THE EFFECTS OF SKIPPING MORE DIFFICULT ITEMS ON TIME-LIMITED TESTS: A QUASI-EXPERIMENTAL DESIGN

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Abstract

Standardized aptitude and achievement tests are often accompanied by directions which recommend skipping items perceived as difficult and returning to answer them if time permits. Prior to the present study, the only empirical research in this area was a single study concerning the effects of examinee decisions to follow or disregard these instructions. It was the conclusion of this research that it was to the advantage of high ability examinees to follow the instructions to skip but that conformity to the instructions was disadvantageous to middle and low ability examinees. The present study, in contrast, was concerned with the effects of *differing* instructions concerning skipping and was quasi-experimental in design. The sample consisted of 423 eighth through twelfth grade students of algebra and biology. Intact classes representing three ability levels were assigned at random to treatment conditions consisting of instructions to skip, not to skip, and with no advice concerning skipping (only "skip" and "do not skip" instructions for the algebra classes.) Schoolwide tests were

administered using special answer sheets designed to identify skipped items even when examinees later returned and answered some or all previously skipped. The scores from these tests were used in determination of end-of-course grades. The primary dependent variables were number-right test scores and the number of items skipped. For each subject area, two, two-way factorial analyses of variance evaluated the effect of the differing instructions across ability levels, one for the number-right scores and one for the number of items skipped. For the algebra test, there was no significant treatment effect for number-right scores. However, there was a significant interaction ($p \leq .01$) between ability level and treatment, with high ability examinees receiving "do not skip" instructions performing significantly worse than their counterparts who received "skip" instructions. For the biology test scores, the main effect for treatment and its interaction with ability were not significant ($p > .05$). For the number of skips in both algebra and biology, the main effect for treatment was significant ($p < .01$), with the fewest skips in the "do not skip" groups. In addition, for the number of skips in algebra, the main effect for ability was significant ($p < .05$) with the fewest skips in the middle ability group. While the instructions apparently had their intended effect, and while the treatment-ability interaction in algebra was consistent with the findings of prior research, the number of items skipped by groups instructed to do so were not large, and groups instructed not to skip had meaningful number

of skips nevertheless. Thus it was not surprising that neither the biology scores nor the algebra scores differed significantly according to treatment. Extensive secondary analyses of item and other statistics provided no basis for explaining the interaction between ability and treatment for the algebra scores. It was concluded that instructions to skip items had relatively little effect for tests of the type employed in this study.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

CHAPTER 1

Introduction

Employment of test-taking strategies, such as skipping difficult items, skipping and returning to difficult items, omitting items, and guessing may influence an examinee's performance, especially on time-limited tests *(Standards for Educational and Psychological Testing,* 1985). Differential use of such response strategies by test takers can reduce test validity. That is, use or non-use of advantageous or disadvantageous strategies can result in systematic score differences for examinees of equal ability. While it is commonplace for test instructions to recommend skipping items perceived as difficult (usually with the possibility of returning to them if time permits), very little research of any kind has been done to determine whether this strategy is actually helpful to examinees.

Apparently the only empirical research on this topic was by Rindler (1980), who investigated how test scores were affected by examinees' decisions to skip items perceived to be difficult on a time-limited test in a single subject area. She administered a short verbal aptitude test to 320 college students under varying time limits. The examinees were volunteers, and no credit or penalty was associated with participation or nonparticipation. Post hoc ability groupings were formed on the basis of grade-point averages (GPAs). High ability examinees were defined as

those with GPAs above 2.79, middle ability with GPAs in the range 2.20-2.79, and low ability with GPAs below 2.20. Conventional formula-scoring instructions were given to all examinees, which advised them to omit items for which they did "not have enough knowledge to hazard a guess" (p.991). The instructions also recommended skipping items perceived as difficult and suggested that the examinees might return to these items if time permitted. Mark-sense, layered answer sheets were used to distinguish items that had been skipped as opposed to those that had been omitted after due consideration. Examinees were classified as skippers or nonskippers according to whether or not they actually skipped items as the instructions recommended.

Corrected-for-guessing and (oddly) number-right scores on the test were subjected to 2X2X3 factorial analyses of variance. The independent variables were the self-determined response strategy (skip or do not skip), time limit (20, 25, and 65 minutes), and ability level (high, middle or low). There was significant ($p < .05$) interaction between response strategy and ability level for both dependent variables. Specifically, the high ability examinees who skipped items performed better than the nonskippers, whereas the reverse was true for middle and low ability examinees. Except for ability, all other main effects and interactions were nonsignificant ($p < .05$). Rindler also reported that high ability examinees returned

to complete more skipped items in each time condition than did middle and low ability examinees.

What motivated Rindler's research was concern about the efficacy of instructions to skip items perceived as difficult. Unfortunately, her results are not generalizable in this regard, because the examinees determined their own strategies under a single set of directions. In other words, her study was not truly experimental, in that subjects were not assigned to groups with different instructions regarding skipping. Her results only speak to the effects of examinee decisions to *disregard* the instructions to skip on a test in a single academic area. In addition, because Rindler's subjects were volunteers, the results may not be generalizable to the more usual testing situation, where the scores may help or harm the examinees. Rindler's results may have been further compromised by the use of formula-scoring instructions. Specifically, examinees may have had difficulty distinguishing items they simply intended to skip (and possibly return to) from those about which they felt totally ignorant.

Purpose of the Study

In view of the foregoing analysis of Rindler's (1980) study, the present study was designed to evaluate three sets of directions regarding skipping on tests in two dissimilar academic areas. Distinct groups of examinees were (a) advised to skip items perceived as difficult (SKP), (b) encouraged

not to skip any items (DNS), and (c) provided with non-directive instructions concerning skipping (NDI). In addition, number-right instructions and scoring were used, and the scores became part of the examinees' permanent school records.

More specifically, this study investigated the following major research questions:

1. Are there mean differences in number-right scores or number of items skipped across the three test direction groups? In other words, do the directions have an effect on examinee behavior or performance?
2. Is there an interaction between examinee ability level and type of test instruction with respect to number-right score or number of items skipped? In other words, are higher or lower ability examinees influenced or benefitted by test directions concerning skipping?

Significance of the Study

Other than Rindler's (1980) study, there is no empirical research reported in journals or otherwise generally available sources concerning the skipping of test items. Moreover, instructions recommending skipping are commonplace for standardized tests, and many teachers and counselors who advise students about test-taking probably consider advice to skip items perceived as difficult as "conventional wisdom." It is plausible

to conjecture that these circumstances, in turn, may lead to the inclusion of instructions to skip on new standardized tests. Clearly, there is a need for studies concerning the *effects* of skipping instructions and the use of empirical results rather than folklore for advising examinees and for determining what directions should be given.

CHAPTER 2

Review of Related Literature

The purpose of this chapter is to present findings from previous research related to test-taking response strategies as manipulated through the use of test-taking directions. Special emphasis is placed on the skipping and guessing response strategies.

Directions which are given to examinees should be specific so that examinees can respond to the task in a manner that will maximize their expected scores. Directions given to examinees are intended to produce a particular behavior. Therefore, test directions which encourage a given response strategy should be created with sensitivity and clarity to enhance student performance *(Standards for Educational and Psychological Testing,* 1985).

In an article providing a theoretical justification for the conventional correction-for-guessing formula, Lord (1975), noted that with number-right scoring, examinees should be informed convincingly that it is to their advantage to answer every question, even if their answer represents a sheer guess. However, he noted that there was much evidence to suggest that when such directions were given with number-right scoring, many examinees failed to comply with directions which were clearly in their best

interest and left questions unanswered. Lord used this observation to argue, that if formula scoring is to be used, it is crucial that the associated directions forcefully and convincingly inform students how best to respond to an item when less than certain of the answer.

Lord's advice regarding the importance and forcefulness of directions would seem to apply as well to skipping over questions, whether number-right or formula scoring is employed. When number-right scoring is used, as in this study, it is essential that students be convincingly advised to return to previously skipped items and provide an answer, even if it is a sheer guess.

Cross and Frary (1977) designed a study to test Lord's theoretical results regarding formula scoring of multiple-choice tests. Cross and Frary requested that examinees, after having completed the test administered under correction-for-guessing instructions, respond to three questions designed to assess their understanding and compliance with the test directions. Of particular relevance to this research was the fact that approximately one-third of the examinees (109 of 307) failed to recall what the directions said about guessing, even though the directions were presented in written and oral form.

Rindler (1980) investigated the extent to which examinees in different ability groups who did employ the strategy of skipping more difficult items on a formula scored time-limited test might be more successful than those

who did not skip. Rindler's directions and procedures influenced various aspects of this study. Of particular relevance to this research were Rindler's directions concerning skipping. Because she used formula scoring, it was necessary to distinguish items about which examinees felt totally ignorant (and should omit) from those they skipped and might return to answer. The directions were stated as follows (p.991):

> If you decide that you do not know enough to answer the question mark the omit box on your answer sheet. Mark the omit box only when you have considered a question and decided that you do not have enough knowledge to hazard a guess.
>
> Do not spend too much time on difficult questions. If you wish to skip a more difficult question and return to it if time permits, leave the answer space for that question blank.

Rindler reported that responding under these instructions about 40% of the examinees skipped items. A two-way analyses of variance was performed on the number of items skipped. The independent variables were ability (3 levels) and testing time (3 levels). Middle ability examinees were found to have a significantly ($p < .05$) greater number of skips. However, the interaction and main effect for testing time were non-significant. Thus, Rindler concluded that examinees adopted their skipping strategies independent of time pressure.

When Rindler examined the proportion of items skipped which were later completed by subjects in the three timed conditions, she found the

return rate of high ability examinees to be greater than for middle and low ability examinees. High ability examinees completed an average of 29% under the 20 minute time limit, 26% under the 25 minute time limit, and 98% under the 65 minute time limit. In the most restrictive time condition, middle ability examinees did not return to answer any items skipped; however 17% were completed in the 25 minute time limit; and 21% were completed in the 65 minute time condition. In no time conditions did low ability examinees complete more than 5% of the initially skipped items. Rindler stated that lower ability examinees may have been disadvantaged by skipping items.

Belcher (1985) investigated improving College Level Academic Skills Test (CLAST) scores through attention to test-taking strategies such as skipping. Belcher's study differed from Rindlers in that she determined the average number of items skipped on a multiple-choice test by ethnic group rather than by ability group. Examinees were encouraged to guess on items skipped with no penalty given for guessing. The purpose of Belcher's study was to determine whether the test-taking strategy (guessing on items skipped) improved the passing rate of black, white, and hispanic subjects on reading, writing, and computational tests. Examinees were directed to fill in all items that they skipped when the time on the test ran out. Percentages and means were calculated on items skipped. The mean number of items skipped was less than one for all ethnic groups,

with most examinees responding to all items. Belcher's findings indicated that even if examinees had a 50% chance of correctly guessing on items skipped, their improvement in the passing rate would be 1% at best.

CHAPTER 3

Methodology and Procedures

This study was a quasi-experimental investigation that manipulated skipping behavior through the use of different sets of directions for examinees in different ability groups. The primary question was whether or not the treatment instructions effected number-right scores or number of items skipped. This chapter presents a description of the subjects, ability groups, and the random assignment of subjects into class sections. Further, this chapter contains a description of the tests used, some questions to determine examinees' understanding of the instructions, the answer sheet used, and the design. Administrative procedures and data analyses also are described.

Subjects

Initially, the sample included 677 eighth through twelfth grade examinees from the Bertie County public school system in eastern North Carolina. All testing was conducted during regular class periods in the algebra, biology and United States (US) history subject areas. However, it became apparent from a preliminary analyses of the data that something was amiss with the US history test results. Specifically, there was more skipping evident among the examinees instructed not to skip than among

those instructed to skip. It was later determined that incorrect instructions had been given to one group of US history examinees. Consequently, the data from the US history classes were eliminated from the study.

The scores from the tests of the study were used, in part, to determine overall class standing and final report card grades. A score for an examinee was included in the analyses only if the examination was taken in class during the regularly scheduled class meeting period. A description of the algebra and biology subject areas is presented in Appendix A.

In Bertie County public schools, the examinees were tracked by ability on the basis of the California Achievement Test (CAT) reading and mathematics percentile scores. The examinees enrolled in the biology classes were categorized using CAT total reading percentile scores while examinees enrolled in algebra classes were categorized using the CAT total mathematics percentile scores. Biology ability ranges were based on the following CAT percentile scores: 26 - 39 low ability, 40 - 74 middle ability, and 75 - 99 high ability. The algebra ability levels were based on the following CAT percentile scores: 50 - 59 low ability, 60 - 79 middle ability, and 80 and above, high ability.

Random assignment of examinees to teacher and class sections was done prior to the beginning of the school year by the principal with the

help of a computer program, The School System, made available through Columbia Computing Services, Inc.

Instruments and Materials

Tests

The tests for the study were designed to be comparable to the North Carolina (NC) end-of-course tests that are administered at the end of each academic term. The NC end-of-course tests' KR20 coefficients ranged from .88 to .90 for algebra scores and .83 to .88 for biology scores. The NC end-of-course test were administered under formula scoring instructions. An overview of the NC end-of-course program is presented in Appendix B. The items for the tests of the study also were constructed to match the NC test standards, goals, and objectives for each of the two subject areas (see Appendix C for NC state test standards, goals, and objectives for algebra and biology).

The tests for the study were constructed by departmental chairpersons and teachers as part of the Bertie County public school's improvement plan. The algebra chairperson developed the items to measure subject area content. Once the algebra chairperson completed a draft of the items, the test was reviewed by the mathematics supervisor of the school system. After this review, the mathematics coordinator of the NC Department of Public Instruction (Region I) reviewed the draft. Both individuals

gave their approval to the algebra chairperson to prepare the test for administration. The biology chairperson and teachers drew their items from the "Biology Test Maker" by J & S Software Company. The item bank questions were chosen from eight categories: animals and plants, biochemistry diversity, ecology, genetics, living things, physiology, and reproduction.

The new tests consisted of 50 multiple-choice items for algebra and 57 multiple-choice items for biology. These tests were designed to be administered during a one hour class meeting period and are presented in appendices D and E.

The tests for both algebra and biology served the following purposes: 1. to provide information about examinees' performance relative to skipping instructions; 2. to determine the extent to which skipping was limited to troublesome or difficult items; and 3. to be used as a preliminary indicators of the levels of student performance that might be expected from administering the actual NC end-of-course tests in June of 1990.

Test Directions and Answer Sheet

A study of the skipping test response strategy was contingent on the development of test directions and answer sheets which allowed skipped items to be distinguished. Further, the directions provided for identifying

items that were skipped over but later completed. Accordingly, the following three sets of instructions were developed.

