



EFFECT OF SEQUENCED AND SCRAMBLED INSTRUCTION ON MENTAL ABILITIES AMONG HIGHER NATIONAL DIPLOMA II STUDENTS OF COOPERATIVE ECONOMICS AND MANAGEMENT, KADUNA POLYTECHNIC

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ABSTRACT

This study investigated the effect of sequenced and scrambled instruction on mental abilities among Higher National Diploma II students of Cooperative Economics and Management Department, Kaduna Polytechnic. The study was a quasi-experimental study which adopted pre-test, post-test control group design. Forty students (20 in the sequenced group comprising HND II (evening) students and 20 in the scrambled group comprising HND II (regular) students, all in their original classroom settings. Analysis of covariance (ANCOVA), regression analysis and Fisher Z transformation were used as statistical procedures. Nidi Hypothesis I which stated that there is no significant difference in the performance of HND II (evening) students given sequences of instruction and HND II (regular) students given the scrambled instruction was retained. Null hypothesis 2 which stated that there is no significant effect of different aptitudes and abilities on equivalent performance of HND II (evening) students and HND II (regular) students in sequenced and scrambled instruction was retained. It was recommended among others that teachers, especially lecturers of higher institutions of learning should prepare a sequenced instruction for the students and that if scrambled instruction is deliberately prepared, teachers should ensure that all the essential aspects of the lesson are delivered and the relationship among the different parts are well understood by

the students. This is possible when the relevance of the parts is extensively discussed.

Keywords: *Sequenced instruction, Scrambled instruction, mental abilities, aptitudes and abilities*

INTRODUCTION

Educators are becoming increasingly aware of the importance of dealing with individual differences in students' learning abilities. Of special concern is the problem of finding the best match between students' individual learning styles and instructional procedures. Since there are different teaching methods such as lecture method, demonstration method, discovery method role playing, excursion, activity etc, teachers may consciously or unconsciously present the instruction in and orderly sequenced, logical and programmed manner or scrambled, illogical and unprogrammed manner. This is common in higher institution of learning where written lesson plan is not produced by lecturers as is the case in lower educational institutions. It was the purpose of this research to study the match between sequence of instruction and specific learning abilities of Higher National Diploma II students of the Department of Cooperative Economics and Management, Kaduna Polytechnic.

Several studies have dealt with the relationship between sequencing of programmed instruction and test performance of students. In general, these studies have revealed that with normal college students, there seem to be few real differences in performance between groups of subjects who have been exposed to logical, systematic instructional sequences and subjects who have taken illogical, random, or scrambled sequences of instruction (Hamilton, 2009; Jacobs and Kulkarni, 2012; Levin and Baker, 2011; Maurer and Jacobs, 2003). Verbal ability might interact with the type of instructional sequencing (random or ordered) to the effect that low ability students might do better under ordered sequencing and high ability students, on the other hand, might provide their own conceptual organizations to a random sequence and achieve comparable performance with both random and ordered sequencing. Educators have found differences in performance following different programmed sequences of the same material. The sequence which led to the most rapid learning did not produce scores that correlated with standardized test scores of general mental ability. A programmed instructional sequence led to greater learning than a textbook style summary on a delayed test but not on an immediate test (Roderick and Anderson 2009).

Based on the aforementioned varying assertions on orderly sequenced and scrambled instruction, the present study sought to -find out the relationship

between instructional sequencing and learning abilities of higher institution students with reference to Higher National Diploma II students of Cooperative Economics and Management, Kaduna Polytechnic so that lecturers particularly in the Polytechnic sector could take instance from outcome of the study for better job performance.

Problem Statement

In higher-institutions of learning, most lecturers make conscious effort to logically sequence their instruction and deliver it as such to the students while some others, for different reasons ranging from poor preparation to incompetence, deliver illogical and scrambled instructions to the students where there is no sequence.

Although the logical sequencing of programmed instruction is intuitively more appealing to educators, including lecturers in higher institutions of learning, there is little evidence that students of higher education learn more effectively under the sequenced instruction than the scrambled sequence which is deliberately prepared to as a strategy to stimulate independent learning. This is what the present study experimented using Higher National Diploma II students of Cooperative Economics and Management, Kaduna Polytechnic.

