AN EXPERIMENT WITH CLASS SIZE IN THE TEACHING OF ELEMENTARY ACCOUNTING

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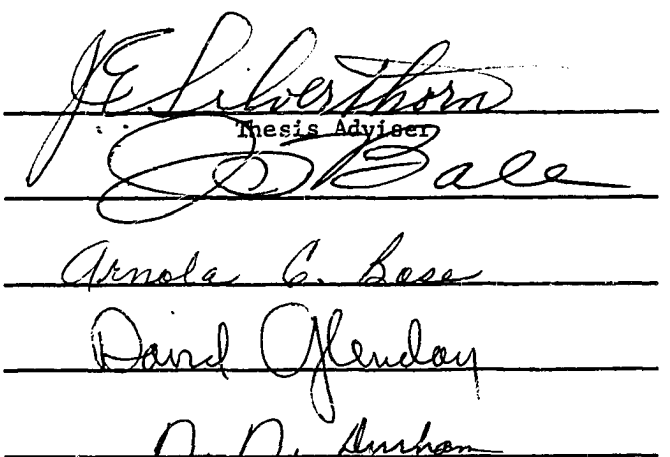

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CHAPTER I

INTRODUCTION

Educators have historically been interested in methods of achieving optimum results in the classroom. The proper use of all the available educational resources is necessary to obtain the maximum benefits for the students involved. One of the most pressing educational problems that has come to the forefront is the increasing number of students enrolling in college. Tickton (1961) indicates that the problems of higher education will be influenced dramatically by five great factors. They are, as stated on page 13:

1. the birthrate since the beginning of the war
2. the increased desire to go to college
3. the increased capacity to go to college
4. a further shift in the center of educational influence from private to public institutions
5. a complete turnaround in the competitive position of well-qualified faculty members.

In a society dedicated to mass education, it would seem that the solution to the problem of overcrowded educational institutions should not be the enactment of more stringent entrance requirements to limit enrollment to the more academically talented student.

Because of increasing college enrollments, much interest is evident in those areas of research that may provide some solutions to the problem. In recent years there has been much interest in research studies involving team teaching, teaching by closed-circuit television, and optimum class size.

The purpose of this study was to provide some experimental evidence to either support or deny the hypothesis that students in small classes of elementary accounting achieve more than students in large classes.

This experiment may aid in determining whether class size is a major factor in student success in elementary accounting. If class size is not a factor in academic achievement, it may be feasible to increase the number of students in each class in order to accommodate more students.

Statement of the Problem

Does class size affect the academic achievement of students enrolled in a course of elementary accounting? The problem is to determine if, in elementary accounting classes, students who are in small classes will achieve more than students who are in large classes.

Null Hypothesis

There will be no significant difference in learning between students who are in small classes of elementary accounting and those who are in large classes. Learning will be measured through the use of the pre-test and post-test method to ascertain any gain in the mean score of each class.

General Design

The experimental study was conducted during two consecutive semesters at Northeastern State College. During each of the semesters a small class and a large class of elementary accounting students were compared to determine whether the null hypothesis was to be accepted or

rejected. The students were allowed to enroll in either section of accounting that they preferred until that section reached the maximum number of students required for the experiment. No effort was made to place any student in any particular section. This method provided for selection of students with no researcher bias involved. It was necessary to use "intact" groups of students in this experiment since approximately 400 students are enrolled in elementary accounting each semester and their individual schedules could not be arranged to obtain a pure random selection. Popham (1967) states on page 221 that:

> it is often impractical to move students from one teacher to another, or from one curriculum to another, in order to help the experimenter work out a 'tight' research design. The researcher must, therefore, resign himself to the necessity of dealing with 'intact' student groups on many occasions.

Popham (1967) also makes this statement concerning experimenting with "intact" groups on page 223:

> Fortunately, a statistical tool of considerable value known as analysis of covariance can be employed in just such instances as that described above. This technique, an extension of the analysis of variance model combined with certain features of regression analysis, provides a useful statistical device for educational investigators. In brief, analysis of covariance may be used when a relationship is being studied between a dependent variable and two or more groups representing an independent variable. This powerful technique allows the researcher to statistically equate the independent variable groups with respect to one or more variables which are relevant to the dependent variable. To put it another way, analysis of covariance allows the researcher to study the performance of several groups which are unequal with regard to an important variable as though they were equal in this respect.

The two sections of accounting each semester were taught at nine o'clock and ten o'clock in the morning. These are popular hours for accounting and insured the number of students required for the experiment. The ten o'clock class was the large class during the first

semester and the nine o'clock was the small class. The class sizes were reversed the second semester to cancel any differences relating to the time the classes were offered.

The classes met five days a week for fifty minutes each day. Three days each week were devoted to lectures by the instructor and two days each week were used as a laboratory session. The classes utilized the same classroom, equipment, and materials. The same instructor taught all of the sections and used lecture notes to insure that the lectures presented were as nearly the same in nature and content as possible. All possible factors (including room temperature and lighting) were held constant with the exception of class size.

A pre-test was administered to each student on the first day of attendance. This test was adapted from tests developed by Niswonger and Fess (1965) and validated by a panel of Certified Public Accountants to determine the prior knowledge of accounting principles and concepts held by each student. To ascertain whether high school bookkeeping had been taken, a data sheet was constructed indicating the name, age, major field of study, and grade earned in bookkeeping, if taken, of each student. The data sheet also indicates whether college accounting had been attempted before. ACT scores were recorded for each student in the experiment and were used with the mean pre-test score in the analysis of covariance computation. The pre-test was utilized at the end of the semester as a post-test to determine the mean gain in accounting knowledge. Through analysis of covariance it was possible to adjust the mean score of the post-test to compensate for the lack of original equivalency that was discovered by a comparison of pre-test and ACT scores.

An opinionnaire was developed to determine what the students thought and felt about the section of accounting in which they were enrolled. This opinionnaire was modeled after the opinionnaire used by Levin (1967) which was constructed from opinionnaires found to be valid. Modifications were made in order to make the opinionnaire applicable for the particular accounting classes under investigation.

The investigator also determined (on a percentage basis) the drop-out rate and the absenteeism rate for each class.