> SKP directions. You will have 55 minutes to complete the test. Do not spend too much time on any one question. If you are not sure of an answer, you are encouraged to move on to the next question, but first mark choice E on the answer sheet as a place holder. Before you hand in your test, go back and answer any questions you may have skipped. For questions skipped, you should have two choices darkened; choice E and the choice you believe is the correct answer. Ten minutes before time is up I will remind you so that you can go back and answer any questions you may have skipped. It is to your advantage to answer all questions even if your answer is a sheer guess.

> DNS directions. You will have 55 minutes to complete this test. You are encouraged not to skip questions. You should answer each question as you come to it to prevent getting your answers out of order. If you nevertheless decide to skip an item, you should mark choice E as a place holder. Before you hand in your test, go back and answer any questions you may have skipped. For questions skipped, you should have two choices darkened; choice E and the choice you believe is the correct answer. Ten minutes before time is up, I will remind you so that you can go back to any questions you may have skipped. It is to your advantage to answer all questions even if your answer is a sheer guess.

> NDI directions. You will have 55 minutes to complete this test. I will notify you when ten minutes of testing time remains. It is to your advantage to answer all questions, even if your answer represents a sheer guess.

These three sets of directions were integrated into the standard set of directions for Bertie County public schools as shown in Appendices F, G, and H.

Answer Sheet

The experimental tests were administered with machine readable answer sheets. Each test question contained four multiple choices. Choice E was identified as a "place holder" at the top of each column of response areas on the answer sheet. The answer sheet is presented in Appendix I.

The Response Strategy Questions

Two questions were constructed to assess the extent to which the examinees understood the test directions relative to skipping and guessing. These questions appeared at the end of the tests in both algebra and biology. A third question at the end of the tests asked the extent to which the examinees actually skipped. This response could be compared with their actual skipping behavior. The three questions were as follows:

1. As best you recall, the test directions:
   a. encouraged you to skip more difficult questions.
   b. discouraged skipping more difficult questions.
   c. said nothing about skipping.
2. As best you recall, the test directions encouraged you to answer all questions:
   a. unless your answer would be a sheer guess.
   b. even if your answer would be a sheer guess.
3. When taking the test, you:
   a. skipped one or more questions.
   b. did not skip any questions.

Quasi-Experimental Design

Skipping instructions and ability level served as independent variables in the analysis of number-right scores and number of items skipped for the algebra and biology experimental tests. Three levels of ability, high, middle, and low, were used for both subject areas.

Seven algebra and 15 biology classes participated in the study. These included two high, two middle and three low ability algebra class sections, and three high, seven middle, and five low ability biology class sections. The biology classes at each ability level were randomly assigned to one of the three treatment conditions. Due to the limited number of algebra class sections, only two treatment conditions were used: the SKP and DNS instructions. Table 1 shows the number of class sections and number of students per class representing each of the three ability levels assigned to each treatment condition for both tests.

Administrative Procedure

This investigator met with the Bertie County public school superintendent, the high school principal, the regional research and development coordinator, the local testing specialist, the math and science supervisor, and the social studies supervisor in December of 1989 for the following purposes: 1. to determine the feasibility and practicality of conducting the study within the Bertie County public schools, 2. to determine how this

Table 1

Number of Class Sections and (Number of Students Per Class) Associated with Each Set of Directions for Both Tests by Ability Groups

	Algebra Test Instructions		Biology Test Instructions		
Ability Group	SKP	DNS	SKP	DNS	NDI
High	1(14)	1(13)	1(30)	1(20)	1(13)
Middle	1(13)	1(24)	3(18,18,16)	2(22,23)	2(20,17)
Low	2(24,22)	1(20)	2(22,18)	2(23,15)	1(18)

investigation could accommodate the needs of the school administrators, teachers, and staff, 3. to obtain permission to have the department chairperson and classroom teachers develop the new tests that replicate the NC end-of-course tests, 4. to modify the answer sheet to identify items that have been skipped but later returned to and answered, and 5. to provide a student population separate from the high school to field test the treatment instructions.

Upon approval by the superintendent to conduct the study, the high school principal engaged the department chairperson and classroom teachers in the development of the subject area tests over a four-month period. While the tests were under construction, the regional research and development coordinator provided a general purpose answer sheet (number 16504) that was obtained from the National Computer Systems (NCS) to be modified to identify skipped items. This answer sheet was recommended because it was economical and had been field tested within the Bertie County public schools. The investigator contacted NCS: 1. to determine if it would be practical to modify answer sheet number 16504 to reflect the "place holder" position, and 2. to determine the cost of the revision for the NCS prepared scannable forms. Bertie County public schools superintendent agreed to purchase the revised answer sheets.

Two months prior to the actual scheduled test administration date of May 1990, advance preparation for test administration was discussed by

the investigator and the Bertie County public school testing specialist. The investigator presented the treatment instructions and the response strategy questions to the testing specialist. Each set of instructions and the response strategy questions were reviewed along with other concerns of the specialist which were as follows: 1. to determine where the treatment instructions would be placed within the Bertie County public school directions, 2. to determine where the response strategy questions would be placed within the test booklet, and 3. to determine the most convenient time to meet with subject area chairpersons and teachers to train them for actual test administration.

Once the subject area chairpersons and classroom teachers completed a draft of the tests and NCS completed the scannable modified answer sheets, the Bertie County public school testing specialist and the high school principal developed the test booklets which included the response strategy questions. The Bertie County public school directions which included the treatment instructions also were prepared.

Before examinations were administered within the Bertie County public school system, it was standard procedure to train the classroom teachers and staff who would be involved in test administration. The same procedures were used for this investigation. The Bertie testing specialist held one training session after school for subject area teachers. The training session covered: 1. a detailed review of the Bertie County public school

directions, 2. a review of the modified answer sheet along with specific code numbers presented in an addendum, 3. a review of the treatment instructions, and 4. the time-limit. The teachers also were instructed not to coach examinees or to deviate from the given instructions.

The Preliminary Testing Phase

Two sets of the treatment instructions, (SKP and DNS) were field tested by 27 high ability eighth grade algebra examinees that comprised two class sections at Southwestern Elementary School within Bertie County public school system. The classroom teacher supplied identification numbers for each examinee. During the test administrations, which were scheduled at different class meeting times, the investigator read aloud the directions to the SKP group; whereby the classroom teacher read aloud the directions to the DNS group.

The purpose of the field test was to evaluate how well the examinees responded to the treatment instructions as well as to determine the effectiveness of the answer choice E used as an indicator of an item skipped identified with the "place holder" column. The preliminary test phase revealed: 1. the tests could be completed within 55 minutes, 2. the examinees had no difficulty using choice E to identify items skipped, and 3. the examinees identified flaws associated with the test items. The test item

flaws, such as spelling errors and word omissions, were corrected by the teachers before the actual test administration.

The Experimental Testing Phase

The principal and the investigator acquainted the teachers with their treatment assignments. The principal supplied the teachers with a computerized class list with four digit identification numbers for each examinee to be recorded on the answer sheets. The principal provided each subject area teacher with a three digit identification number that was to be placed on the answer sheet along with the class meeting period; i.e., first through six period. The day before the tests were administered, the previous information was placed on the answer sheets by the examinees. Further, the teachers followed the Bertie County public school directions by having the examinees fill in information on the left side of the answer sheet. The upper columns contained spaces for the name; whereas the lower columns contained spaces for birth month, day, year, examinee ethnicity, gender, grade, and year in school. The codes for the answer sheet are presented in Appendix J. Once the examinees completed filling in the requested information, the teachers returned the answer sheets for all examinees and the Bertie County public school directions to the principal's office. The test booklets and the modified answer sheets were given to the teachers the day of test administration. After examinees entered the classroom and

were settled, the teacher passed out the modified answer sheets and the test booklets. As required by the Bertie County public school administrators, the teachers read aloud the test directions to the examinees.

A starting time was placed on the chalkboard by the teacher. The examinees were then told to open the test booklets and begin the examination. The examinees were informed by the teacher ten minutes before the exam period was to end. When the 55 minute time period ended, the teacher instructed examinees to stop and close the test booklets. The teacher obtained the modified answer sheets and the test booklets. When the bell rang, the examinees were dismissed. At the close of each testing session, the teachers personally returned the testing materials to the principal or to the investigator.

Data Analyses

This section contains a description of the statistical procedures used to perform the primary and secondary analyses. The data were analyzed using SPSS-X on the Virginia Polytechnic Institute and State University's mainframe computer system and using SPSS-PC on a personal computer.

Primary Analyses

Number-right scores for each examinees were used for the primary analyses. The number-right scores were analyzed using a two-way factorial ANOVA for the algebra and biology subject areas. A 3x2 analysis of

variance for algebra and a 3x3 analysis of variance for biology were conducted to test the significance of the main effects, ability level and treatment instructions. For the algebra test, there was a significant interaction, which led to the calculation of simple main effects by ability level and treatment condition.

Secondary Analyses

Secondary analyses included: 1. the analyses of variance on number of items skipped for both subject areas; 2. the response frequencies to three response strategy questions were crosstabulated with treatment instructions; 3. percentages were computed by ability groups for number of items skipped, for number of attempts on items skipped, and for the success rate on items attempted; 4. item information included data relative to skipping behavior along with item analyses for difficulty (p-value) and discrimination (item/total score point biserial) coefficients; and 5. number-right scores also were correlated with other ability measures to determine the criterion-related validity. Reliability for the algebra and biology subject area tests was determined by use of Kuder Richardson formula 20 (KR20).

CHAPTER 4

Results

Part I - Primary Analyses

The main objective of the present investigation was to enlarge upon Rindler's (1980) findings through the manipulation of the subjects by varying the test instructions. The effect of the treatment conditions was judged based upon a factorial ANOVA of number-right scores as an indicator of the examinees' performance on the tests.

Analyses of Number-Right Scores for Algebra Test

Table 2 shows the sample sizes, means, and standard deviations of the number-right scores broken out by ability and treatment combinations. Table 3 presents a summary of the 3X2 factorial ANOVA on number-right scores with simple main effects for ability level and treatment. As expected, the main effect for ability level was significant at the ($p \leq .01$) with higher mean number-right scores associated with high ability followed by middle ability examinees. The treatment condition was non-significant at ($p > .05$) due to only slight differences in the overall mean number-right scores for skip ($\bar{X} = 27.64$) and DNS ($\bar{X} = 29.04$) instructions. This significant main effect, however, must be qualified by the finding of a significant inter-

Table 2

Means, Standard Deviations, and n's for Number-Right Scores on Algebra Test

Algebra		SKP	DNS	Overall
High	n	14	13	27
	$\bar{X}$	36.00	29.69	32.96
	SD	8.30	6.94	8.19
Middle	n	13	24	37
	$\bar{X}$	30.23	31.04	30.76
	SD	6.22	4.69	5.20
Low	n	46	20	66
	$\bar{X}$	24.37	26.20	24.92
	SD	4.68	4.26	4.55
Overall	n	73	57	130
	$\bar{X}$	27.64	29.04	28.25
	SD	7.36	5.49	6.62

Table 3

Summary ANOVA with Simple Main Effects for Number-Right Scores on the Algebra Test

Source	SS	df	MS	F
Ability	1503.82	2	751.91	24.69*
Ability @ Skip	1557.02	2	778.51	25.57*
Ability @ DNS	262.96	2	131.48	4.32
Treatment	3.55	1	3.55	.12
Treatment @ High	268.00	1	268.19	8.81*
Treatment @ Middle	5.54	1	5.50	.18
Treatment @ Low	46.70	1	46.70	1.53
Ability by Treatment	316.89	2	158.45	5.20*
Error	3775.95	124	30.45	
Total	7740.43	136		

* $p \leq .01$

action. Figure 1 shows a graph of the cell means, which illustrates the nature of the interaction.

As indicated by the cell means graphed in Figure 1, high ability examinees who were given DNS instructions have lower mean number-right scores than those who were given SKP instructions; whereas, middle and low ability examinees who were given DNS instructions have elevated mean number-right scores over those who were given SKP instructions.

The simple main effects tests also are shown in Table 3. Specifically for ability level, the three means associated with DNS were not significantly different but those associated with SKP were significantly different at $p \leq .01$ level. These findings indicated that the mean number-right scores were statistically different across ability groups for examinees given SKP instructions.

Alternatively, the differences in instruction for high ability were significant at $p \leq .01$ level but not for middle or low ability groups. These findings, however, were rendered unexplainable because many of the high ability examinees given DNS instructions ignored the directions and skipped nearly the same number of items as the examinees given the SKP instructions. Because the investigator did not know what to make of the anomolous finding, the principal was contacted in an effort to determine if he could address this occurrence. He stated that the difference in performance scores may have occurred because the high ability algebra

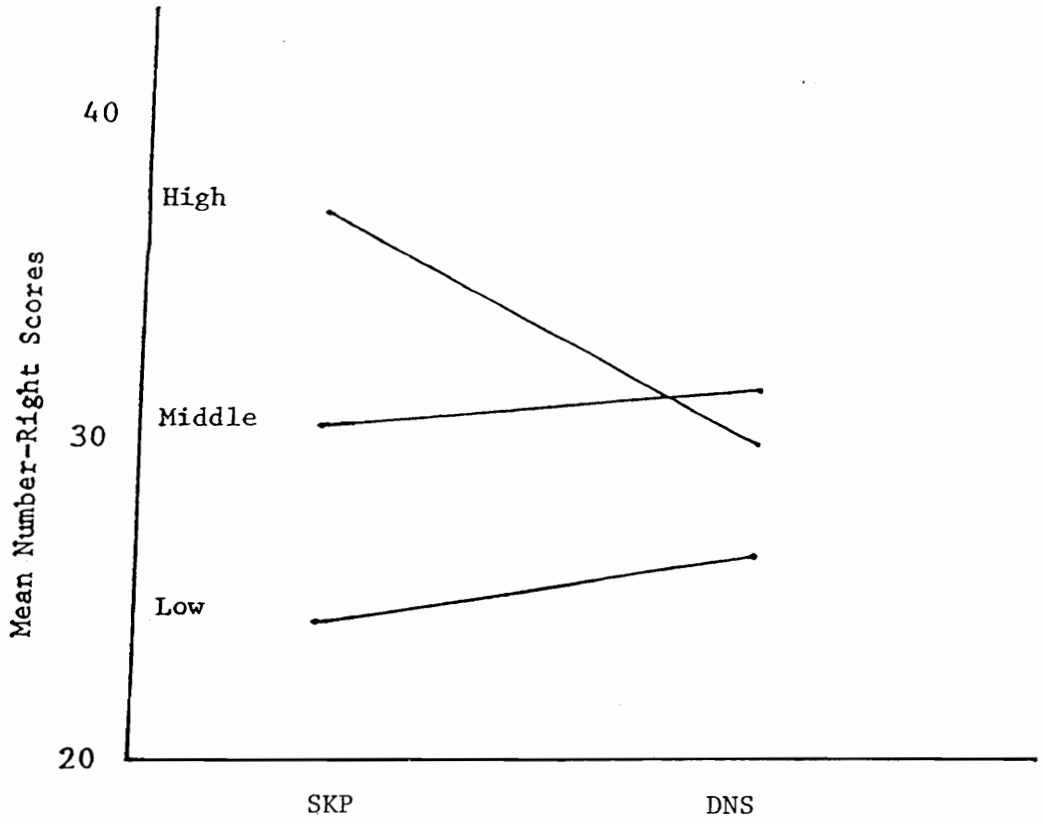

Figure 1. Mean Number-Right Algebra Test Scores for Treatment and Ability Groups

examinees given DNS instructions had an administrative turnover of three instructors within the same academic term. For this reason, the investigator decided to assess the NC end-of-course test means for algebra examinees to determine if clues could be obtained relative to the examinees performance and the principal's supposition. Table 4 shows the sample size, means, and standard deviations of the number-right scores by ability and treatment conditions for the NC end-of-course test. The findings did not support the principal's explanation. What was found is the reverse of performance reported in Table 2. High ability examinees given DNS instructions mean number-right scores were higher than those given SKP instructions. The data from the NC end-of-course test gave no clue as to why the phenomenon occurred.

