommended for adoption by Elementary Statistics teachers.
2. It can be used in other difficult mathematics subjects like calculus for ease and convenience of both teacher and students.
3. It is also highly recommended for use in schools which have problems in acquiring textbooks.

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