Definition of Terms

ACT Scores: The scores made on the American College Test. All entering freshmen take this test. Students transferring from other colleges and universities may not have ACT scores on record at Northeastern State College. If the ACT scores could not be obtained for a student, he or she was omitted from the investigation. ACT scores consist of four tests--one each in the areas of English, mathematics, social studies, and natural science. The tests average forty-five minutes in length and are designed to measure the student's ability to perform the kinds of intellectual tasks college students typically perform. Test items are concerned with intellectual skills and abilities--not with specific and detailed content. The test yields four test scores and a composite, or average, score. High school grades were not available and college grade-point averages could not be computed since many first-semester freshmen were in the experimental classes.

Small Class: A class beginning with twenty-five or fewer students.

Large Class: A class beginning with seventy or more students.

Principles of Accounting 213: That course defined by the Northeastern State College Catalog, 1968-1970. The course description reads as follows: "An introductory course in the gathering, recording, and use of financial data of business."

Pre-test: A test validated by a board of Certified Public Accountants to measure accounting knowledge prior to beginning instruction.

Post-test: The same test as the pre-test. This was utilized to measure accounting knowledge at the conclusion of the course.

Opinionnaire: An opinionnaire adapted from Levin (1967) to determine what each student thought and felt about the accounting class in which he or she was enrolled.

Data Sheet: A form completed by each student indicating name, age, prior accounting instruction or attempted instruction, and grades received, if any.

Scope and Limitations of Study

All of the accounting classes were taught at Northeastern State College. The classes consisted of one small class and one large class of Principles of Accounting 213 for two consecutive semesters. The courses were taught by the same instructor.

The following are basic assumptions of the study:

1. The findings of a similar study, conducted in the near future, and including a larger sample will yield results comparable to the findings of this study.

2. The students who enroll in elementary accounting courses at Northeastern State College are representative of students who will enroll in future classes of elementary accounting at Northeastern State College.

CHAPTER II

A REVIEW OF SELECTED RELATED RESEARCH AND LITERATURE

The related literature and research during the past seventy-five years does not reveal a simple and unequivocal solution to the problem of determining the optimum class size for a particular subject and set of circumstances. Although more than 300 investigations have been reported relative to class size, the issue has not been resolved. Holland (1954) states on page 171 that:

> despite the many notable researches that have been undertaken, the answers are confused and uncertain. It is not surprising that investigation into this important area has been all but abandoned for the past fifteen years.

A review of related literature and research reveals a renewed interest in optimum class-size experiments when enrollments soar as a result of an increasing birth rate and a relative decrease in the number of trained teachers. Educational administrators are faced with a most frustrating dilemma in attempting to provide quality education for all students when adequate financial resources are not available.

This review of related research and literature will attempt to cite selected experiments and observations pertinent to the evolution of class-size experiments. These experimental studies may be classified as: (1) the Pioneer Period studies; (2) the Early Experimental Period studies; and (3) the Refined Experimental Period studies. A larger

proportion of the review of literature will be devoted to the Refined Experimental studies period.

The Pioneer Period Studies

(1895-1915)

A review of related research and literature concerning class size indicates interest in this area of education dating back to 1895. The first recorded experiment occurred in 1895 when Rice (1902) administered arithmetic tests to 6,000 elementary students and language tests to 8,300 elementary students. Although he did not hold any factors constant other than class size, it was an important experiment because it was the first attempt to apply the scientific method to educational research. He found there were no significant differences in academic achievement in either the language or arithmetic experiments. He discovered that some of the best work had been done in the largest classes and some of the poorest work done in the smallest classes.

Cornman (1909) reports an experiment conducted in Philadelphia in the primary grades. Three hundred and twenty classes were studied after being arranged into three sizes: under 40, 40 to 49, and 50 and over. The only variable controlled was the size of the classes and the criteria for measurement were promotion marks and conduct. Cornman's analysis of promotion revealed no significant relationship between class size and rate of promotion. He found that the medium-sized classes made the best showing and that the smaller classes were only slightly superior to the larger classes in terms of promotion marks. Pupil conduct in the largest classes was best and worst in the medium-sized classes. Cornman, as a result of his investigation, recommended elementary

classes composed of 40 to 50 pupils with smaller classes for pupils with special problems. It must be noted that Cornman's data were gathered from the report cards of the pupils and scientific treatment of the data or the variables is not evident.

Harlan (1913) conducted experiments in 1,346 cities pertaining to promotion, achievement, and improvement. He determined the rate of promotions by an analysis of report cards and achievement and improvement through the usage of improvised tests. Again, as in the preceding experiment, the only variable considered was class size. The size of the classes involved ranged from 20 to 50 pupils. His findings indicated that there was no relationship between class size and rate of promotion. He discovered that in the fifth grade large classes were slightly better in composition, arithmetic, and handwriting while smaller classes achieved slightly more in vocabulary and spelling. In the seventh grade the larger classes were better in composition and the smaller classes were better in vocabulary, arithmetic, and spelling. He noted that penmanship improvement was distinctly favorable to large classes; in fact, large classes performed better than the smaller classes in a ratio of three to one. The largest gains in language were made by the large classes. Harlan found that students pay as much attention to recitation in large classes as in small classes and that approximately the same percentage of students will participate in discussion-type activities in large classes as in small classes. He also indicates that routine classroom procedures such as checking the roll does not take more class time in a large class. In fact, smaller classes are more inclined to waste time.

Summary of the Pioneer Period in Class-Size Experiments

The foregoing studies typify the investigations conducted prior to 1916. It is worthy of notice that the only variable controlled was that of class size. The investigators were hampered by the lack of intelligence tests and evaluative techniques; thus, the results reflect much subjectivity in the analysis of the studies. A review of the experiments during the Pioneer Period reveals that, in general, unless the class size exceeds 45 there is no clear evidence of superiority of either small or large classes. It must be noted, however, that studies of this period were made on the basis of available administrative records and subjective observations of the investigators. Intelligence tests were developed and refined during World War I and enabled investigators of class size to move into a new era--the Early Experimental studies period. This period was destined to become the period of most active interest in class-size experiments.