Analysis of Number-Right Scores for Biology Test

Table 5 shows the sample size, means, and standard deviations of the number-right scores by ability and treatment combinations. A summary of the 3X3 factorial ANOVA applied to these data is shown in Table 6. Again, as expected, the main effect for ability was significant at the $p \leq .01$ level with higher mean number-right scores associated with high and middle ability examinees. Neither the main effect treatment nor the interaction was significant. The three overall means for SKP, DNS, and NDI were only slightly different which indicated the lack of a treatment effect as measured

Table 4

Means, Standard Deviations, and n's for Number-Right Scores for the NC End-of-Course Test for Algebra

Algebra		SKP	DNS	Overall
High	n	14	13	27
	$\bar{X}$	40.43	44.53	42.41
	SD	9.36	8.83	9.18
Middle	n	13	24	37
	$\bar{X}$	44.92	43.12	43.76
	SD	7.52	5.39	6.18
Low	n	46	20	66
	$\bar{X}$	35.06	37.30	35.74
	SD	4.99	5.30	5.15
Overall	n	73	57	130
	$\bar{X}$	37.85	41.40	39.41
	SD	7.49	6.91	7.43

Table 5

Means, Standard Deviations, and n's for Number-Right Scores on Biology Test

Biology		SKP	DNS	NDI	Overall
High	n	30	20	13	63
	$\bar{X}$	35.40	37.05	38.08	36.48
	SD	6.11	5.84	5.17	5.86
Middle	n	52	45	37	134
	$\bar{X}$	27.08	26.78	28.08	27.25
	SD	6.07	4.08	4.94	5.15
Low	n	40	38	18	96
	$\bar{X}$	19.08	19.58	16.89	18.86
	SD	4.81	4.81	4.48	4.80
Overall	n	122	103	68	293
	$\bar{X}$	26.50	26.12	27.03	26.49
	SD	8.36	7.84	8.65	8.23

Table 6

Summary ANOVA for Mean Number-Right Scores on the Biology Test

Source	SS	df	MS	F
Ability	11924.33	2	5962.17	221.66*
Treatment	15.62	2	7.81	.29
Ability by Treatment	187.60	4	46.90	1.74
Error	7639.12	284	26.90	
Total	19785.21	292		

* $p \leq .01$

by the number-right scores. These findings suggested that whether examinees were given SKP, DNS, or NDI the differences in number-right scores were only slight. Interestingly, Rindler also did not obtain a treatment main effect on number-right or formula scores for the response strategy effect but she did detect a significant treatment by ability effect.

Part II - Secondary Analyses

The aim of the secondary analyses was to determine why the treatment (variation in skipping directions) did not make a significant difference in how well examinees performed on the algebra and biology tests. Through the secondary analyses, the investigator set out to determine if the lack of a treatment effect occurred due to the possibilities that 1. too few items on the average were skipped by examinees to make a difference, 2. examinees did not understand the directions, and 3. examinees performed poorly on items attempted after skipping, or whether they attempted too few items.

Section I - Analyses on Items Skipped

Results for algebra analyses of items skipped. The means and standard deviations of numbers of items skipped for the algebra test is shown in Table 7. A summary ANOVA of these data presented in Table 8 revealed that both main effects were significant but the interaction was not significant. If the instructions had been heeded by the examinees, one

Table 7

Means, Standard Deviations, and n's for Number of Skips on the Algebra Test

Algebra		SKP	DNS	Overall
High	n	14	13	27
	$\bar{X}$	5.14	5.00	5.07
	SD	2.98	4.69	3.82
Middle	n	13	24	37
	$\bar{X}$	2.69	1.08	1.65
	SD	2.95	3.53	3.38
Low	n	46	20	66
	$\bar{X}$	5.15	1.15	3.94
	SD	6.08	1.95	4.82
Overall	n	73	57	130
	$\bar{X}$	4.71	2.00	3.52
	SD	5.21	3.72	4.79

Table 8

Summary ANOVA for Number of Skips Per Item on the Algebra Test

Source	SS	df	MS	F
Ability	140.76	2	70.38	3.48**
Treatment	169.85	1	169.85	8.40*
Ability by Treatment	75.39	2	37.70	1.86
Error	2508.80	124	20.23	
Total	2960.43	129		

* $p \leq .01$
** $p \leq .05$

would expect more skips among those given SKP instructions. While this was clearly the case for low ability examinees and also true, but less dramatic for middle ability examinees, it was not true for high ability examinees. Indeed, among high ability examinees the mean number of items skipped was nearly identical (5.14 vs 5.00). Thus the number of items skipped cannot explain the previously noted significant difference observed for number-right scores for these two groups of high ability examinees.

Number of questions skipped by examinees along with percentages and cumulative percentages for the algebra subject area is shown in Table 9. The findings indicated that examinees given SKP instructions, skipped more frequently than examinees given DNS instructions.

Results for biology analyses on items skipped. Sample sizes, means, and standard deviations for number of items skipped are reported in Table 10. In contrast to the algebra data, the mean number of skips associated with the three treatment conditions was consistent with expectations across all three ability groups. That is, the mean for the SKP group was 5.98 items, whereas, the DNS mean was .67. Interestingly, the NDI mean was the smallest at .06.

A summary of a 3X3 factorial ANOVA computed on items skipped for biology examinees is shown in Table 11. The main effect for ability was

Table 9

Number of Questions Skipped by Examinees Across both Treatment Conditions Along with Percentages and Cumulative Percentages for Algebra

SKP Instructions Examinees				DNS Instructions Examinees			
Number	Number of Questions Skipped	%	Cumulative %	Number	Number of Questions Skipped	%	Cumulative %
29	0	27.4	27.4	34	0	59.6	59.6
3	1	4.1	31.5	3	1	5.3	64.9
10	2	13.7	45.2	6	2	10.5	75.4
3	3	4.1	49.3	5	4	8.8	84.2
8	4	11.0	60.3	4	5	7.0	91.2
6	5	8.2	68.5	1	6	1.8	93.0
2	6	2.7	71.2	1	9	1.8	94.7
3	7	4.1	75.3	1	10	1.8	96.5
5	8	6.8	82.2	2	17	3.5	100.0
2	9	2.7	84.9				
2	10	2.7	87.7				
1	11	1.4	89.0				
3	12	4.1	93.2				
1	14	1.4	94.5				
1	15	1.4	95.9				
1	18	1.4	97.3				
1	20	1.4	98.6				
1	25	1.4	100.0				
Total 73	344	100.0	100.0	57	114	100.0	100.0
$\bar{X}$ 4.71				2.00			
SD 5.21				3.72			

Table 10

Means, Standard Deviations, and n's for Number of Skips Per Item on Biology Test

Biology		SKP	DNS	NDI	Overall
High	n	30	20	13	63
	$\bar{X}$	6.57	.95	.00	3.43
	SD	5.48	1.93	.00	4.94
Middle	n	52	45	37	134
	$\bar{X}$	5.23	.27	.03	2.13
	SD	6.21	.86	.16	4.60
Low	n	40	38	18	96
	$\bar{X}$	6.50	1.00	.17	3.14
	SD	6.43	2.55	.51	5.27
Overall	n	122	103	68	293
	$\bar{X}$	5.98	.67	.06	2.74
	SD	6.09	1.87	.29	4.92

Table 11

Summary ANOVA for Number of Skips Per Item on the Biology Test

Source	SS	df	MS	F
Ability	46.77	2	23.39	1.38
Treatment	2158.81	2	1079.41	63.89*
Ability by Treatment	16.88	4	4.22	.25
Error	4797.82	284	16.89	
Total	7068.77	292		

* $P \leq .01$

not significant as evident by the fact that the mean number of items skipped for each of the three ability groups was only slightly different. The treatment main effect, however, was significant at the $p \leq .01$ level. However, the interaction was non-significant. Number of items skipped by examinees along with percentages and cumulative percentages for the biology subject area is shown in Table 12. Examinees encouraged to skip, skipped in large numbers while examines encouraged not to skip followed the directions as instructed. Examinees given NDI with regard to skipping, chose not to skip. The evidence suggested that examinees given SKP instructions, skipped more often than those given DNS and NDI. The fact that DNS examinees skipped more often than DNI examinees was not readily explainable but may have resulted because the instructions called to the attention of the DNS group not to skip. The NDI group instructions said nothing about skipping, therefore, they chose not to skip.

Section II - Response Strategy Questions

Three questions were appended to the end of the algebra and biology tests to assess the examinees' understanding and compliance with the test instructions. Responses to these questions were compared across instructional groups. Crosstabulations of frequencies and percentages were computed for response strategy questions by treatment conditions.

Table 12

Number of Questions Skipped by Examinees Across Three Treatment Conditions along with Percentages and Cumulative Percentages for Biology

SKP Instructions Examinees				DNS Instructions Examinees				NDI Instructions Examinees			
#	Number of Questions Skipped	%	Cumulative %	#	Number of Questions Skipped	%	Cumulative %	#	Number of Questions Skipped	%	Cumulative %
31	0	25.4	25.4	83	0	80.6	80.6	65	0	95.6	95.6
10	1	8.2	33.6	8	1	7.8	88.3	2	1	2.9	98.5
8	2	6.6	40.2	1	2	1.0	89.3	1	2	1.5	100.0
7	3	5.7	45.9	3	3	2.9	92.2				
5	4	4.1	50.0	2	4	1.9	94.2				
3	5	2.5	52.5	2	5	2.9	97.1				
11	6	9.0	61.5	3	7	1.0	98.1				
8	7	6.6	68.0	1	8	1.0	99.0				
4	8	3.3	71.3	1	12	1.0	100.0				
3	9	2.5	73.8								
4	10	3.3	77.0								
6	11	4.9	82.0								
3	12	2.5	84.4								
1	13	.8	85.2								
5	14	4.1	89.3								
3	15	2.5	91.8								
3	16	2.5	94.3								
1	18	.8	95.1								
1	19	.8	95.9								
1	20	.8	96.7								
2	22	1.6	98.4								
1	23	.8	99.2								
1	24	.8	100.0								
Total 122	729	100.0	100.0	103	69	100.0	100.0	68	4	100.0	100.0
$\bar{X}$	5.98				.67				.06		
SD	6.09				1.87				.09		

Analyses of response strategy questions for algebra. The response frequencies to all three response strategy questions for algebra are reported in Table 13. In response to question one, most examinees apparently recalled what the instructions said about skipping; i.e., 79% of the examinees given SKP instructions and 95% of the examinees given DNS instructions. However 18 of the 130 examinees stated that they did not recall the given directions. The misperception of the instructions could have weakened the treatment effect.

A crosstabulation of the response frequencies to question two are also reported in Table 13. Ninty-two percent of the examinees given the SKP instructions and 95% of the examinees given the DNS instructions indicated that they recalled correctly that the instructions encouraged them to answer all questions "even if your answer would be a sheer guess", which was the correct response.

Table 13 also contains the response frequencies to response strategy question three. Clearly, the examinees report of skipping behavior were largely consistent with the directions; i.e., 62% of those given SKP instructions, skipped and 88% of those given DNS instructions, did not skip. However, 12% of the examinees who were advised not to skip did not comply with the treatment instructions and skipped while 38% of the examinees given SKP instructions either did not follow the instructions or may not have felt the need to skip.

Table 13

Crosstabulation of Response Frequencies to Strategy Questions by Treatment Condition for Algebra

Question 1: As best you recall the test directions, they:	Treatment Condition SKP		DNS	
Response Options	n	%	n	%
a. encouraged you to skip	58	79	0	0
b. discouraged skipping	11	15	54	95
c. said nothing about skipping	4	6	3	5
Total	73	100	57	100

Question 2: As best you recall, the test directions encouraged you to answer all questions:	Treatment Condition SKP		DNS	
Response Options	n	%	n	%
a. unless a sheer guess	6	8	3	5
b. even if a sheer guess	67	92	54	95
Total	73	100	57	100

Question 3: When taking the test you:	Treatment Condition SKP		DNS	
Response Options	n	%	n	%
a. skipped one or more questions	45	62	7	12
b. did not Skip any question	28	38	50	88
Total	73	100	57	100

Analyses of response strategy questions for biology. The response frequencies for all three response strategy questions for biology examinees are shown in Table 14. A crosstabulation was computed for question one to determine how well examinees recalled the directions. The data indicated that a majority of examinees in each group correctly reported what the directions said about skipping. However, 22% of those given SKP directions reported they thought the directions discouraged skipping. This misperception would tend to weaken the treatment effect dramatically. By contrast, only 8% of the DNS group thought the directions encouraged skipping.

A crosstabulation for the guessing response frequencies with treatment conditions is also shown in Table 14. A substantial number of the examinees across each treatment indicated that they were encouraged to answer all questions "even if your answer would be a sheer guess", 85% of the examinees given SKP instructions, 93% of the examinees given DNS instructions, and 96% of the examinees given NDI instructions. These examinees used the "guessing strategy" which was evidenced by the selection of the correct choice b.