Research Hypotheses:

The following null hypotheses were generated and tested at 0.05 level of significance:

Ho1. There is no significant difference in the performance of HND II (evening) students given sequences of instruction and HND II (regular) students given the scrambled sequence in terms of (a) immediate learning, (b) transfer, and (c) retention.

Ho2. There is no significant effect of different aptitudes and abilities on equivalent performance of HND II (evening) students and HND II (regular) students in orderly sequenced and scrambled instruction.

Review of Related Literature

Orderly sequenced instruction, according to Wodtke (2001) is a teaching method where the teacher has organized or structured the lesson in sequence in such a manner that the presentation follows an order such as from known to unknown, from abstract to concrete, from local to foreign, from simple to complex or from recent to past. Or it could be simply teaching of reading starting from alphabets to morpheme to word to phrase to sentence to paragraph to passage to text (Synthetic method).

Smith (2001) describes the scrambled instruction as the opposite of sequenced instruction in which the teacher does not follow a sequence. The method of

instruction could be such that the teacher could start at any aspect of the instruction. This may be meant to stimulate thought and reasoning. It could be deliberately done to establish baseline knowledge of the students. The author laments however that some teachers unconsciously scramble their lesson as a result of poor preparation or total incompetence. While some teachers are trained and resourceful, others are not and this could culminate either consciously or unconsciously in presenting either sequenced or scrambled instruction.

In their contribution, Roderick and Anderson study (2009) suggested that careful, systematic sequencing of instruction is necessary to ensure retention of the material presented. On the contrary, Wodtke (2001) suggested that the effect of scrambling an instructional programme depends on the nature of the learning task and or individual differences in the learners and might not inhibit learning. These varying positions need further empirical investigation so that a clear sense of direction could be determined for effective teaching and learning towards national development.

Smith (2001) posited that an unsystematic programme or sequence of instruction places more demands on the general intellectual abilities of the students. A systematic, ordered programme, does not demand the same general abilities but requires that the student make use of more specific intellectual or learning abilities.

Methodology

This study was a quasi-experimental research which adopted pre-test/post-test control group design. The design consisted of two groups of Cooperative Economics and Management students namely; HND II (evening) and HND II (regular) students. The subjects were forty Cooperative Economics and Management students (20 in the sequenced, logical and programmed instruction author laments however that some teachers unconsciously scramble their lesson as a result of poor preparation or total incompetence. While some teachers are trained and resourceful, others are not and this could culminate either consciously or unconsciously in presenting either sequenced or scrambled instruction group comprising HND II (evening) students in their original classroom setting and 20 in the scrambled, illogical and unprogrammed instruction group comprising HND II (regular) students also in their original classroom setting. Experts such as Gay cited in Olayiwola, (2007) and Okoli, (2000) suggest a minimum of 15 participants per group in such quasi experiments so the 20 participants in each group for this study was adequate.

The instrument used for this study was a 60-item objective test on Cooperative Economics and Management Research developed by the researchers which was administered at pretest and posttest stages. Orderly sequenced lectures and

scrambled lectures with the same instructional content on Cooperative Economics and Management Research were prepared by the experimenters. The instruments were validated by one chief lecturer in the Department of Cooperative Economics and Management and two chief lecturers in the Department of Education Technical, Kaduna Polytechnic who were vast in Research methodology. They judged the face and content validity of the items in the 60-item objective test as well as the prepared sequenced and scrambled lectures in Cooperative Economics and Management Research. Kendal measure of concordance was used to determine the degree of relationship among the observations of the lecturers. Their contributions were used in the final drafts. To determine the reliability of the instrument, a pilot test was conducted with 10 uninformed HND II (regular) students in Cooperative Economics and Management to merely ascertain if they understood the item structure of the objective test items. The 10 respondents did not form part of the main investigation. The instrument was subjected to statistical analysis using SPSS to determine the reliability coefficient which yielded a standardized Cronbach alpha of 0.78 which indicated that the items were reliable.

Procedure

The 20 participants in each group were not specially drawn out for this experiment but were pretested, instructed and post-tested together with their classmates as if it was the normal classroom lectures but the experimenters maintained strict focus on the responses of the actual participants. The actual participants were high academic achievers who were sorted out through their 1st/2nd semester grades obtained from the Examination Office of the Department. Those with GP of between 3.00 and 4.00 constituted the 40 participants for the study. This method of selection ensured the desired equivalence of the participants in the two groups. This category of students was relevant for the study as it will be easy to ascertain the effects of the sequenced and scrambled instructions given their performance at posttest.