The Early Experimental Period (1916-1930)

Breed and McCarthy (1916) conducted the first experiment in which an attempt was made to control some variables other than class size. Their experiment pertained to the improvement of spelling ability in elementary classes ranging from 20 to more than 45 students. They attempted to control the ability of teachers (although they do not state how this was done), the size of the town in which the experiments were conducted, the time given to study and recitation, teaching method,

testing personnel, and number of words studied per week. Their findings indicated that all large classes showed a higher rate of improvement except grades III and VII. The means of measurement was a test composed of the same 80 words given as a pre-test and a post-test over a period of 20 days. Fifty-nine per cent of the large classes exceeded the small classes when the pupils were paired on the basis of initial spelling ability. They found a regular increase of improvement in classes of 20 up to classes of 45; beyond 45, a decrease. Their recommendation was to limit elementary-school spelling classes to less than 40, especially below the seventh grade. The significance of the Breed and McCarthy experiment seems to be the attempt to control, for the first time, variables other than the size of the class.

Edmonson and Mulder (1924) conducted the first experiment at the college level in 1923. The experiment involved a one-semester investigation in an education course--Introduction to High-School Problems. The comparison was between a small class of 45 students and a large class of 109 students. The variables controlled were class size, intelligence, and past experiences of the students. The sections were taught by the same instructor. The criterion of measurement was achievement; and the means of measurement consisted of examinations, objective tests, and one essay. Their conclusion was that there were no significant differences in student achievement. The students in the experiment were asked to indicate their attitudes concerning class size and efficiency. Of those expressing opinions it was determined that:

(1) Fifty-one per cent preferred small classes;

(2) Fourteen per cent preferred large classes; and

(3) Thirty-five per cent believed class size to be immaterial.

Mueller (1924) conducted an experiment at Worcester State Normal School. The experiment covered a span of one semester in a course of Introductory Psychology. The comparison was made between a small class of 20 and a large class of 40. Mueller states on page 203 that the students were selected for the following reasons:

(1) each group studied the same subject (Introductory Psychology);

(2) the same length of time (one semester);

(3) the same number of class periods weekly (four);

(4) were taught by the same instructor, who used identical methods in both groups, so far as possible; and

(5) the achievement in the subject could be measured objectively. The criterion of measuring achievement was accomplished by the administration of an objective test. The results of the experiment were in favor of the small class. When measured by an objective test, the small group was 17.5 per cent superior to the large class. Mueller (1924) makes this statement regarding his experiment on page 206:

> This experiment does not determine the exact size of classes for the greatest efficiency of instruction. The Michigan experiment (referring to the study of Edmonson and Mulder) shows that no difference exists between classes of 45 and 109. Upon the basis of these findings it is reasonable to assume that the critical point lies somewhere below 45. Once an instructor takes on a class of 45 he might--so far as class achievement is concerned--take on any number beyond that. It is reasonable to believe that this is true, for one can perhaps lecture as well to 200 as to 45.

Trueblood (1926) experimented with geometry classes at Arsenal High School, Indianapolis, Indiana. Because of soaring enrollments, he was forced to adopt techniques enabling him to teach more students. His classes consisted of 100 or more students and the results of his

experiment were ascertained by a test indicating mastery of the subject. He selected an "A" student from a former geometry class and placed him in charge of ten students currently enrolled in geometry. By utilizing this technique he was able to teach classes of 100 or more without lowering his standards of mastery. Although this investigation does not contain the necessary ingredients to qualify as an objective experiment, it supports Mueller's (1924) contention that if the number exceeds 45, it may be possible, with additional assistance, to increase the class size to 200 with only a slight decrease in efficiency.

The most famous experiments of this period were those of Hudelson (1928) at the University of Minnesota. Between the years of 1924 and 1927 Hudelson and his associates conducted: (from Table I)

> Fifty-nine experiments in 108 classes in 11 departments in four colleges under 21 instructors. The experiments involved 6,059 students; 4,205 in large classes and 1,288 in small classes.

Hudelson used the matched-pair technique, consequently the number of students in large and small classes does not equal the original experimental population (6,059) because some students could not be paired and were discarded from the experiment. The students were matched or paired on the basis of sex, intelligence, and past scholarship records. The criterion of measurement was achievement. The size of the classes ranged from 12 to 109. Hudelson makes these comments (from Table I) concerning the results of the experiments:

> In 46 of the 59 experiments, or 78%, a more or less decided advantage in achievement accrued to the large classes and in only 13 experiments, or 22%, was there any advantage to the small classes.
>
> Both faculty and students decidedly prefer small classes because of the closer personal contacts which they feel are possible in small classes. Results, however, fail to show an advantage from such contacts when measured either by term marks or achievement scores.

> Conclusion: when measured by term marks and achievement tests, large classes do not seem to lower the efficiency of university instruction in the 108 classes investigated.

Kidd (1952) reports that Hudelson's study at Minnesota is in general agreement with other studies of that period. He feels, however, that the study points out additional considerations that should be examined. Further studies should include these requirements: There should be two sections in the same course, a large and small one, each taught by the same instructor. The classes should meet at approximately the same time of day and the order of meeting should be reversed at midpoint. The students should be carefully matched on the basis of prior knowledge of the subject, sex, intelligence, classification, and scholarship.

Referring to Hudelson's statistical technique of matching pairs of students, Kidd comments that students cannot be truly matched, even when using the best known methods. As the number of variables to be considered increases, a larger number of students will have to be discarded because they cannot be paired with other students. The process of discarding the unmatched students may influence the results of the experiment. An instructor is not likely to behave in the same manner in a large and small class; therefore, the instruction to both groups may not be identical. Both of these assumptions are basic to Hudelson's experiment.

The Committee of Class Size at Ball State Teachers College, Muncie, Indiana, (Shively, 1950) conducted a rather extensive review of literature relative to class size. In reviewing Hudelson's experiments they point out that insofar as grades are concerned class size makes no difference--at least in classes from 20 to 150 or more. The Committee

makes these comments on page 47:

> Much has been written and more has been said about the Minnesota studies, both for and against. It is doubtful that Hudelson was very popular with his colleagues for awhile. But facts are facts and he seems to have a lot of facts. Many have pointed out, however, that the Minnesota studies did not consider important aspects of class size problems such as: (1) wear and tear on teacher; (2) lack of personal contact; (3) interest of students in further study of a subject; and (4) measurement of other factors than facts, etc.