The results of the third response strategy question for biology also are reported in Table 14. A crosstabulation was computed to determine how the examinees stated they responded to the test instructions. Sixty-four percent of those given SKP directions reported that they skipped one or

Table 14

Crosstabulation of Response Frequencies to Strategy Questions by Treatment Condition for Biology

Question 1: As best you recall the test directions, they:	Treatment Condition					
	SKP		DNS		NDI	
Response Options	n	%	n	%	n	%
a. encouraged you to skip	89	73	8	8	7	11
b. discouraged skipping	27	22	88	85	25	37
c. said nothing about skipping	6	5	7	7	36	52
Total	122	100	103	100	68	100

Question 2: As best you recall, the test directions encouraged you to answer all questions:	Treatment Condition					
	SKP		DNS		NDI	
Response Options	n	%	n	%	n	%
a. unless a sheer guess	18	15	7	7	3	4
b. even if a sheer guess	104	85	96	93	65	96
Total	122	100	103	100	68	100

Question 3: When taking the test, you:	Treatment Condition					
	SKP		DNS		NDI	
Response Options	n	%	n	%	n	%
a. skipped one or more questions	78	64	19	18	16	24
b. did not skip any question	44	36	84	82	52	76
Total	122	100	103	100	68	100

more questions, whereas 36% given DNS instructions indicated that they did not comply with the directions. For examinees given NDI with regard to skipping 76% did not skip any questions and 24% skipped one or more questions. These examinees had the opportunity to respond as they preferred and the preferred choice of most examinees was not to skip any items. However, 18% of the examinees given DNS instructions did not comply with the instructions. Thirty-six percent of the examinees given SKP instructions did not follow the directions or may not have felt the need to skip.

Section III - Performance on Items Skipped

This section addresses the examinee's performance on items skipped. This analysis considered how well examinees by ability groups performed on items skipped when they returned to consider them. Table 15 and 16 show percents for number of skips for the whole test, number of attempts on items skipped, and success rate on items attempted by ability level. The data were reported only for examinees given SKP instructions to avoid confounding the findings with the data of examinees given DNS instructions that skipped.

Analyses of performance on items skipped for algebra. As shown in Table 15, skipping was most prevalent among low ability algebra examinees. It was somewhat surprising that skipping was least prevalent

Table 15

Performance on Items Skipped by Ability Level for Algebra

Ability Level	n	Number of Skips for Examinees Given SKP Instructions Only	Number of Attempts on Items Skipped	%	Success Rate on Attempts	%
High	14	72	61	85	40	66
Middle	13	35	18	51	4	22
Low	46	237	156	66	53	34
Total	73	344	235	68	97	41
$\bar{X}$		4.71	3.22		1.33	
SD		5.21	4.14		1.89	

among middle rather than high ability students. Not only did the middle ability examinees skip the fewest number of items, but they only attempted 51% of those items skipped and answered correctly only 22% of those attempted. Since these were four choice items, the expected percent correct by chance guessing alone would be 25%. By contrast, the high ability examinees returned to attempt 85% of the skipped items with a success rate of 66%; whereas low ability examinees returned to attempt 66% of the skipped items with a success rate of 34%. Thus it appears that high and low ability examinees were making effective use of the skipping strategy but this was not true for middle ability examinees. By contrast, Rindler (1980) reported that middle ability examinees within each time condition skipped a greater percentage of items than did high and low ability examinees. The return rate of high ability examinees for attempts on items skipped was greater than that of low followed by middle ability examinees in this study. Rindler also reported that the return rate was greater for high ability examinees. However, she did not report on the success rate of the examinees who returned to complete items skipped. It was crucial that examinees attempt to answer 100% of the previously skipped items when using number-right scores to enhance test performance. The performance on items skipped for high ability algebra examinees given DNS instructions was addressed to gain insight as to why their mean number-right score (36.00 vs 29.69) was lower than high ability examinees given SKP

instructions. The findings indicated that high ability examinees given DNS instructions attempted 74% of the items previously skipped; however, their success rate was only 21% on the items they returned to reconsider after skipping. Their success rate was much lower than the 66% success rate for high ability examinees given SKP instructions. The findings indicated that the success rate of high ability examinees given DNS instructions was much lower than those given SKP instructions.

Analyses of performance on items skipped for biology. The performance on items skipped is assessed in this section for biology examinees. The analyses considered how well examinees performed on items skipped when they returned to answer the question. Table 16 shows percents for number of skips for the whole test, number of attempts on items skipped, and success rate on attempts by ability level.

As shown in Table 16, skipping was most prevalent among middle ability examinees. Consistent with Rindler's findings, middle ability examinees skipped the greatest percentage of items. Skipping also was more prevalent among low ability rather than high ability examinees in this study. Low ability examinees attempted to answer a greater proportion of the items skipped (90%) than did middle (80%) and high (79%) ability examinees. Interestingly, middle and high ability examinees' percentages of attempts was only slightly different. Not surprising, high ability examinees' success rate on items attempted was 53%. By contrast the

Table 16

Performance on Items Skipped by Ability Level for Biology

Ability Level	n	Number of Skips for Examinees Given SKP Instructions Only	Number of Attempts on Items Skipped	%	Success Rate on Attempts	%
High	30	196	155	79	82	53
Middle	52	272	218	80	85	39
Low	40	262	236	90	65	28
Total	122	730	609	83	232	38
$\bar{X}$		5.98	4.99		1.90	
SD		6.09	4.54		2.42	

middle ability examinees returned to answer correctly (39%) of the attempted items; while low ability examinees returned to answer correctly (28%) of the attempted items. Since these were four choice items, the expected percent correct by chance guessing alone would be 25%. It appeared that high and middle ability examinees were making effective use of the skipping behavior in contrast to the low ability examinees who answered items correctly only slightly better than would result by chance. When using number-right scoring as a measure of success, it was crucial that examinees return to answer all of the previously skipped items to increase performance scores.

Section IV - Item Information

Presented in this section are data for both subject area tests including the number of skips per item, number of attempts on items skipped, success rate on attempts, item difficulty (p-value) and item discrimination (item/total score point biserial) coefficients. Further, intercorrelations were calculated to determine the degree of the relationship among these indices.

Item analysis for algebra. Item statistics for number of skips per item, number of attempts on items skipped, success rate on attempts are presented in Table 17 along with item difficulty (p-values), and discrimination (item/total score point biserial) coefficients. The intercorrelations among

Table 17

Item Analysis for Algebra

Item	Number of Skips Per Item	Number of Attempts on Items Skipped	Success Rate on Attempts	Item Difficulty (p-value)	Item/Total Score Point-Biserial Coefficients
1	11	8	3	.73	.45
2	10	7	3	.65	.43
3	6	6	6	.98	.14
4	10	4	3	.70	.27
5	1	1	1	.96	.26
6	1	0	0	.98	.73
7	8	8	7	.86	.05
8	3	2	1	.63	.35
9	7	5	1	.59	.46
10	3	3	2	.91	-.03
11	11	6	1	.43	.42
12	6	5	1	.59	.35
13	0	0	0	.49	.41
14	0	0	0	.93	.32
15	1	1	1	.91	.19
16	2	2	2	.89	-.09
17	2	2	2	.95	.18
18	15	8	5	.54	.54
19	11	7	5	.83	.30
20	3	1	0	.83	.21
21	10	6	2	.73	.77
22	10	6	1	.77	.53
23	31	17	3	.42	.37
24	2	2	1	.41	.21
25	18	9	2	.43	.62

Table 17 (continued)

Item Analysis for Algebra

Item	Number of Skips Per Item	Number of Attempts on Items Skipped	Success Rate on Attempts	Item Difficulty (p-value)	Item/Total Score Point-Biserial Coefficients
26	18	9	2	.37	.38
27	5	5	2	.48	.39
28	11	6	4	.21	.20
29	7	3	0	.42	.35
30	22	15	14	.60	.49
31	5	4	3	.84	.53
32	5	2	0	.38	.38
33	4	2	0	.76	.25
34	3	3	2	.80	.82
35	12	7	3	.61	.50
36	5	5	2	.60	.21
37	2	2	2	.26	.64
38	7	3	0	.59	.49
39	5	3	2	.73	.18
40	3	1	0	.64	.22
41	8	4	2	.50	.18
42	20	11	0	.37	.28
43	18	12	3	.36	.07
44	14	8	1	.16	.43
45	22	18	5	.24	.20
46	14	10	3	.35	.27
47	29	19	3	.17	.40
48	11	7	3	.17	.42
49	13	10	3	.22	.23
50	13	8	1	.27	.21
Total	458	293	113	29.00	17.50
$\bar{X}$	3.52	2.25	.87	.58	.35
SD	4.79	3.75	1.57	.25	.18

these indices are shown in Table 18. Across all items, the number of skips per item correlated negatively with item difficulty (r=-.57) indicating that skipping was more prevalent among difficult items. It was of interest to consider the item statistics for the three items most frequently skipped (23, 30, and 47) as well as a sampling of two items rarely skipped (32 and 37).

Item 47 was most consistent with expectations. It was the most difficult of the three items (p-value = .17) and was skipped by 29 examinees of whom 19 later attempted the item but only three were successful. By contrast item 30 was relatively easy (p-value = .60), it was skipped by 22 examinees of whom 15 later attempted the item of whom 14 were successful. Item 23 was a relatively difficult item (p-value = .42), it was skipped by 31 examinees of whom 17 later attempted the item while only three answered the item correctly. Curiously, item 32 was skipped by five examinees of whom two attempted the item while none answered the item correctly. A p-value of .38 indicated that item 32 was a somewhat difficult item. Item 37 was a difficult item with a p-value of .26. Contrary to expectations, item 37 was skipped by only two examinees who returned to attempt the item and were successful in answering it correctly. These findings indicated that skipping occurred on easy as well as difficult items. Likewise, in some cases, items were difficult and examinees did not frequently skip the item.

Table 18

Intercorrelations Among Item Statistics[1] for the Algebra Test

Item		1	2	3	4	5
1	Difficulty	1.0000				
2	Item/Total Score Point Biserial	-.0591 p=.684	1.0000			
3	Number of Skips Per Item for Examinees Who Skipped Only	-.5737 p=.001	.0724 p=.618	1.0000		
4	Number-Attempts on Items Skipped	-.5337 p=.001	-.0048 p=.974	.9553 p=.001	1.0000	
5	Success Rate on Attempts	-.0074 p=.959	-.0508 p=.726	.4395 p=.001	.5535 p=.001	1.000
	$\bar{X}$	.58	.35	3.52	2.25	.87
	SD	.25	.18	4.79	3.75	1.57

[1]Based on responses of examinees who received SKP instructions, N = 73.

Number of skips per item had a low positive correlation with discrimination (item/total scores point-biserial) as indicated by a coefficient of .07. The finding suggested that skipping was unrelated to discrimination. High number of attempts on items skipped was associated with a high number of skips per items as indicated by a coefficient of .96. The coefficients indicated that only if an item was skipped can it be attempted. The results also suggested that examinees did return to attempt previously skipped items, as encouraged in the test directions. Success rate on attempts had a positive correlation with number of skips per item ($r = .44$) and number of attempts on items skipped ($r = .55$) which was slightly higher suggesting a moderate success rate on items previously skipped and later attempted.

Item information for biology. Item data for number of skips per item, number of attempts on items skipped, success rate on attempts, along with the item difficulty (p-value), and discrimination (item/total score point biserial) coefficients are shown in Table 19. The intercorrelations for these data are shown in Table 20.

The number of skips per item had a low negative correlation with item difficulty ($r = -.05$) which indicated that skipping was more prevalent among troublesome or difficult items. The item statistics for two items that were frequently skipped (items 23 and 34) as well as an item that was rarely skipped (item 3) are discussed. Item 23 was consistent with expectations that it was a difficult item (p-value = .38). It was skipped by 37 examinees

Table 19

Item Analysis for Biology

Item	Number of Skips Per Item	Number of Attempts on Items Skipped	Success Rate on Attempts	Item Difficulty (p-value)	Item/Total Score Point-Biserial Coefficients
1	19	15	6	.54	.26
2	21	18	7	.38	.14
3	7	6	1	.29	.55
4	3	3	2	.60	.25
5	0	0	0	.00	.00
6	5	3	2	.54	.16
7	26	23	8	.39	.65
8	8	8	3	.25	.10
9	7	7	2	.64	.59
10	10	8	5	.48	.62
11	15	11	7	.63	.72
12	18	13	9	.60	.49
13	24	20	6	.35	.42
14	13	10	4	.36	.15
15	3	3	1	.88	.60
16	16	14	3	.30	.41
17	18	18	11	.58	.45
18	7	6	2	.69	.82
19	9	8	1	.05	.00
20	13	10	6	.51	.25
21	12	8	2	.35	.35
22	15	15	7	.59	.66
23	37	30	7	.38	.37
24	9	9	3	.50	.77
25	12	9	0	.45	.02
26	0	0	0	.00	.00
27	19	17	6	.40	.40
28	9	7	3	.69	.45
29	25	21	4	.21	.30
30	22	19	12	.58	.04
31	12	8	3	.71	.89

Table 19 (continued)

Item Analysis for Biology (continued)

Item	Number of Skips Per Item	Number of Attempts on Items Skipped	Success Rate on Attempts	Item Difficulty (p-value)	Item/Total Score Point-Biserial Coefficients
32	8	7	3	.53	.35
33	14	14	6	.54	.47
34	28	23	10	.63	.61
35	22	16	3	.52	.66
36	20	13	9	.52	.21
37	10	8	1	.33	.48
38	11	8	4	.26	.05
39	14	12	4	.39	.49
40	9	7	3	.71	.50
41	7	6	0	.33	.45
42	27	23	7	.25	.27
43	11	8	6	.69	.34
44	5	4	4	.90	.40
45	15	13	9	.80	.69
46	8	7	1	.50	.01
47	11	9	4	.67	.60
48	11	9	1	.49	.43
49	20	18	1	.37	.34
50	14	13	3	.35	.58
51	23	21	6	.36	.27
52	18	16	6	.42	.55
53	14	10	2	.49	.56
54	18	14	8	.72	.58
55	16	13	3	.64	.23
56	20	16	8	.48	.51
57	14	10	6	.74	.58
Total	803	665	252	27.36	23.37
$\bar{X}$	2.74	2.27	.86	.48	.41
SD	4.92	4.43	1.85	.20	.23

Table 20

Intercorrelations Among Item Statistics[1] for the Biology Test

Item		1	2	3	4	5
1	Difficulty p-value	1.0000				
2	Item/Total Score Point-Biserial	.5311 p =.001	1.0000			
3	Number of Skips Per Item For Examinees Who Skipped Only	-.0450 p =.739	.1110 p=.411	1.0000		
4	Number of Attempts On Items Skipped	-.0760 p =.574	.1140 p=.399	.9794 p=.001	1.0000	
5	Success Rate On Attempts	.3018 p =.023	.1680 p=.212	.6730 p=.001	.6691 p=.001	1.0000
	$\bar{X}$	.48	.41	2.74	2.27	.86
	SD	.20	.23	4.92	4.43	1.85

[1]Based on responses of examinees who received SKP instructions, N = 122.

of whom 30 later attempted the item but only seven answered the item correctly. By contrast, item 34 was relatively easy (p-value = .63). It was skipped by 28 examinees of whom 23 later attempted the item and only 10 examinees were successful. Surprisingly, item three was skipped by seven examinees of whom six attempted the item while only one answered the item correctly with a p-value of .29 indicating that the item was difficult and expecting that item would have been skipped more often. These findings indicated the examinees skipped difficult as well as easy items. Apparently, a few difficult items were not skipped very often.