At the beginning of the experiment, each student in both groups took a 60-item test on Cooperative Economics and Management Research. Orderly sequenced lecture in the same course was then delivered to the participants in HND II (evening) class while scrambled lecture was delivered to the participants in HND II (regular) class. This lasted for a period of one month (2 hours-per week x 4 weeks in each class). The students were not aware that two sequences of instructions were being presented. At the end of the lectures in both groups, the 60-item test on Cooperative Economics and Management Research was re-administered as posttest. Approximately 21 days after the posttest, the retention and transfer tests were administered to both groups. The retention test consisted of 40 items not on the posttest which were included in the two sequences of

lectures. The transfer test consisted of 40 items that were not taught or tested at all during the course of the experiment but had bearing on problem-solving lessons learnt.

The pre-test/post-test control group design is diagrammed as follows:

Table 1 Pretest/post-test Control Group Design

HND II (evening)	O1	X	O3
HND II (regular)	O2	O	O4

Key: O1 and O2 = Pretests.
 X = Orderly sequenced lectures.
 O = Scrambled lectures.
 O3 and O4 = Posttests.

Statistical Procedure.

The following Statistical Procedures were used:

- i) Means and standard deviations of raw scores were calculated for the posttest, transfer test, and retention test.
- ii) Analyses of covariance (ANCOVA) were performed to determine if there were any statistically significant differences between the means of the two groups on any of the dependent variables. Tests for homogeneity of regression indicated parallel regression lines.
- iii) Two separate correlation matrices of 10, achievement, and dependent variables were computed, one each for the ordered sequence group and the scrambled sequence group. Those instances in which correlation coefficients were significantly different from zero in one group but not the other were noted.
- iv) Tests of the significance of differences between the correlation coefficients were performed by means of the Fisher Z transformation.

Results

Means, adjusted means, and standard deviations for HND II (evening) and HND II (regular) on the pretest and the three dependent variables are shown in Table 1:

Table 1. Summary of Learning, Transfer, and Retention Data

	Group		Scrambled Sequence		
	SD	Mean	Adjusted Mean	SD	
Ordered Sequence					
Mean					
Adjusted Mean					
Pretest	30.9		13.7	26.1	10.6
Learning	47.8	46.7	10.9	45.2	46.7
Transfer	25.9	25.2	8.3	27.0	27.9
					5.8

Retention	25.2	24.3	8.6	21.7	22.8	9.9
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The data in table 1 shows that there is no significant difference in the means, adjusted means and standard deviations for HND II (evening) and HND II (regular) on the pretest and the three dependent variables.

Table 2. Adjusted Analyses of Variances with Pretest as Covariate

Variable	Source	DF	SS	MSF
Learning	Treatment	1	10.015	
Error	33	2564.494	77.712	<1
Transfer	Treatment	1	60.312	60.312
Error	33	1324.167	40.126	1.503
Retention	Treatment	1	18.361	18.361
Error	33	1821.748	55.204	<1

In table 2, the results of the covariance analyses are reported. None of the analyses produced F values that were significant with $p > .05$. It was concluded that the two different sequences of instruction (orderly sequenced and orderly scrambled) produced equivalent learning, retention, and transfer with the two groups of HND II students. Consequently, Null Hypothesis 1 which stated that there is no significant difference in the performance of HND II (evening) students given sequences of instruction and HND II (regular) students given the scrambled sequence in terms of (a) immediate learning, (b) transfer, and (c) retention is hereby retained.

Variable	Correlation				
Individual	Ordered	Scrambled			
Dependent	Difference	Sequence	Sequence		
Variables	Variables	Group	Group	Z	P
Learning					
Protest IQ	.187	614	1.428	0.76	
Protest Tot. Lang	.411		634	.844	.200
ProtestRead Comp.	.511	.457	.193	.423	
Protest Arith Fund	.738		.414	1.371	.085
% Max. Gain2 Mental Age		-.010	.513	1.566	.059
% Max. Gain IQ		.130	605	1.547	.061
% Max. GainTot. Lang		.239	.557	1.045	.148
% Max. GainArith. Reas.	.531		.455	.271	.393
% Max. GainArith. Fund.	.452		.175	.841	.201
	Tot. Arith.	.509	.331	.592	.277
Transfer					