The Committee, after observing that class size does not seem to make a difference in student achievement, made the following revealing recommendations:

(1) small classes are more desirable than large classes when effective teaching is desired. Classes larger than 30 usually do not provide for optimum teacher-pupil relationships; and,

(2) the college should attempt to establish classes not exceeding 35 students.

Summary of the Early Experimental Period in Class-Size Experiments

The period 1916 to 1930 seems to have been the period of the most active interest in the problems of class size. During this period the emphasis appears to have been on the academic achievement of various sizes of classes. The most notable and extensive investigations were those of Hudelson and his associates. His conclusion seems to summarize quite well this period of research when he states: "In the light of all available evidence, class size seems to be a relatively minor factor in educational efficiency, measured in terms of student achievement."

Morgan (1930), however, feels that the impression in certain quarters that larger classes result in as much or more learning at reduced

educational costs is not true. He feels that no studies thus far have succeeded in getting to the "heart" of the issue. He states, on page 56, that education is: "fundamentally a question of character growth, and anyone with half an eye knows that it takes intimate personal attention to quicken the spirit and school character of young folk."

The Refined Experimentation Studies Period (1931 to the Present)

About one-hundred years ago a frequently repeated definition of a university was Mark Hopkins at one end of a log and a student at the other. There seems to be a rather unanimous feeling among teachers that a relatively small class (20 or 25 students) provides the optimum atmosphere for learning. A class of this size enables a closer personal relationship between the student and instructor. A small class may decrease the wear-and-tear effect on the instructor and enable him to be more energetic in his efforts to promote learning.

Cherrington (1955) approaches the topic with this statement on page 90:

> The question, How many students can an instructor teach? is one which instructors find difficult to approach in an impersonal manner, and one which brings forth a variety of answers. My experience shows that a class of twenty students is the best size. We get more done; we progress faster; we have more discussion; the student learns most in a class of twenty. As the number increases the rate of learning declines because discussion diminishes, I get around the class less frequently, and we have less written work.

Cherrington later defines the optimum class size as being determined by the amount of browbeating and prodding necessary to bring about the desired results.

One current view of the optimum class size seems to be best expressed by Gross (1961) when he states on page 58: "The right number? There is none. It varies with the subject, with the teacher, and with a lot of things."

In a similar vein, French (1946) declares that there is no single standard that can be applied to determine the optimum number of students each class should contain. He suggests that a larger number of students could possibly be enrolled in a typing course than in an English class. A motion picture could be viewed by a whole auditorium of students instead of being restricted to a smaller group. He feels, however, that if discussion is the predominant activity, the class should be smaller.

In an attempt to clarify the more recent experiments and observations concerning class size, this writer has selected surveys of recent findings. Selected experimental studies that are recent and (in the opinion of the writer) typical will also be described.

Otto and von Borgersrode (1950) completed a survey of class size relative to academic achievement in 1940 and found that practically all subjects in the elementary and secondary school curriculum have been studied. Many subjects in higher education have also been covered. Of the more than 250 studies surveyed, 73 were deemed to be based on valid procedures. The following are their conclusions as stated on page 214:

> 16.4 per cent were reported as significantly in favor of large classes; 23.3 per cent in favor of large classes but not significantly so; 38.4 per cent in favor of neither; 17.8 per cent in favor of small classes but not significantly so, and 4.1 per cent in favor of small classes. On the whole the statistical findings definitely favor large classes at every level of instruction except kindergarten.

Otto and von Borgersrode concluded that the experimental evidence to date places the burden on those who advocate small classes.

Blake (1954) surveyed an additional 85 studies during the same decade and arrived at these conclusions:

The smaller the class the better. . . . . 35 studies

The larger the class the better . . . . . 18 studies

No case either way. . . . . 32 studies

Blake maintains that only 22 of the above 85 studies are valid. This was ascertained by utilizing criteria designed to determine the validity of the studies. Of the 22 studies considered to be valid, 16 favored small classes, three favored large classes, and three were inconclusive.

Jamison (1943) also fails to support the earlier contention that large classes are as effective as small classes in terms of academic achievement. Of the more than 250 studies since 1900, Jamison states that only about 70 can be considered experimental in nature. Of these, about 20 included controlled conditions. On the basis of the pupil outcomes measured, the results are inconclusive and do not favor either large or small classes when pupil achievement is measured. In one controlled experiment Jamison reports that teachers considered 31 to be the appropriate size for elementary classes. When teaching classes of this size, more was known about individual differences, health, and socio-economic status. Classes of this size also enabled more class discussion and participation than larger classes.

McKenna (1957) reports a summary of extensive studies conducted at Teachers College, Columbia University. This report also tends to refute the notion that large classes are as effective as small classes. It was found that students were more adaptable to change in small classes and exhibited more creativity. Pupils in small classes have more of an opportunity to receive individual attention. Small classes

are more likely to have a greater variety of instructional techniques. On this point, McKenna states on page 438:

> On every criterion used, small classes had the advantage over the large ones. In all small classes, there was more group work, more informality, and more opportunity for interaction of all kinds. In most small classes many enrichment materials were used, while three-fourths of the larger classes were totally 'textbook' classes. The typical small class made greater use of dramatizations, special publications, and similar devices to make subject matter more meaningful.

It seems evident that some recent studies and surveys indicate findings contrary to those of earlier reports. Shane (1961) states that large-class students in higher education retain more of the subject matter a year or more after the course is completed than small-class students. However, he continues with this statement: "Small classes foster more educational innovations, greater individual attention to pupils, and better teaching methods than do larger classes."

Perry (1957) experimented with six sections of beginning geography at Miami University, Oxford, Ohio. The experimental classes ranged from 30 to 125 and the variables utilized for control purposes were the results of the Cooperative English and Mathematics Tests, the American Council on Education examination, grade-point averages for the first year, and I. Q. No statistical difference was found when student achievement was measured. The results of a questionnaire completed by each student revealed these attitudes:

(1) students think they learn more in small classes,

(2) the majority of students preferred small classes and felt they had a more personal relationship with the instructor,

(3) students in small classes were more attentive and attended class more regularly than students in large classes, and

(4) the students thought the teaching during the experiment was superior to other instruction at the college, based on their experiences with other instructors in other classes.