Across all items, discrimination (item/total score point-biserial) coefficients correlated positively with item difficulty ($r = .53$) suggesting that the easier the item, the stronger the relationship between the examinees success on the item and the performance on the test as a whole. Number of skips per item had a low positive correlation ($r = .11$) with discrimination (item/total scores point-biserial) coefficients which indicated that skipping had little or no relationship with discrimination.

Section V - Reliability and Validity of Experimental Tests

The Kuder-Richardson formula 20 (KR20) was used to estimate the reliability of the algebra and biology test scores. A coefficient of .80 was obtained for algebra and a coefficient of .84 was computed for biology. These reliability coefficients for the tests in this study were consistent with

the NC end-of-course reliability estimates that were reported in Chapter three. These findings indicated that the algebra and biology teacher-made test were sufficiently reliable for the purpose of this study. Content validity was established through the chairperson and/or teacher's judgment in the evaluation and selection of items in the development of the subject area tests. The criterion-related validity of the test was investigated by correlating number-right scores with other ability measures related to examinees academic performance.

The Pearson product-moment intercorrelations among the number-right scores of the 130 examinees on the algebra test with other ability measures to ascertain criterion-related validity are shown in Table 21. As shown in Table 21, number-right scores from the algebra test correlated substantially with end-of-course test scores ($r = .64$) suggesting that the test performance was predictive of end of year test performance. Number-right scores also correlated positively ($r = .45$) with teacher awarded mid-term grades; however a slightly higher correlation ($r = .54$) existed between end-of-course test scores and teacher given midterm grade. Number-right scores differed across ability levels as suggested by the $r = .55$ correlation.

Intercorrelations of number-right scores for 293 examinees on the biology test with other ability measures are shown in Table 22. As shown in Table 22, number-right scores from the biology test correlated highly with the end-of-course test scores ($r = .79$) suggesting that the biology test

Table 21

Intercorrelations of Algebra Test Scores with Ability Measures for 130 Algebra Examinees

Item		1	2	3	4
1	Number-Right Scores	1.000			
2	Mid-term Grades	.4490	1.000		
		p= .001			
3	Ability Level	.5515	.1617	1.000	
		p= .001	p= .066		
4	NC End Of Course Test Scores	.6440	.5377	.3758	1.000
		p= .001	p= .001	p= .001	
$\bar{X}$		28.25	5.22	2.30	39.19
SD		6.62	3.42	.79	7.45

Table 22

Intercorrelations of Biology Test Scores with Ability Measures for 293 Biology Examinees

Item		1	2	3	4
1	Number-Right Scores	1.000			
2	Mid-term Grades	.2140	1.000		
		p= .001			
3	Ability Level	.7765	.1111	1.000	
		p= .001	p= .058		
4	NC End Of Course Test Scores	.7852	.1713	.7896	1.000
		p= .001	p= .003	p= .001	
$\bar{X}$		26.49	5.19	2.11	37.35
SD		8.23	3.52	.73	9.99

performance was predictive of the end of the year test performance scores. Number-right scores also correlated positively ($r = .21$) with teacher awarded mid-term grades and were slightly higher than the ($r = .17$) correlation between end-of-course scores and teacher given mid-term grades. Across ability levels, the number-right scores correlation ($r = .78$) and the end-of-course test correlation ($r = .79$) were only slightly different. Collectively, these findings indicated that both subject area tests yielded reasonably reliable scores that correlated moderately well with other measures of knowledge in these content areas.

CHAPTER 5

Conclusions and Recommendations

The main objective of the investigation was to determine whether or not the treatment instructions had an effect on skipping behavior and test performance. Two research questions were cited: 1. are there mean differences in number-right scores or number of items skipped across the three test direction groups? Did the test directions have an effect on examinees behavior or performance, and 2. is there an interaction between examinee ability level and type of test instructions with respect to number-right scores or number of items skipped? Are higher or lower ability examinees influenced or benefitted differentially by the test directions concerning skipping. The instructional treatment did impact the examinees' skipping behavior; however, neither the algebra nor the biology test scoes differed significantly according to the treatment. An interaction occurred for the algebra subject area only. The number-right scores were significantly higher for high ability examinees given the SKP instructions when compared to high ability examinees given the DNS instructions. There was no significant difference between the number-right scores of middle or low ability examinees given SKP and DNS instructions.

Three major concerns were addressed which may, in part, explain the lack of a treatment effect on performance scores:

1. examinees skipped too few items,
2. some examinees reported not understanding the directions, and
3. examinees did poorly on items attempted after skipping them or attempted too few items after skipping them.

Based upon the analyses on items skipped for algebra, the findings suggested that a high percentage of examinees given SKP instructions, skipped too few times to make a significant difference on number-right scores when compared to the percentage of skipped items by examinees given the DNS instructions. Thus, the treatment may be ineffective for number-right algebra scores, given the relatively small (yet significant) difference in the mean number of skips between the two instructional groups. In contrast, for biology, the mean number of skips for examinees given SKP, DNS and NDI instructions were substantially different. High percentages of examinees followed the directions. However, the percentage of examinees given SKP instructions that actually skipped, was not high enough to result in a significant difference in the mean number-right scores, although the mean differences on number of items skipped were statistically significant. Nevertheless, in the Rindler (1980) study, the mean number of items skipped across treatments ranged only from .61 to 3.04, which suggested that small numbers of items skipped might affect score outcomes.

A major concern also focused upon whether or not the examinees understood the treatment instructions. As reported by the examinees themselves, most in the two subject areas recalled the test directions. The examinees for both subject areas reported in high percentages that the instructions encouraged them to answer all questions even if their answer would be a sheer guess. When they were asked how they responded to the test directions, 12% of the algebra and 18% of the biology examinees given DNS instructions reported that they did not comply with the treatment instructions. In addition, 38% of the algebra and 36% of the biology examinees given SKP instructions reported behaviors inconsistent with the directions, though some may not have felt the need to skip. The fact that some examinees did not comply with the instruction may have accounted for, in part, the lack of a treatment effect on number-right scores.

The findings in this study also indicated that high percentages of the examinees in the algebra and biology subject areas attempted to answer relatively high proportions of items previously skipped. The rate for attempts on items previously skipped was much higher for examinees in this study than for examinees who participated in Rindler's study. However, the success rate on items previously attempted did not make a meaningful difference in the treatment effect on number-right scores.

The intercorrelations for both subject area tests among number of skips per items, number of attempts on items skipped, success rate on attempts,

item difficulty (p-value) and discrimination (item/total score point-biserial) coefficients revealed that, for both subject areas: 1. examinees skipped difficult items more frequently, and 2. there was no meaningful relationship between number of skips per item and item discrimination coefficients (item/total score point-biserial). The tests yielded reasonable reliability estimates for both subject areas. Content and criterion-related validity were established. The lack of a treatment effect on number-right scores remains unexplained from these findings. However, the interaction between ability and treatment apparently resulted from an extraneous influence on instruction of the high ability DNS group (see Chapter 4, p.28).

The conclusions of this study that skipping instructions have little or no effect on number-right scores should be used with caution when applied to other settings and/or subject areas. This recommendation is based not only on the quasi-experimental nature of the research design but also on the possible unequal effects of the high ability algebra instruction just mentioned.

The investigator recommends that the study be replicated using an experimental or a quasi-experimental design to examine the effects of skipping in additional subject areas. The procedures used in this study should be employed to distinguish between items skipped and those omitted. Examinees should be randomly assigned to treatment groups in which directions regarding the response strategy differ.

In terms of practical consideration for students in the classroom, based upon the findings in this study, biology teachers might be advised to encourage students to answer all questions as they get to them without skipping or spending too much time on any one question.

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Appendix A

Description of the Algebra and Biology Subject Areas

The algebra subject area included advanced algebra offered to high ability eighth graders, algebra I to middle ability ninth through twelfth graders, and introductory algebra I to low ability ninth through twelfth graders. The algebra subject area consisted of several sections, two sections for high ability, two sections for middle ability, and three sections for low ability examinees. Among these sections there were 130 examinees that were taught by one of three teachers. One unit of algebra was equivalent to: 1. one-half unit for high ability algebra examinees first semester and one-half unit for high ability algebra examinees second semester, 2. one-half unit for middle ability algebra I first semester and one-half unit for middle ability algebra I second semester, and 3. one-half unit for low ability examinees enrolled in introductory algebra part I first semester and one-half unit for low ability examinees enrolled in introductory algebra part II second semester. Examinees were not allowed to enroll in both courses during the same semester. When eighth grade examinees who took advanced algebra reached ninth grade, these examinees were placed in geometry and calculus courses.

The biology subject area consisted of two courses, botany and zoology. One-half unit for botany and one-half unit of zoology was equivalent to one unit credit for biology. These courses were attended by 295 tenth grade examinees that were grouped into high, middle, and low ability sections. There were five teachers who teach one or more sections of botany or zoology. Examinees may enroll in one course either botany or zoology but not in both courses during the same semester. There were two sections of zoology and one section of botany for high ability examinees; whereas, there were three sections of zoology and one section of botany for middle ability examinees. Finally, there were three sections of zoology and two sections of botany for low ability examinees.

Appendix B

Overview of the North Carolina End-of-Course Testing Program

In 1984 the North Carolina commission for economic growth recommended that appropriate testing procedures should be developed and used in implementing a competency-based curriculum. The primary purpose of the NC competency-based curriculum was 1. to develop specific competencies for examinees to improve critical thinking skills and basic content knowledge, 2. to integrate the curriculum through classroom teacher preparation for instructions and presentation of content, and 3. to provide instructional and administrative leadership.

The general assembly appropriated funds for the development of high school course tests in 1986. The general assembly established a state wide testing program that included assessment in grades and courses specified in the basic education program. The NC commission on testing and the state board of education began development for algebra and biology end-of-course tests in the spring of 1985. The first algebra end-of-course test was administered statewide at the end of the 1985-86 school year. The biology end-of-course test was added in the 1986-87 academic

year. This information was provided by the Bertie public school Administrators.

The North Carolina end-of-course test for algebra and biology was administered at the end of the academic term to be used as part of the examinees final course grade. The end-of-course tests were designed to serve a dual purpose: 1. to provide information about each examinee's performance relative to that of other examinees in NC, and 2. to provide information about school and school district achievement on subject area goals and objectives (NC Department of Public Instruction, Division of Research and Testing Services, 1989).

Appendix C

Standards, Goals and Objectives for Algebra and Biology

Algebra Goals and Objectives

1. The learner will use the language of Algebra.
2. The learner will use the structural properties of number systems.
3. The learner will perform operations with rational numbers.
4. The learner will locate numbers on the number line or rectangular coordinate plane.
5. The learner will perform operations with real numbers.
6. The learner will solve linear equations.
7. The learner will solve linear inequalities.
8. The learner will demonstrate an understanding of and solve systems of linear equations.
9. The learner will perform operations with polynomials.
10. The learner will solve quadratic equations.
11. The learner will perform operations with algebraic fractions.
12. The learner will simplify expressions which contain radicals.

Appendix C (continued)

Standards, Goals and Objectives for Algebra and Biology

Biology Goals and Objectives

1. The learner will understand the nature of life.
2. The learner will have an understanding of the continuity of life.
3. The learner will have an understanding of the nature of organisms.
4. The learner will understand the nature and relationship of science to human endeavor.
5. The learner will have an understanding of the behavior of living things.
6. The learner will have an understanding of the biology of humans.
7. The learner will have an understanding of ecology.
8. The learner will have an understanding of how the dynamics of biology are relevant to people.

Appendix D

Algebra Test

Bertie High School

End-of-Course Algebra 1 Test

DIRECTIONS: CHOOSE THE BEST ANSWER FOR EACH QUESTION.

1) Simplify $10(4+3^2) \div (2 \cdot 6 - 7)$

A) 4 B) 26 C) 28 D)100

2) Evaluate $a^2 + 3a-4(9-a)$ if a = 5

A) 9 B) 24 C) 69 D)56

3) Write the expression in exponential form.
6 6 M M Y Y YM

A) $6^2 M^3 Y^3$ B) $66M^3Y^3$ C) $66MY^3$ D) 6^2MY^3

4) Use the formula I = prt to find the interest (I), when p = $1200, r = 10%, t = 1 yr.

A) $12 B) $1320 C) $1210 D) $120

5) Complete the statement. 93 + 7 = _____ + 93

A) 100 B) 86 C) 651 D) 7

6) Simplify the expression. 176 + 14 + 85

A) 190 B) 99 C) 265 D) 275

7) Simplify the expression. -31 + (-26) + 79 + (-8)

A) -144 B) -30 C) 14 D) 73

8) Replace the ? with <, =, or > to make a true statement.

$\frac{2}{3} \; ? \; \frac{9}{12}$

A) > B) = C) < D) None of these

9) Replace the ? with <, =, or > to make a true statement.

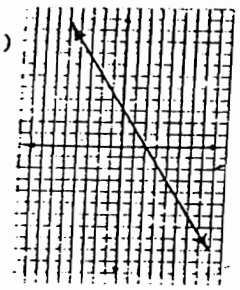
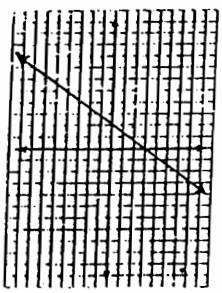
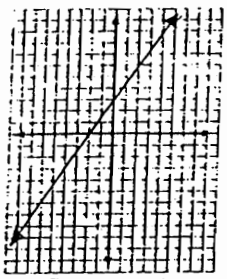
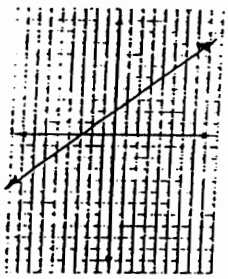
$\frac{14}{17} \; ? \; \frac{42}{51}$

A) < B) = C) < D) None of these

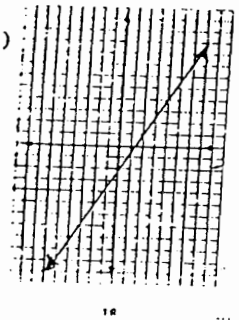
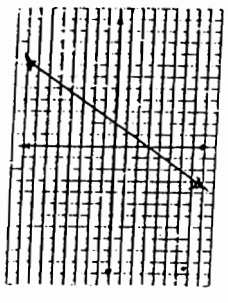
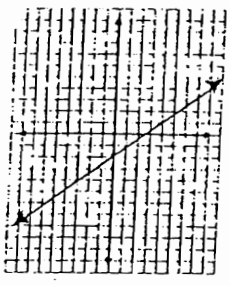
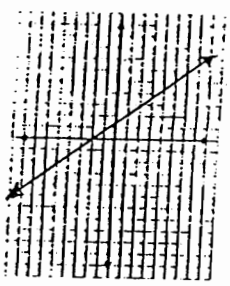
10) Simplify the expression. If necessary, Draw a number line to help you. 9 + (-5)

A) -4 B) 14 C) 4 D) -14

11) Which is the graph of 3X + 2Y = 6?