Raw Score	Read Vocab	.620	.415	.768	.221
Raw Score	Read. Comp.	.593	.355	.844	.220
Raw Score Tot.	Read	.634	.434	.768	.221
Raw Score	ArithReas.	.508	.477	.109	.457
Raw Score	Arith Fund.	.544	.234	1.010	.156
Raw Score Tot.	Arith.	.550	.371	.622	.267
Raw Score Tot.	Lang	.519	.243	.578	.282
Raw Score Tot.	Battery	.595	.376	.787	.215
Retention:					
Raw Score	Arith Fund	.671	.441	.923	.178
Raw Score	Tot. Lang	.505	.404	.345	.365

Table 3 presents the data on listed correlation coefficients which were significantly different from zero for one group but not the other. Also, results of the tests for significance of differences between correlation coefficients are reported in the table. With $\alpha = .05$, none of the tests revealed significant differences between correlation coefficients. Thus, the results of the correlational analyses were not statistically significant. All underlined correlation coefficients in this table are significantly different from zero with $p > .05$. The Percent maximum possible gain measure was calculated by dividing the difference between a student's pretest and posttest score by the difference between his pretest score and the total number of questions on the posttest.

Support for the suggestion that different aptitudes and abilities are required to achieve equivalent performance from scrambled and systematic presentation can be drawn from inspection of the correlations between the dependent variables and the measures of general and specific aptitudes and abilities as shown in Table 3. These data suggest that different educational requirements were placed on the HND II (evening) students and HND II (regular) students in the two different sequences. Different kinds of skills or abilities were used to achieve equivalent performances. Most notable was the fact that with students taking the scrambled sequence the general ability measures tended to correlate significantly with criterion variables. The reverse was true with the ordered sequence group; specific, not general abilities, tended to correlate with criterion variables.

Overall, the findings of this study do not provide strong support for the theory that sequences of instruction should be matched to student's profiles of general and specific abilities. Thus, null hypothesis 2 which stated that there is no significant effect of different aptitudes and abilities on equivalent performance of HND II (evening) students and HND II (regular) students in orderly sequenced and scrambled instruction is hereby retained.

Discussion

The data indicated that HND II (evening) students and HND II (regular) students taking two different sequences of instruction covering the same content obtained equivalent scores on the criterion tests for immediate learning, retention, and transfer. It appeared that scrambled and ordered sequences of instruction were equally effective in teaching/learning process. This result corroborates the findings of Hamilton, (2009); Jacobs and Kulkarni, (2012); Levin and Baker,

(2011); Maurer and Jacobs, (2003) that with normal students, there seem to be few real differences in performance between groups of subjects who have been exposed to logical, systematic instructional sequences and subjects who have taken illogical, random, or scrambled sequences of instruction. The findings of the present study do not support the suggestion of Smith (2001) that an unsystematic programme or sequence of instruction places more demands on the general intellectual abilities of the students. A systematic, ordered programme, does not demand the same general abilities but requires that the student make use of more specific intellectual or learning abilities. The variations in findings could be because of the different geographical locations, the time of the study and the course used for the experiment.

Conclusion

In teaching/learning process at any level, methods preparation and instruction are key to effective attainment of educational objectives. If the instructional material is consciously sequenced, the students will benefit. If it is also consciously scrambled, the students will benefit. However, if scrambled instruction is delivered to students because of the teacher's incompetence and poor knowledge of the subject, the students' mental abilities may be hampered.

Recommendations

The following recommendations are made to enhance effective mental abilities of students taught with either sequenced or scrambled instruction.

1. Teachers, especially lecturers of higher institution should as much as possible, prepare an orderly sequenced instruction for the students. Even though it may not be submitted to superiors, they should develop a lesson plan that could guide them in their lecture delivery.
If scrambled instruction is deliberately prepared, teachers should ensure that all the essential aspects of the lesson are delivered and the relationship among the different parts are well understood by the students. This is possible when the relevance of the parts are extensively discussed.

To avoid unconscious delivery of scrambled instruction by teachers, adequate preparation and proper mastery of the subject is important. Intensive reading, notation of main points and expected behavioural objectives should be made clear in the mind of the teacher.

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