Peterson (1960) experimented with large classes of 250 students meeting in the auditorium at Orange Coast College, Costa Mesa, California. The experiment was conducted in order to make plans for an expanding enrollment. The experimental classes were in American History and the only variable that is mentioned in the report is class size. These steps were followed in the experiment:

(1) the instructor was given more time to prepare for the classes,

(2) assistants were available to aid in the grading and record-keeping duties involved,

(3) visual aids were used extensively,

(4) students attended the large lecture groups two hours per week and were divided into smaller groups (25-30) one hour per week, and

(5) the instructors of the large and small groups coordinated their activities relative to instructional techniques and methods.

Although no statistical difference was discovered these general conclusions were stated concerning the experiment and the attitudes of the students:

(1) the students were enthusiastically in favor of the larger classes,

(2) over 80 per cent of the students thought they learned more in the large groups,

(3) there was no appreciable difference in the dropout rate between large and small groups,

(4) over 90 per cent of the students said they would recommend large classes to their friends, and

(5) only five per cent of those enrolled in the large class switched to the small class for the completion of the second half of the course the following semester.

Rohrer (1957) reports an experiment at the University of Oklahoma in a beginning course in American Government. The project involved three instructors. Instructors A and B had a large and a small class and Instructor C had two small classes--one of which was taught by the lecture method and the other by the discussion method. The variables that were controlled were:

(1) sex,

(2) age,

(3) veteran or non-veteran status,

(4) college classification (freshman, sophomore, etc.),

(5) aptitude as measured by the Ohio State Psychological Examination,

(6) prior knowledge of American Government at the beginning of the course as measured by the Cooperative American Government Test, and

(7) the subject matter taught in all sections.

The results of the experiment were not statistically significant when comparing the achievement of the groups involved. Rohrer makes this comment on page 279 pertaining to the results:

> The most significant finding of this study is the amount of achievement, as measured by standardized tests, and the attitudes of students toward American Government, varied as a function of the course instructor and did not vary as a function of size of class.

Husband (1949) experimented with General Psychology classes at Iowa State College. This experiment covered two regular college years and involved 1,700 undergraduate students. The author taught all of the classes and each semester had one large class ranging from 180 to 300 students and one or more smaller sections ranging from 30 to 60. He does not indicate any variables controlled other than those just cited. He found that the small classes provided more opportunities for discussion, more informality in presentation of material, and more class time available for recitation. There were no statistically significant differences in the results but the advantage was in favor of the large classes five times out of six. Husband concludes on page 216:

> It is evident, stated conservatively, that large lectures do not hamper sheer academic earnings of students. The necessary impersonality did not lead to lessened motivation, nor did lesser opportunity to ask questions appear to leave gaps in knowledge. On the instructor's side, it may be that a larger audience causes him to prepare more carefully, and to do a better and more enthusiastic job of teaching. Less discussion also frees the entire hour for formal presentation. It must be admitted that non-informational factors, which may constitute an important future benefit of the course are not measurable.

Nelson (1959) designed an experiment at Kansas State University to determine whether elementary economics can be taught as effectively in large classes as in small classes. The experiment involved four different instructors--each teaching a large and small class of Economics I. The sections were matched, insofar as was possible, on the basis of the student's school (the area of his major), student classification, and sex. Any remaining differences in student ability were eliminated or controlled through analysis of covariance. The variable considered most important was the cumulative grade-point average and this was utilized in equating the groups. Presentation of material in the large

groups was primarily straight lecture, while the small groups engaged in a discussion-recitation procedure. The two classes were treated in the same manner in that they were presented the same material and took the same tests. The means of measurement included a pre-test, interim tests, and a post-test. When the gain in mean scores was adjusted for student differences, there was no statistically significant difference in the results. Nelson discovered that: "Student achievement was as great in large sections of from 85 to 140 as in small sections of 16 to 20." Nelson qualifies the foregoing statement by remarking on page 338 that:

> For the four instructors involved, teaching the courses they taught and using the teaching techniques they employed, large classes of from 85 to 140 can be taught as effectively as small classes of 16 to 20.

Nelson continues with a criticism of his study by noting there might have been important variables not controlled. Assuming that uncontrolled variables were present and did influence the results, Nelson feels that these uncontrolled variables would continue to influence future related studies in the same manner--thus, the conclusion is still valid; no significant difference between large and small classes. Again we hear a familiar ring when Nelson points out on page 339 that: "Presumably the advantages of small classes stem primarily from the intimate student-instructor relationship which they permit or promote."

Long and Perry (1961) reported that the size of classes at the City College of New York had been restricted to 20 or 30 students for many years. More recently, classes range from 25 to 35. Experiments were conducted in the areas of History II, a basic drafting course, Mechanics of Material I, and Fluid Mechanics I. The large and small classes ranged from 35 to 148 and were equated on the basis of American

Psychological Examination scores, Entrance Composite scores (high-school averages and entrance examination scores), and college grade-point averages. The results of the experiment can be described by the statement on page 63 that: "The results of the studies at City College can be summarized by saying that increasing class size did not produce any adverse effects."

In an attempt to determine whether a well-qualified teacher could teach as effectively in classes larger than the traditional 30, Cammarosano and Santopolo (1958) conducted an experiment at Fordham University. The experiment involved classes in Principles of Economics, Introduction to American Government, and Introductory Sociology. Two classes were established in each course consisting of a small class of 30 and a large class of 60. The classes were equated on the basis of high-school and college grade-point averages. Each pair of test sections was taught by the same instructor and by the same method of instruction. Assistants were utilized to aid in the routine clerical duties involved. The means of measurement were routine quizzes, written assignments, and examinations. The only statistically significant difference was in sociology in which the small class surpassed the large class. The conclusion of the investigators is that a large class with a well-qualified teacher will equal the achievements of a small class with a well-qualified teacher. The participating teachers in the experiment were asked to indicate their reactions to teaching larger classes. The reactions may be summarized as follows:

(1) informality was more difficult to establish in the large classes,

(2) it was more difficult to engage in discussion in the large

classes, and

(3) there was a diminished degree of intimacy because of the routine duties performed by the assistants. The teachers felt they became better acquainted with the students by checking the attendance and performing other related duties.