A)  B)  C)  D) 

12) Which is the graph of a line whose slope is 3/4 and Y - intercept is -2.

A)  B)  C)  D) 

13) Simplify $|7 - 12|$

A) -5 B) 5 C) 19 D) -19

14) Which of the following statements is true?

A) $-3 > 0$ B) $-3 > 3$ C) $-6 < 1$ D) $6 < 0$

15) Replace the ? with <, =, or > to make a true statement.

-9 ? 9

A) = B) < C) > D) None of these

16) Simplify $12 - (-32)$.

A) -44 B) 44 C) -20 D) 20

17) Simplify $(-3)(-2)(-4)$

A) -24 B) -9 C) 24 D) 9

18) Let $A=\{4,5,6,7\}$ and $B=\{5,6,7\}$, then $A \cap B=$?

A) $\{4,5,6,7\}$ B) $\{5,6\}$ C) $\{5,6,7\}$ D) $\{4,5,6\}$

19) Solve $3x-2=7$ if $x=\{1,2,3,4\}$

A) $\{4\}$ B) $\{13\}$ C) $\{2\}$ D) $\{3\}$

20) Solve $5x - x + 4 = 16$

A) -3 B) 2 C) -2 D) 3

21) Solve $2X + 6 = 5X + 12$.

A) 2 B) -2 C) 6 D) -6

22) Mary has a collection of 23 coins worth \$4.35. If the collection consist of nickels and quarters, how many nickels does she have?

A) 7 B) 16 C) 12 D) 9

23) Solve

$$\frac{3}{5}x-4=\frac{x}{2}$$

A) 4 B) -20 C) 40 D) -40

24) A store regularly sells air conditioners for $280.00. If they were on sale for $28.00 off what was the rate of discount?

A) 10% B) 1% C) 100% D) 20%

25) Solve $3X - 1 > -4$ if $X = \{-3,-2,-1,0,1,2,3\}$

A) {-3,-2,-1,0,1}
B) {-1,0,1,2,3}
C) {-3,-2}
D) {0,1,2,3}

26) Solve $5X - 6 \geq 7X + 8$

A) $x \leq -7$ B) $x \geq -7$ C) $x \geq 1$ D) $x \leq -1$

27) Write the slope - intercept from of: $4X = -2y - 3$

A) 4x + 2y = -3
B) y = 2x -1 1/2
C) y = -2x - 1 1/2
D) 2y = 4x -3

28) Write an equation of the line which passes through the point (6,-2) and has a slope of 2.

A) 2x + y = 10
B) 2x + y = -14
C) 2x - y = -10
D) 2x - y = 14

29) Which ordered pair is a solution of 2x - y = -4?

A) (3,0) B) (1,-2) C) (-2,-1) D) (-1,2)

30) Solve by the substitution method:

$$\begin{aligned} X + 3y &= 2 \\ 2x - y &= 11 \end{aligned}$$

A) (5, -1) B) (-1, 5) C) (4, -2) D) (-2,4)

31) Simplify: $(9t^2 + 4t - 6) + (t^2 - 2t + 4)$.

A) $10t^2 + 2t - 2$ B) $9t^2 + 2t + 2$
C) $10t^2 + 2t + 2$ D) $9t^2 + 2t - 2$

32) Simplify: $(7a^2 - 8) - (10a^2 + 6a + 2)$

A) $-3a^2 - 6a - 6$ B) $-3a^2 + 6a - 6$
C) $-3a^2 + 6a - 10$ D) $-3a^2 - 6a - 10$

33) Simplify: $(-2a^3)^3$

A) $-8a^9$ B) $8a^9$ C) $-6a^9$ D) $-6a^{27}$

34) *Simplify:* $\frac{32x^4y^3}{-8x^2y}$

A) $-4x^6y^4$ B) $-4x^2y^2$ C) $\frac{-4}{x^2y^2}$ D) $4x^2y^2$

35) *Divide:* $\frac{16y^2-98y+55}{8y-5}$

A) $2y - 11$ B) $-2y + 11$ C) $2y + 11$ D) $-2y - 11$

36) Factor: $9y^2 - 25$

A) $(3y - 5)^2$ B) $(3y + 5)(33y - 5)$
C) $(3y + 5)^2$ D) $(y + 5)(9y - 5)$

37) Multiply: $(y - 6)^2$

A) $y^2 - 36$ B) $y^2 - 12y + 36$
C) $y^2 + 12y + 36$ D) $y^2 + 36$

38) Factor: $y^2 + 10y + 25$.

A) $(y+5)^2$ B) $(y-5)^2$
C) $(y+5)(y-5)$ D) $(y+1)(y+25)$

39) Multiply: $(a - 6)(a + 3)$

A) $a^2 - 9a - 9$ B) $a^2 - 3a - 9$

C) $a^2 + 3a - 18$ D) $a^2 - 3a - 18$

40) Factor: $y^2 - 5y - 24$

A) $(y + 8)(y - 3)$ B) $(y - 8)(y - 3)$
C) $(y - 8)(y + 3)$ D) $(y - 6)(y + 4)$

41) Factor: $3y^2 - y - 10$

A) $(3y + 5)(y - 2)$ B) $(3y - 5)(y - 2)$
C) $(3y - 5)(y + 2)$ D) $(3y + 5)(y + 2)$

42) Solve: $(y - 5)(2y + 3) = 0$

A) $\{5, -3\}$ B) $\{5, -2/3\}$
C) $\{5, -3/2\}$ D) $\{-5, 3/2\}$

43) A rectangle is 6 cm longer than it is wide. If the area is 40 cm^2, find the length.

A) 8 cm B) 10 cm C) 5 cm D) 4 cm

44) Express in simplest form: $\dfrac{x^2 + 2x - 24}{x^2 - 16}$

A) $\dfrac{x + 6}{x + 4}$ B) $\dfrac{x + 6}{x - 4}$ C) $\dfrac{x - 6}{x + 4}$ D) $\dfrac{x - 6}{x - 4}$

45) Multiply and simplify: $\dfrac{x^2 - 4}{(x + 2)^2} \cdot \dfrac{x^2 + 2}{x - 2}$

A) $x + 2$ B) $\dfrac{x^2 + 4}{x - 2}$ C) $\dfrac{x^2 + 2}{x + 2}$ D) $\dfrac{x + 2}{x - 2}$

46) Divide and simplify: $\frac{a - b}{2a - 2b} \div \frac{a - b}{4a - 4b}$

A) 2 B) $\frac{1}{8}$ C) $\frac{1}{2}$ D) 8

47) Simplify: $\frac{6x}{6x - 14} \cdot \frac{9x - 21}{21} \div \frac{x^2}{35}$

A) $\frac{15}{x}$ B) $\frac{15x}{7}$ C) $\frac{30x}{7}$ D) $\frac{30}{7x}$

48) Simplify: $\frac{2x - 3}{12} + \frac{3x + 1}{6}$

A) $\frac{8x - 1}{12}$ B) $\frac{5x - 2}{18}$ C) $\frac{5x - 1}{9}$ D) $\frac{2x - 1}{3}$

49) Express in simplest form: $\sqrt{14} \cdot \sqrt{18}$

A) $7\sqrt{6}$ B) $7\sqrt{36}$ C) $6\sqrt{7}$ D) $\sqrt{252}$

50) Simplify: $\sqrt{18} - \sqrt{54} + 2\sqrt{50}$

A) $13\sqrt{2} - 3\sqrt{6}$ B) $-4\sqrt{3} + 4\sqrt{5}$

C) $-4\sqrt{3} - 4\sqrt{5}$ D) $8\sqrt{2} - 3\sqrt{6}$

51) As best you recall, the test directions:

A) Encouraged you to skip over more difficult questions.
B) Encouraged you <u>not</u> to skip over more difficult questions.
C) Said nothing about skipping.

52) As best you recall, the test directions encouraged you to answer all questions:

A) Unless your answer would be a sheer guess.
B) Even if your answer would be a sheer guess.

53) When taking the test, you:

A) Skipped one or more questions.
B) Did not skip any questions.

Appendix E

Biology Test

Bertie High School

End-of-Course Biology Test

1. Which high level of gas in the atmosphere causes the green house effect?
   A. CO_2 C. CO
   B. N_2 D. H_2

2. In a green plant cell, the synthesis of organic compounds from inorganic raw materials occurs in the
   A. Cell membrane C. Nucleus
   B. Chloroplast D. Mitochondria

3. Down's syndrome is an inherited human defect which results in mental retardation. The most common cause of this defect is known to be
   A. Gene linkage C. Crossing over
   B. Nondisjunction D. Sex-linkage

4. A pure tall pea plant (TT) is crossed with a pure short pea plant (tt). With reference to height, what will be the normal genotype of any resulting offspring
   A. TT C. TtTt
   B. Tttt D. Tt

- No number 5 -

6. In the human, where is bile stored?
   A. Gall bladder C. Pancreas
   B. Liver D. Spleen

7. The pigment responsible for the green color in plants is chlorophyll. The pigment responsible for color in humans is
   A. Melanin C. Thyroxin
   B. Estrogen D. Carotenoids

8. The human heart contains arteries which feed the heart and supply it oxygen. These arteries are known as
   A. Aorta C. Vena Cava
   B. Cornary D. None of the above

9. Which of these is not a characteristic of science?
   A. Use of tools B. Objectivity
   C. Conclusions based on evidence D. Reliance on personal beliefs

10. In humans, fertilization of the egg by the sperm takes place in the
    A. Ovary B. Fallopian tube
    C. Uterus D. Vagina

11. The study of prehistoric plants and animals is
    A. Paleontology B. Histology
    C. Mycology D. Herpertology

12. Which of the following are not blood cells?
A. Epidermis cells C. Leucocytes
B. Platelets D. Erythrocytes

13. Intra cellular transport of materials is most closely associated with which cell organelle?
A. Cell membrane C. Ribosome
B. Cell wall D. Endoplasmic Reticulum

14. There is not a cure for all of the following genetic controlled diseases except
A. Diabetes C. Flu
B. Parkensons Disease D. Sickle Cell Anemia

15. Which is not a part of the scientific method?
A. Time B. Hypothesize
C. Draw a conclusion D. Experiment

16. Compared to animals that carry on internal fertilization animals that carry on external fertilization usually
A. Produce fewer eggs
B. Reproduce in water
C. Reproduce by spores
D. Display more parental care

17. Which does not show support for the theory of evolution?
A. Fossils B. Comparative embryology
C. Comparative anatomy D. All support evolution

18. A gamete is a
A. A brain cell B. A nerve cell
C. A sex cell D. None of the above

19. In Andalusian fowl, if a blue rooster is mated with a blue hen, what will be the expected percentages of phenotypes in their offspring?
A. 100% blue C. 50% black and 50% blue
B. 50% blue and 50% white D. 25% black, 50% blue, 25% white

20. What 2 diseases cause more deaths than others in the U.S.A.
A. Lung cancer and breast cancer
B. Heart disease and stokes
C. AIDS and venereal diseases
D. None of the above

21. Which theory has not been disproved?
A. Spontaneous generation B. Evolution
C. Abiogenesis D. All have been disproved

22. The most serious consequence of cutting down forest land is?
A. The prevention of flooding B. Increase in chance of fire
C. Increase in number of predators D. Loss of topsoil cover

23. The coded information in a DNA molecule directly determines the formation of
A. Polypeptides C. Lipids
B. Polysaccharides D. Monosaccharides

24. The study of the structure of the human body
A. Physiology B. Anatomy
C. Biology D. Zoology

25. Which arthropod has 3 pairs of legs?
A. Arachnid B. Insect
C. Crustacean D. Diplopod

26. According to the fluid mosaic model, a cell membrane is described as a (CORRECT) structure composed of a
A. Protein layer in which large lipids are found
B. Carbohydrate structure in a "sea of lipids"
C. Double lipid layer in which proteins float
D. Phospholipid layer divided by carbohydrates

27. In animals the organelles in which aerobic respiration occurs are know as
A. Ribosomes C. Nuclear membranes
B. Chloroplasts D. Mitochondria

28. Which organelle contains hereditary factors and controls most cell activities?
A. Nucleus B. Cell membrane
C. Vacuole D. Endoplasmic reticulum

29. In the process of evolution, the effect of the environment is to
A. Prevent the occupance of mutations
B. Act as a selective force on variations in species
C. Provide conditions favorable for the formation of fossils
D. Provide stable conditions favorable to the survival of all species

30. Penicillin was considered the miracle drug of the 1950's. Who discovered this drug?
A. Alexander Haig C. Alexander Fleming
B. Edward Jenner D. Jonas Salk

31. Watson and Crick described a DNA molecule as a
A. Straight chain C. Double helix
B. Single strand D. Branching chain

32. The respiratory organs of an adult frog are
A. Skin and lungs B. Trachea and spicules
C. Nephridia D. Gills and lungs

33. Most of the minerals within an ecosystem are recycled and returned to the environment by the direct activities of organisms known as
A. Producers B. Secondary consumers
C. Primary consumers D. Decomposers

34. Which statement describes a part of Darwin's theory of evolution?
A. Variation is not essential of evolution
B. Too few offspring are produced in any population
C. Organisms with favorable adaptations tend to survive
D. Unfavorable mutations cause an increase in populations

35. Which is a positive aspect of the human influence on the environment?
A. Increased use of DDT in agriculture
B. Soil reclamation by reforestation
C. Use of the automobile as primary transportation
D. Urbanization of large amounts of farmland

36. Which reproductive method most likely produces organisms that possess adaptations for survival in a changing environment?
A. Sexual reproduction C. Parthenogenesis
B. Vegetative propagation D. Budding

37. Sexually reproducing species show greater variation than asexually reproducing species due to
A. Lower rates of mutations B. Occurrence of polyploidy
C. Environmental changes D. The recombination of alleles

38. The organs of an earthworm, that get rid of nitrogenous wastes are
A. Flame cells B. Kidneys
C. Nephridia D. Malpighian tubes

39. Which of the following is the most ecologically promising method of insect control?
A. Interference with insect reproduction processes
B. Stronger insecticide designed to kill higher percentages of insects
C. Physical barriers to insect pests
D. Draining marshes and other insect habitats

40. What subject is not being researched currently?
A. Cures for diseases B. Origin of man
C. Diversity of life D. All are being researched

41. The earth's magnetic field is not used to migrate from north to south by what animals
A. Whales B. Penguins
C. Birds D. Racoons

42. Which is a new career developed to implement new technological procedures?
A. Organ transplant surgical nurse B. Pediatric nurse
C. Biochemist D. None of these

43. Chemotherapy and radiation are used as treatments for cancer. What is a disadvantage of these treatments?
A. Too expensive
B. Not available in N.C.
C. Destroys healthy cells
D. Can only be used on patients over 65

44. The organ responsible for the production of sperm in the human male is
A. Vas deferens
B. Urethra
C. Epididymis
D. Testes

45. The number of African elephants has been drastically reduced by poachers who kill the animals for their ivory in their tusks. This negative aspect of human involvement in the ecosystem could best be described as
A. Poor land use management
B. Importation of organisms
C. Poor agricultural practice
D. Exploitation of wildlife

46. Which would be a good control group for an experiment which deals with normal plant growth?
A. Plants not watered set in sunlight
B. Plants watered and left in the dark
C. Plants watered and given sunlight
D. Plants fed fertilizer, water and set in sunlight

47. Which organ is responsible for gas exchange in <u>homo sapiens</u>?
A. Lungs
B. Heart
C. Skin
D. Appendix

48. Which would not be able to be researched using the scientific method?
A. Life cycle of insects
B. Origins of the universe
C. Antibiotics effects on bacteria
D. None of these

49. When traveling from the U.S. mainland to Hawaii, what would be most likely upset in humans
A. Diet
B. Sleep
C. Circulation
D. Biological clock

50. Which is not a recent technological advancement?
A. Amniocentesis
B. X-rays
C. Surgery
D. Chemotherapy

51. During the 20th Century, the greatest factor in upsetting the balance of nature has been the increase in the
A. Salt content of the ocean
B. Number of virus varieties on earth
C. Ability of humans to modify the environment
D. Amount of solar radiation

52. Why do arctic rabbits change from brown to white when the fall turns to winter?
A. Lack of sun
B. Biological rhythm
C. DDT
D. Temperature

53. Which is a factor that deters scientists from solving scientific problems?
A. Time
B. Tornadoes
C. Money
D. All of these

54. The implanting of a zygote in a human female is referred to as:
A. Amniocentesis
B. Echosounding
C. Invitro sterilization
D. Invitro fertilization

55. Which is a reason why pollution is a very difficult problem for scientists to solve?
A. Pollution destroys large parts of food chains
B. Many toxins are not biodegradable
C. Modern society produces large amounts of pollution
D. All are reasons

56. A study of a trait in a large number of families showed that 50% of the boys and none of the girls exhibited this trait. The gene for this trait is most likely
A. Autosomal dominant
B. Incompletely dominant
C. Sex-linked
D. Homozygous

57. The principal function of genes is to
A. Maintain continuity from one generation to the next
B. Aid in the excretion of waste products from organisms
C. Cause mutations to occur
D. Aid in the maintenance of the water balance in the cell

58. As best you recall, the test directions:

A) Encouraged you to skip over more difficult questions.
B) Encouraged you <u>not</u> to skip over more difficult questions.
C) Said nothing about skipping.

59. As best you recall, the test directions encouraged you to answer all questions:
A) Unless your answer would be a sheer guess.
B) Even if your answer would be a sheer guess.

60. When taking the test, you:

A) Skipped one or more questions.
B) Did not skip any questions.

Appendix F

SKP Directions

Instructions Set A for Experimental Group that Encourage Examinees to Skip

Directions for Administration

In the directions for administration read aloud only the material that is preceded by the word "say." Notice that this material is typed in **boldface**. Do not read aloud any material that is not typed in boldface. The material printed in standard type is provided for your information only.

When your examinees have settled down begin the testing session.

SAY: **You should have two sharpened No. 2 pencils. Please check to be sure that your pencils are No. 2 and that they are sharpened. If you do not have pencils, raise your hand and I will provide them for you.**

Pass out appropriate materials to examinees who need them.

SAY: **Now I am going to give each of you an answer sheet for the test. Do not write or mark on the answer sheet until I tell you do do so.**

Distribute the answer sheets to the examinees. (Do not distribute the test booklets.) When each examinee has an answer sheet, begin.

SAY: **Turn your answer sheet to side 1. Now find the boxes under the words STUDENT'S LAST NAME. Starting at the left, print one letter of your last name in each box. If your last name has more letters than there are boxes, print as many letters of your last name as there are boxes. Follow the same procedure for your first name.**

In the space labeled MI, print your middle initial. If you have no middle name, leave the box blank.

Each box has a column of circles beneath it. In the first column of circles, fill in the circle that has the same letter as the first letter of

your last name. Repeat the process for each of the other letters in your name. Mark only one circle in each column. Be sure to fill in the blank circle at the top of the column for any unused spaces.

Check to be sure that the examinees are printing their names and are filling in the circles correctly.

Say: **Now darken the circle to indicate birth month under birth date. In the boxes labeled day and year, write in numbers for day and year. In the column of circles beneath it, fill in the circle that has the same number that you recorded for day and year. Mark only one circle in each column.**

Follow the same procedure for identification number using the first seven boxes. Mark only one circle in each column beneath each box. Use box "J" under identification number to indicate ethnicity. Darken: 0 - American Indian, 1 - Black, 2 - White, 3 - Other. Leave boxes "H" and "I" blank since no identification numbers correspond to these boxes.

Under sex, grade, and education, fill in the appropriate circles. Mark only one circle in each column.

Check to be sure that the examinees are providing the information. If a examinee objects to coding the social security number or does not remember his or her social security number, do not force the issue.

SAY: **The North Carolina Test contains multiple-choice questions that will test your mastery of the concepts we have learned in class this year. For each test question you will be given several possible answers, A-D, from which you will choose the one correct answer.**

To answer a question, first decide which is the correct answer choice for a particular item. Then, find the item number on your answer sheet. Make a dark mark in the circle containing the letter of the correct answer.

There are several important things to remember when taking this test:

1. **Make a dark mark and fill the answer circle completely. Be sure to use a No. 2 pencil.**

2. **Be sure you are filling a circle beside the item number on the answer sheet that corresponds to the item number in the test booklet.**

3. **If you decide to change an answer, be sure to completely erase your first answer. If you erase the printed circle, do not redraw the circle with your pencil. The redrawn circle might be scored as your answer.**

Are there any questions about how to mark your answers on the answer sheets?

Pause to answer questions. Be sure each examinee understands the marking process before you begin the test.

Distribute the test booklets.

When examinees have the materials they will need, begin.

SAY: **In a moment we will begin work on the test. Remember to mark your answers only on your answer sheet.**

You will have 55 minutes to complete the test. Do not spend too much time on any one question. If you are not sure of an answer, you are encouraged to move on to the next question, but first mark choice 'E' on the answer sheet as a place holder. Before you hand in your test, go back and answer any questions you may have skipped. For questions skipped, you should have two choices darkened; choice 'E' and the choice you believe is the correct answer. Ten minutes before time is up I will remind you so that you can go back and answer any questions you may have skipped. It is to your advantage to answer all questions even if your answer is a sheer guess.

Pause to respond to questions or clarify instructions.

SAY: **If there are no more questions, you may begin.**

Record the starting time on the board. Add 55 minutes, and record the stopping time on the board so that the examinees can pace themselves. Then move quietly about the room to ensure that examinees are working on the proper pages of their test booklets and are making dark marks on their answer sheets. Frequent checks should be made throughout the

period. Assistance may be provided to examinees who do not seem to understand the general directions, but examinees may not be given assistance with solving the test items.

Ten minutes before the allotted time is over, ask the examinees to check back over their work.

SAY: **There are only ten minutes in the working period. Complete the test and check back over your answers.**

At the end of 55 minutes (or when everyone has completed the test) ask the examinees to stop work.

SAY: **STOP. Close your test booklet. Look over your answer sheet and make sure that all your marks are dark and heavy and that they completely fill the circles. Erase any stray marks.**

Allow sufficient time for examinees to check the marks on their answer sheets. Then collect the answer sheets and test booklets.

SAY: **Thank you for your cooperation.**

Check carefully to be sure that each examinee turns in all test materials, including test booklet and answer sheet. Count the test booklets and answer sheets you receive and be sure this number agrees with your count at the beginning of the testing session. Report any discrepancies and the class period after which they occurred to your Test Coordinator. Store the test booklets and answer sheets in a secure place.

Appendix G

DNS Directions

Instructions Set B for Control Group I that Discourages Skipping

Directions for Administration

In the directions for administration read aloud only the material that is preceded by the word "say." Notice that this material is typed in **boldface**. Do not read aloud any material that is not typed in boldface. The material printed in standard type is provided for your information only.

When your examinees have settled down begin the testing session.

SAY: **You should have two sharpened No. 2 pencils. Please check to be sure that your pencils are No. 2 and that they are sharpened. If you do not have pencils, raise your hand and I will provide them for you.**

Pass out appropriate materials to examinees who need them.

SAY: **Now I am going to give each of you an answer sheet for the test. Do not write or mark on the answer sheet until I tell you do do so.**

Distribute the answer sheets to the examinees. (Do not distribute the test booklets.) When each examinee has an answer sheet, begin.

SAY: **Turn your answer sheet to side 1. Now find the boxes under the words STUDENT'S LAST NAME. Starting at the left, print one letter of your last name in each box. If your last name has more letters than there are boxes, print as many letters of your last name as there are boxes. Follow the same procedure for your first name.**

In the space labeled MI, print your middle initial. If you have no middle name, leave the box blank.

Each box has a column of circles beneath it. In the first column of circles, fill in the circle that has the same letter as the first letter of your last name. Repeat the process for each of the other letters in your name. Mark only one circle in each column. Be sure to fill in the blank circle at the top of the column for any unused spaces.

Check to be sure that the examinees are printing their names and are filling in the circles correctly.

Say: **Now darken the circle to indicate birth month under birth date. In the boxes labeled day and year, write in numbers for day and year. In the column of circles beneath it, fill in the circle that has the same number that you recorded for day and year. Mark only one circle in each column.**

Follow the same procedure for identification number using the first seven boxes. Mark only one circle in each column beneath each box. Use box "J" under identification number to indicate ethnicity. Darken: 0 - American Indian, 1 - Black, 2 - White, 3 - Other. Leave boxes "H" and "I" blank since no identification numbers correspond to these boxes.

Under sex, grade, and education, fill in the appropriate circles. Mark only one circle in each column.

Check to be sure that the examinees are providing the information. If a examinee objects to coding the social security number or does not remember his or her social security number, do not force the issue.

SAY: **The North Carolina Test contains multiple-choice questions that will test your mastery of the concepts we have learned in class this year. For each test question you will be given several possible answers, A-D, from which you will choose the one correct answer.**

To answer a question, first decide which is the correct answer choice for a particular item. Then, find the item number on your answer sheet. Make a dark mark in the circle containing the letter of the correct answer.

There are several important things to remember when taking this test:

1. **Make a dark mark and fill the answer circle completely. Be sure to use a No. 2 pencil.**

2. **Be sure you are filling a circle beside the item number on the answer sheet that corresponds to the item number in the test booklet.**

3. **If you decide to change an answer, be sure to completely erase your first answer. If you erase the printed circle, do not redraw the circle with your pencil. The redrawn circle might be scored as your answer.**

Are there any questions about how to mark your answers on the answer sheets?

Pause to answer questions. Be sure each examinee understands the marking process before you begin the test.

Distribute the test booklets.

When examinees have the materials they will need, begin.

SAY: **In a moment we will begin work on the test. Remember to mark your answers only on your answer sheet.**

You will have 55 minutes to complete this test. <u>You are encouraged not to SKP questions.</u> You should answer each question as you come to it to prevent getting your answers out of order. If you nevertheless decide to SKP an item, you should mark choice 'E' as a place holder. Before you hand in your test, go back and answer any questions you may have skipped. For questions skipped, you should have two choices darkened; choice "E" and the choice you believe is the correct answer. Ten minutes before time is up, I will remind you so that you can go back to any questions you may have skipped. It is to your advantage to answer all questions even if your answer is a sheer guess.

Pause to respond to questions or clarify instructions.

SAY: **If there are no more questions, you may begin.**

Record the starting time on the board. Add 55 minutes, and record the stopping time on the board so that the examinees can pace themselves. Then move quietly about the room to ensure that examinees are working on the proper pages of their test booklets and are making dark marks on their answer sheets. Frequent checks should be made throughout the period. Assistance may be provided to examinees who do not seem to understand the general directions, but examinees may not be given assistance with solving the test items.

Ten minutes before the allotted time is over, ask the examinees to check back over their work.

SAY: **There are only ten minutes in the working period. Complete the test and check back over your answers.**

At the end of 55 minutes (or when everyone has completed the test) ask the examinees to stop work.

SAY: **STOP. Close your test booklet. Look over your answer sheet and make sure that all your marks are dark and heavy and that they completely fill the circles. Erase any stray marks.**

Allow sufficient time for examinees to check the marks on their answer sheets. Then collect the answer sheets and test booklets.

SAY: **Thank you for your cooperation.**

Check carefully to be sure that each examinee turns in all test materials, including test booklet and answer sheet. Count the test booklets and answer sheets you receive and be sure this number agrees with your count at the beginning of the testing session. Report any discrepancies and the class period after which they occurred to your Test Coordinator. Store the test booklets and answer sheets in a secure place.

Appendix H

NDI Directions

Instructions Set C for Control Group II with Non-Directive Instructions in Regards to Skipping

Directions for Administration

In the directions for administration read aloud only the material that is preceded by the word "say." Notice that this material is typed in **boldface**. Do not read aloud any material that is not typed in boldface. The material printed in standard type is provided for your information only.

When your examinees have settled down begin the testing session.

SAY: **You should have two sharpened No. 2 pencils. Please check to be sure that your pencils are No. 2 and that they are sharpened. If you do not have pencils, raise your hand and I will provide them for you.**

Pass out appropriate materials to examinees who need them.

SAY: **Now I am going to give each of you an answer sheet for the test. Do not write or mark on the answer sheet until I tell you do do so.**

Distribute the answer sheets to the examinees. (Do not distribute the test booklets.) When each examinee has an answer sheet, begin.

SAY: **Turn your answer sheet to side 1. Now find the boxes under the words STUDENT'S LAST NAME. Starting at the left, print one letter of your last name in each box. If your last name has more letters than there are boxes, print as many letters of your last name as there are boxes. Follow the same procedure for your first name.**

In the space labeled MI, print your middle initial. If you have no middle name, leave the box blank.

Each box has a column of circles beneath it. In the first column of circles, fill in the circle that has the same letter as the first letter of your last name. Repeat the process for each of the other letters in your name. Mark only one circle in each column. Be sure to fill in the blank circle at the top of the column for any unused spaces.

Check to be sure that the examinees are printing their names and are filling in the circles correctly.