Size of class and enjoyment of teaching is a topic discussed by McKeachie and Bordin (1961). Their major premise is that one of the major variables in educational effectiveness is the professor's enjoyment of teaching. A source of enjoyment to many professors is the interaction that takes place in a classroom. With ample opportunities for questions and discussion, it is possible to see young people develop and grow. Large classes do not lend themselves readily to this type of interchange between the professor and his students. In smaller classes, professors may be more inclined to utilize term papers, essay tests, and other evaluative techniques; consequently, they may become more familiar with each student's abilities and limitations. McKeachie and Bordin feel that enjoyment of teaching is very important, not only for the growth of his students, but for the growth of the professor as well. They maintain that some of the "important values are likely to be lost if teaching becomes so routine and impersonal that it is no longer enjoyable."

Sachar (1960) also defends the small class. He asserts on page 424 that:

> It is as easy to speak to 200 as to 50, but the essence of the educational experience is not the lecture; it is the faculty-student personal relationship. When the student body is materially increased at the same time that the faculty is decreased to achieve more economic operations, the personal relationship virtually disappears, except for an infrequent office appointment.

Sachar feels that a university must maintain a close personal relationship between the instructor and the student; it must not be allowed to develop into a department-store function with mass merchandising in college teaching.

Summary of the Refined Experimental Studies Period in Class-Size Experiments

In summary, the review of literature of this era indicates that many studies were conducted relative to class size and that the basic premise has not changed--when measured by academic achievement, class size does not seem to make a difference. However, the consensus of opinion of the researchers does not overwhelmingly support this conclusion. Some of the reports seem to indicate a much more favorable attitude toward smaller classes, especially when variables other than academic achievement are considered. One variable that received considerable attention during this period was that of the teacher-student relationship. It was generally believed that smaller classes promoted more personal instructor-student relationships and resulted in more discussion-recitation activities.

Students were given the opportunity in several studies to express their opinions relative to the size of classes preferred. The reports are contradictory--one survey reveals that students prefer small classes while another study reports the opposite. The current trend seems to indicate the majority of students prefer small classes. Students are more attentive in large classes, according to one study, while another study reports many students enjoy the anonymity of large classes--because they could be less attentive.

This period might be best summarized by Otto and von Borgersrode's (1950) statement that the burden of proof is still on the advocates of the small classes.

Summary of Class-Size Experiments

Beginning with the first experiment of Rice (1902) and continuing throughout all the experiments conducted since, there seems to be one primary conclusion that can be accepted by most experimenters and observers. Out of the more than 300 studies surveyed thus far the general consensus of opinion seems to be that large classes do not adversely affect academic achievement. The majority of studies support this conclusion although there are a few studies that report contradictory results in favor of small classes.

Following the development of intelligence and standardized tests, experimenters were provided with more scientific methods of conducting their studies, but once again, the results indicated no significant differences between large and small classes. The decade of 1920-1930 was the period of the most intensive investigation in class-size experiments. During this period the focus of attention shifted slightly away from the concentration on academic achievement and began to consider other variables affecting the total education of the student.

The Hudelson (1928) studies instigated many published comments--some authors agreeing with him because he seemed to have all the "facts" and others disagreeing with him for various reasons. Those who disagreed with him may have done so for personal reasons; many teachers did not want to change from the traditional class of 25 students. Others disagreed because of the lack of intimacy inherent in a large

class.

From 1930 to the present time researchers have attempted to devise more sophisticated research designs in order to control all possible variables. Statistical techniques, such as analysis of covariance, have enabled researchers to equate intact groups statistically. In general, the later investigations are probably more valid because the variables were more adequately controlled.

An examination of the later experiments reveals a number of concurring conclusions and a number of contradictory conclusions. For example, in small classes tests are given more frequently and are less likely to be of the objective type (True-False, etc.). In larger classes the instructor is less likely to establish a close personal relationship with his students. The instructor of a small class, conversely, is more likely to know more about the health, abilities, and socio-economic status of his students.

One advantage accruing to the large class is that the instructor will probably be better prepared and present the material in a more organized manner, while in a small class he may be more inclined to stray from the main topics.

Some observers pointed out that the most important classroom variable was the instructor.

The findings throughout the study are, to some degree, contradictory. Perhaps Gross (1961) made the most pertinent observation when he noted on page 58: "The right number? There is none. It varies with the subject, with the teacher, and with a lot of things."

CHAPTER III

RESEARCH DESIGN AND PROCEDURES

Selection of Students

The curriculum of Northeastern State College normally includes eight sections of Principles of Accounting 213 during the fall semester and six sections during the spring semester. An attempt is made to limit the number of students to 30 or less in each section. This is not always possible depending on the demand for the classes. It has been ascertained from past experience that the nine, ten, and eleven o'clock sections are most in demand because of the number of commuters attending Northeastern State College. The classes meet five days a week for 50 minutes each period. Three days each week are devoted to lectures and illustrations by the instructor, and two days are utilized as laboratory periods. The instructor attends all laboratory sessions to assist students on an individual basis.

The author selected the nine and ten o'clock sections as the experimental groups. Since these hours are popular, it was felt that there would be no difficulty in obtaining the number of students required for the experiment. Students were allowed to enroll in any section of accounting that they preferred until the maximum number necessary for the experiment had been obtained. This method of selecting students does not provide a "pure" random sample but as Popham (1967)

indicated it is often necessary to experiment with "intact" groups because of the inability to rearrange the students' schedules.

Northeastern State College is a non-selective college (any high-school graduate may enroll), therefore, the attrition or drop-out rate is usually higher than that of colleges and universities that utilize selective techniques in accepting students. Table I indicates the number of students enrolling in the experimental classes, the number completing the course, and the drop-out rate during the experiment.

Research Design--Analysis of Covariance

The statistical technique utilized was analysis of covariance. Van Dalen (1966) stated on page 259 that:

> Because of the difficulties that arise when matching procedures are employed, educators are grateful for the development of procedures that enable them to control variation in the experimental and control groups through an analysis of covariance. This statistical tool enables an E to adjust T_2 mean scores to compensate for a lack of original equivalency between groups that is discovered when T_1 is given or that arises during the experiment.

Garrett (1958) also stated on page 295:

> Covariance analysis is especially useful to experimental psychologists when for various reasons it is impossible or quite difficult to equate control and experimental groups at the start: a situation which often obtains in actual experiments. Through covariance one is able to effect adjustments in final or terminal scores which will allow for differences in some initial variable.

The variables utilized in controlling the individual differences of the students were: (1) pre-test scores, (2) ACT_1 scores, (3) ACT_2 scores, (4) ACT_3 scores, (5) ACT_4 scores, and (6) ACT_5 scores.

Individual t values were computed to ascertain the original equivalency of the two groups each semester as shown in Tables II and III.

TABLE I

SIZE OF SAMPLE

	Large Classes						Small Classes					
	Enrollment	Classification 1	2	3	4	Present at Final Rating	Enrollment	Classification 1	2	3	4	Present at Final Rating
First Semester	72	18	22	8	2	50	25	11	3	2	0	16
Second Semester	73	13	27	9	2	51	25	7	9	2	0	18
Totals	145	31	49	17	4	101	50	18	12	4	0	34
Percent in Attendance at Final Rating				69.7%						68.0%		

An analysis of covariance was used to determine the gain in adjusted mean scores for each class while holding the variables constant. The analysis of covariance tables are shown in Appendix E and the data for the computation of t values are shown in Appendices C and D.

Procedures

Development of Tests

The pre- and post-test was constructed from objective tests supplied by the authors of the textbook utilized in the accounting classes involved in the experiment. These tests have been administered to many accounting students throughout the nation and are revised periodically to prevent "leakage" of information. The authors, because of this periodic revision, are able to eliminate ambiguous phraseology to a large extent. The authors were contacted as to the reliability and validity of the tests and they reported that efforts were being made to establish national norms for the examinations but the data were not currently available. This author selected test items from the objective tests in an attempt to develop a test that would measure existing accounting knowledge of the experimental groups at the beginning and also at the end of the course. Questions were selected from each objective test covering the first thirteen chapters of the accounting textbook. An effort was made to select questions that were indicative of the material to be covered in the classes under investigation. This test is shown in Appendix A.

Administration of the Test

The test was administered during the first class meeting each

semester and during the last class meeting of each semester. Students enrolling late in the course were required to take the examination before attending any of the accounting classes. The author made notation of the time required by the students in completing the test and found all students had adequate or more than adequate time in attempting to answer each item on the test. Thus, the test was not a "power" test. Any student who did not take the post-test was, out of necessity, excluded from the experiment.

Validity of the Pre- and Post-Test

Concerning validity Guilford (1965) stated on page 470:

> The question of validity, of a test or of any measuring instrument, has many facets, and it requires clear thinking not to be confused by them. In crudest terms, we say that a test is valid when it measures what it is presumed to measure. This is, however, but one step better than the definition that states that a test is valid if it measures the truth.

Gronlund (1965) stated on page 59 that:

> Validity refers to the extent to which the results of an evaluation procedure serve the particular uses for which they are intended. If the results are to be used to describe pupil achievement, we should like them to represent the specific achievement we wish to describe, to represent all aspects of the achievement we wish to describe, and to represent nothing else.

In constructing the test for this experiment, the author was interested in determining the gain in academic achievement in elementary accounting of those students participating in the experiment. As previously mentioned, the test was constructed from tests developed by Niswonger and Fess (1965). The test was then submitted to a panel of four Certified Public Accountants, all of whom had had educational experience in the particular course involved in the experiment. It was

their professional opinion (see Appendix F) that this test was valid for this particular research project.

Reliability of the Test

Gronlund (1965) stated on page 79 that:

> Next to validity, reliability is the most important characteristic of evaluation results. . . Reliability (1) provides the consistency which makes validity possible, and (2) indicates how much confidence we can place in our results.

Gronlund (1965) described four methods of determining the reliability of a test: (1) test-retest method, (2) equivalent-forms method, (3) split-half method, and (4) Kuder-Richardson method. The test-retest method involves giving the same test to the same group of students with a given time interval between the two administrations. This method could not be utilized in the experiment because of the intervening accounting instruction between the administrations of the test. In referring to the equivalent-forms method, Gronlund (1965) made this comment on page 84: "It should be noted that the coefficient of equivalence tells us nothing about the stability of the pupil characteristic being measured." Gronlund also stated on page 85 concerning the split-half method that: "However, like the equivalent-forms method, it tells nothing about changes in the individual from one time to another."

For the purpose of this study, the Kuder-Richardson method was utilized in determining the reliability of the test. Gronlund (1965) made these comments about the Kuder-Richardson method on page 85:

> Another method of estimating the reliability of test scores from a single administration of a single form of a test is by means of formulas such as those developed by Kuder and Richardson. These formulas also provide a <u>coefficient of internal consistency</u> but they do not require

> splitting the test in half for scoring purposes. One of the formulas, called the Kuder-Richardson Formula 20, is based on the proportion of persons passing each item and the standard deviation of the total test scores. The computation is rather cumbersome, unless information is already available concerning the proportion passing each item, but the resulting coefficient is equal to the average of all possible split-half coefficients for the group tested.

Gronlund (1965) also made this statement on page 86: "The simplicity of applying the split-half and the Kuder-Richardson method has led to their widespread use in estimating reliability."

Guilford (1965) made this statement on page 458 relative to determining the reliability of a test:

> In accordance with item theory, the Kuder-Richardson (K-R) formulas for estimating r_{tt} depend upon item statistics. They were developed because of dissatisfaction with split-half methods. A test can be split into halves in a great many ways, and each split might yield a somewhat different estimate of r_{tt}. The use of item statistics gets away from such biases as may arise from arbitrary splitting into halves.

Guilford (1965) indicated that the use of the Kuder-Richardson formula probably results in an underestimate of the reliability of the test.

Garrett (1952) made these comments pertaining to the Kuder-Richardson formula on page 385:

> The Kuder-Richardson formula will give a satisfactory approximation to the test's reliability, however, even when the test items cover a wide range of difficulty. This formula always underestimates to a slight degree the reliability of a test as found by the split-half technique and the Spearman-Brown formula, and the more widely items vary in difficulty the greater the underestimation. This formula provides a minimum estimate of reliability--we may feel sure that the test is at least as reliable as we found it to be by the Kuder-Richardson formula.