Say: **Now darken the circle to indicate birth month under birth date. In the boxes labeled day and year, write in numbers for day and year. In the column of circles beneath it, fill in the circle that has the same number that you recorded for day and year. Mark only one circle in each column.**

Follow the same procedure for identification number using the first seven boxes. Mark only one circle in each column beneath each box. Use box "J" under identification number to indicate ethnicity. Darken: 0 - American Indian, 1 - Black, 2 - White, 3 - Other. Leave boxes "H" and "I" blank since no identification numbers correspond to these boxes.

Under sex, grade, and education, fill in the appropriate circles. Mark only one circle in each column.

Check to be sure that the examinees are providing the information. If a examinee objects to coding the social security number or does not remember his or her social security number, do not force the issue.

SAY: **The North Carolina Test contains multiple-choice questions that will test your mastery of the concepts we have learned in class this year. For each test question you will be given several possible answers, A-D, from which you will choose the one correct answer.**

To answer a question, first decide which is the correct answer choice for a particular item. Then, find the item number on your answer sheet. Make a dark mark in the circle containing the letter of the correct answer.

There are several important things to remember when taking this test:

1. **Make a dark mark and fill the answer circle completely.**

Be sure to use a No. 2 pencil.

2. **Be sure you are filling a circle beside the item number on the answer sheet that corresponds to the item number in the test booklet.**

3. **If you decide to change an answer, be sure to completely erase your first answer. If you erase the printed circle, do not redraw the circle with your pencil. The redrawn circle might be scored as your answer.**

Are there any questions about how to mark your answers on the answer sheets?

Pause to answer questions. Be sure each examinee understands the marking process before you begin the test.

Distribute the test booklets.

When examinees have the materials they will need, begin.

SAY: **In a moment we will begin work on the test. Remember to mark your answers only on your answer sheet.**

You will have 55 minutes to complete this test. I will notify you when ten minutes of testing time remains. It is to your advantage to answer all questions, even if your answer represents a sheer guess.

Pause to make sure that all examinees understand the directions.

SAY: **If there are no more questions, you may begin.**

Record the starting time on the board. Add 55 minutes, and record the stopping time on the board so that the examinees can pace themselves. Then move quietly about the room to ensure that examinees are working on the proper pages of their test booklets and are making dark marks on their answer sheets. Frequent checks should be made throughout the period. Assistance may be provided to examinees who do not seem to understand the general directions, but examinees may not be given assistance with solving the test items.

Ten minutes before the allotted time is over, ask the examinees to check back over their work.

SAY: **There are only ten minutes in the working period. Complete the test and check back over your answers.**

At the end of 55 minutes (or when everyone has completed the test) ask the examinees to stop work.

SAY: **STOP. Close your test booklet. Look over your answer sheet and make sure that all your marks are dark and heavy and that they completely fill the circles. Erase any stray marks.**

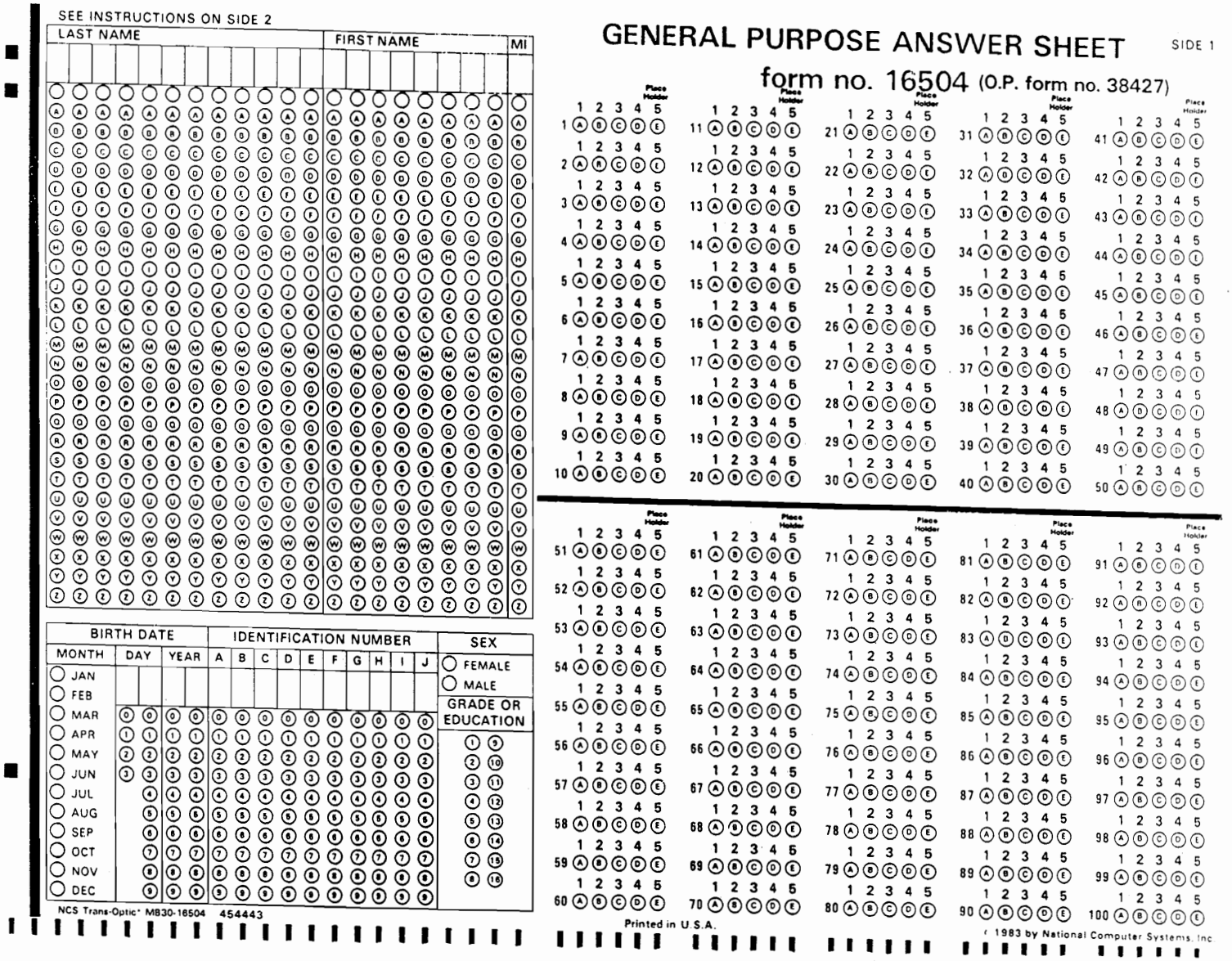
Allow sufficient time for examinees to check the marks on their answer sheets. Then collect the answer sheets and test booklets.

SAY: **Thank you for your cooperation.**

Check carefully to be sure that each examinee turns in all test materials, including test booklet and answer sheet. Count the test booklets and answer sheets you receive and be sure this number agrees with your count at the beginning of the testing session. Report any discrepancies and the class period after which they occurred to your Test Coordinator. Store the test booklets and answer sheets in a secure place.

Appendix I

Modified Answer Sheet for Experimental and Control Groups



SEE INSTRUCTIONS ON SIDE 2

LAST NAME | FIRST NAME | MI

BIRTH DATE: MONTH (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC) | DAY | YEAR

IDENTIFICATION NUMBER: A B C D E F G H I J

SEX: FEMALE, MALE

GRADE OR EDUCATION: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

NCS Trans-Optic® MB30-16504 454443

GENERAL PURPOSE ANSWER SHEET

SIDE 1

form no. 16504 (O.P. form no. 38427)

Place Holder

1 A B C D E	11 A B C D E	21 A B C D E	31 A B C D E	41 A B C D E
2 A B C D E	12 A B C D E	22 A B C D E	32 A B C D E	42 A B C D E
3 A B C D E	13 A B C D E	23 A B C D E	33 A B C D E	43 A B C D E
4 A B C D E	14 A B C D E	24 A B C D E	34 A B C D E	44 A B C D E
5 A B C D E	15 A B C D E	25 A B C D E	35 A B C D E	45 A B C D E
6 A B C D E	16 A B C D E	26 A B C D E	36 A B C D E	46 A B C D E
7 A B C D E	17 A B C D E	27 A B C D E	37 A B C D E	47 A B C D E
8 A B C D E	18 A B C D E	28 A B C D E	38 A B C D E	48 A B C D E
9 A B C D E	19 A B C D E	29 A B C D E	39 A B C D E	49 A B C D E
10 A B C D E	20 A B C D E	30 A B C D E	40 A B C D E	50 A B C D E

51 A B C D E	61 A B C D E	71 A B C D E	81 A B C D E	91 A B C D E
52 A B C D E	62 A B C D E	72 A B C D E	82 A B C D E	92 A B C D E
53 A B C D E	63 A B C D E	73 A B C D E	83 A B C D E	93 A B C D E
54 A B C D E	64 A B C D E	74 A B C D E	84 A B C D E	94 A B C D E
55 A B C D E	65 A B C D E	75 A B C D E	85 A B C D E	95 A B C D E
56 A B C D E	66 A B C D E	76 A B C D E	86 A B C D E	96 A B C D E
57 A B C D E	67 A B C D E	77 A B C D E	87 A B C D E	97 A B C D E
58 A B C D E	68 A B C D E	78 A B C D E	88 A B C D E	98 A B C D E
59 A B C D E	69 A B C D E	79 A B C D E	89 A B C D E	99 A B C D E
60 A B C D E	70 A B C D E	80 A B C D E	90 A B C D E	100 A B C D E

Printed in U.S.A.

Appendix J

Code Sheet for Algebra and Biology

Identification Numbers

A thru D ... Student four digit ID number E ... Subject area with examinee ability level

E1 ... Algebra / High
E2 ... Algebra / Middle
E3 ... Algebra / Low

E4 ... Biology / High
E5 ... Biology / Middle
E5 ... Biology / Low

F thru H ... Teacher ID Number

I ... Class Meeting Period With Treatment Condition

Note: Teacher Id number F - H along with class meeting period (I) yields the treatment

J ... Student Ethnicity

J0 ... American Indian
J1 ... Black
J2 ... White
J3 ... Other

Algebra test item responses
1 thru 50 Algebra test item choices
51 thru 53 Student response strategy questions
61 thru 65 Student second semester mid-term class performance grade

Biology test item responses
1 thru 57 Biology test item choices
58 thru 60 Student response strategy questions
61 thru 65 Student second semester mid-term class performance grade

** test item 5 missing from questionnaire
** test item 26 - no correct response

Columns	A	B	C
61	A+	A	A-
62	B+	B	B-
63	C+	C	C-
64	D+	D	D-
65	F		

Actual North Carolina End-of-course performance grades were recorded in items 66 through 70 using choices A, B, and C on the answer sheet.

Columns	A	B	C
66	A+	A	A-
67	B+	B	B-
68	C+	C	C-
69	D+	D	D-
70	F		

Appendix K

Correspondence

14362 Chesterfield Rd.
Rockville, Maryland
20853

1/27/90

Mr. George Stancil
Superintendent
Bertie County Public Schools
P.O. Box 10
Winsdor, N.C. 27983

Dear Mr. Stancil:

Thank you for taking time out of your schedule to see me in regards to measuring student performance as part of the school performance plan.

I look forward to working with you, Mr. Spain, Mrs. Bazemore, and your staffs on this comprehensive evaluation. It's my understanding that we will assess student performance on the end of course tests for algebra, biology, nd U.S. history. The test items will be constructed by the chairpersons and teachers in these subject areas. Further, we will analyze student performance relative to skipping difficult test items by gender, item difficulty, and test directions.

In an effort to position ourselves to assess these areas, assistance is needed in the following areas:

(1) modification of the answer sheet to reflect those items that have been skipped,

(2) allow me to merge my test directions to include instructions relative to skipping into the end of course test directions for each subject area,

(3) provide an environment to conduct a pilot study that will enable us to field test the directions, and

(4) scoring the answer sheet for the number of right items.

These preliminary steps should provide us the basis needed to pursue testing all students in all the subject areas.

Again, thank you for your assistance. I look forward to positive results for the Bertie County School System.

Sincerely,

Gwendolyn C. Davis

Gwendolyn C. Davis

cc: Ms. Mildred Bazemore
Mr. Ray Spain

NORTH CAROLINA DEPARTMENT OF PUBLIC INSTRUCTION

Bob Etheridge
Superintendent

Northeast Regional Education Center
Box 1028, Williamston, NC 27892

March 5, 1990

Mrs. Gwendolyn Davis
14362 Chesterfield Road
Rockville, MD 20853

Dear Mrs. Davis:

As per our telephone conversation on March 5, 1990, please find enclosed a zerox copy of the NCS General Purpose Answer Sheet Number 16504; I recommend that you use this form for the project with Bertie County Schools. This answer document is both economical and can be scanned using the Standard North Carolina Scan Program. In fact, our agency has in the past used these documents for EOC testing and field testing.

Upon analyzing the document layout that you sent me earlier, it became apparent that our agency does not currently have the capability to modify our regular EOC answer documents to reflect the change you desire (5th item response area).

Please note that while the general purpose document attached has limited spaces for student identification information; one area, ethnicity, can possibly be added as a code to the identification number section in column J or after a nine-digit social security number has been included. Remember that either a statistical package or data management package may be needed to translate or to lift special codes or "E" responses to be translated for your purposes.

I hope you find this information helpful. If I can assist further, please let me know.

Sincerely,

Mildred G. Bazemore
Regional Research & Development
Coordinator

MGB:ace

c: Ray Spain

VITA

Gwendolyn Berry Davis was born July 17, 1950 in Marion, South Carolina (SC). In 1968, she graduated from Johnakin High School, Marion, SC. She then entered Johnson C. Smith University and earned a Bachelor of Science degree in Health and Physical Education. In 1975, she became an instructor of health and physical education in the Charlotte Mecklenburg School system. During the summer of 1975, she co-supervised a program for challenged individuals at Johnson C. Smith University.

In 1977, Mrs. Davis taught in the health and physical education department at Spelman College. She entered The University of North Carolina at Greensboro in 1978 and obtained a Master of Science degree in physical education with a concentration in measurement and evaluation. The degree was completed in 1980.

Mrs. Davis accepted the position as instructor of physical education at Winston-Salem University where she taught measurement and evaluation and science based courses. When her husband took advantage of an employment opportunity in eastern Virginia in 1985, Mrs. Davis accepted a position at Norfolk State University. She entered the graduate program at Virginia Polytechnic Institute and State University in the pursuit of a Doctor of Philosophy degree in Educational Research, Evaluation, and Policy Studies. During her course of study, Mrs. Davis worked as a graduate

assistant and tutored doctoral students in the educational research program. During the spring semester of 1990, she accepted a part-time position in the Department of Psycho-Educational Studies at Howard University. Mrs. Davis taught intermediate statistics for graduate students.

Mrs. Davis is a member of Phi Delta Kappa. She has been recognized as an Outstanding Graduate Student in America as well as an Outstanding Young Woman of America.