In addressing himself to how high the self-correlation of a test should be, Garrett (1952) made these comments on page 387:

> How high should the self-correlation of a test be in

> order for the reliability of the test to be considered satisfactory? This is an important question, and its answer depends upon the nature of the test, the size and variability of the group tested, and the purpose for which the test was given. To distinguish reliably between the means of two relatively small groups of narrow range of ability (for example, a fifth grade and a sixth grade) a reliability coefficient need be no higher than .50 or .60. If the test is to be used to differentiate among the individuals in the group, however, its reliability should be .90 or more.

The reliability of the test, as computed by the Kuder-Richardson formula was .80. This computation may be seen in Appendix B. Since both Garrett (1952) and Gronlund (1965) indicated that this formula produces an underestimation of the reliability of a test, it seems safe to assume that the test is at least this reliable.

Development of the Opinionnaire

The author was aware that the consideration of academic achievement is only one of a number of factors that constitutes the students' total educational experiences. Other variables affecting the student's educational growth include his interest in further study in the academic area, his ambitions, his perceptions and evaluation of himself, the class, and the instructor. The measurement of academic achievement alone would very probably result in a clinical study in which the students' hopes, fears, interests, anxieties, and the general objectives of the course would be, to some extent, ignored.

In an attempt to give recognition to other variables, the author administered an opinionnaire to each of the experimental classes to obtain some information relative to the students' opinions regarding variables other than academic achievement. This opinionnaire is a modification of other opinionnaires found to be valid. Implanted in the

opinionnaire are questions designed to give recognition to such variables as the student's feelings of self importance, his opinion of the instructional techniques employed, his opinion of the instructor, the extent to which he engaged in daydreaming during class periods, and the degree of motivation he experienced in pursuing the necessary assignments for the course. One variable that should not be overlooked is the retention of subject matter after a period of time has passed.

Siegel (1960) conducted an experiment at Miami University pertaining to academic achievement. He measured retention of subject matter after one or more years had passed and found there was no significant difference between those who had been in large or small classes. He stated on page 13 that:

> Hence, it appears, within the limits of the present investigation, that retention of subject matter a year or more after completion of a course is not adversely affected by increased class size or by the particular instructional procedures used.

Regarding educational objectives Levin (1967) stated on page 89 that: "attitudes generally considered favorable for the attainment of educational objectives were found to a greater degree in the small control classes than in the large experimental groups."

The opinionnaire utilized in this study was considered to be ancillary to the main research topic (the measurement of academic achievement in elementary accounting), therefore the results are conveyed by utilizing a percentage rating. (See Table IV.) The opinionnaire was administered during the last class meeting and the students were afforded complete anonymity in their responses.

CHAPTER IV

ANALYSIS AND DISCUSSION OF DATA

The analysis of the data pertinent to the experiment is compiled and summarized in the following fashion: (1) Table II presents the data related to the first-semester experiment; (2) Table III presents the data related to the second-semester experiment; and (3) Table IV reports the results of the student opinionnaire. Following Table II and Table III is a detailed explanation of the statistical values obtained and the level of significance required to accept or reject the null hypothesis.

Tables II and III reveal the mean differences of the large and small classes and the *t* value of each controlling variable. Appendices C and D should be consulted in interpreting the adjustment in post-test mean scores.

Pre-Test Scores

The pre-test administered during the first-semester experiment indicated the small class was initially superior to the large class. Mean class scores: small class, 29.13; large class, 24.12. A *t* value of 2.00 was required to reject the null hypothesis utilizing a two-tailed test. Since the direction in mean scores could not be predetermined, the two-tailed level of significance was material to the analysis of the pre-test scores. However, the computed *t* value of 1.67 did

TABLE II

LARGE VERSUS SMALL CLASSES PERFORMANCE MEASURES
--FIRST SEMESTER

Item	Mean Scores			
	Large	Small	"t"	Significance
Pre-test	24.12	29.13	1.67	NS
ACT_1	16.94	18.69	1.33	NS
ACT_2	16.34	15.06	.82	NS
ACT_3	17.36	17.50	.09	NS
ACT_4	17.56	17.94	.24	NS
ACT_5	17.20	17.44	.23	NS
[1]Post-test	58.98	65.69	2.06*	S
[2]Post-test	59.69	63.46	1.15	NS
Absences	2.54	2.44	.17	NS

*statistically significant differences

t $p = .05$ two-tailed 2.00

[1]Post-test scores when not adjusted for covariables.

[2]Post-test scores when adjusted for covariables.

TABLE III

LARGE VERSUS SMALL CLASSES PERFORMANCE MEASURES
--SECOND SEMESTER

Item	Mean Scores			
	Large	Small	"t"	Significance
Pre-test	16.59	18.11	.60	NS
ACT_1	16.96	15.28	1.28	NS
ACT_2	17.45	15.44	1.18	NS
ACT_3	18.96	15.56	1.88	NS
ACT_4	19.31	17.78	.95	NS
ACT_5	18.29	16.11	1.71	NS
[1]Post-test	56.04	56.61	.15	NS
[2]Post-test	55.78	57.34	.40	NS
Absences	5.20	2.56	2.09*	S

*statistically significant differences

t $p = .05$ two-tailed 2.00

[1]Post-test scores when not adjusted for covariables.

[2]Post-test scores when adjusted for covariables.

approach the table t value of 2.00.

Differences, also favoring the small class, were revealed by the pre-test administered to the classes during the second-semester experiment. Mean class scores: small class, 18.11; large class, 16.59. The computed t value of .60 was not significant at the .05 level.

ACT_1 Scores

The ACT_1 scores (those scores pertaining to the English proficiency of the students) indicated that the small class was superior to the large class in the first-semester experiment. Mean class scores: small class, 18.69; large class, 16.94. The computed t value of 1.33 was not significant.

Conversely, the mean score for the large class exceeded the mean score for the small class during the second-semester experiment. Mean class scores: small class, 15.28; large class, 16.96. The computed t value of 1.28 is not significant at the .05 level.

ACT_2 Scores

The large class was superior to the small class in mathematical ability according to the ACT scores. In the first semester experiment the large class had a mean score of 16.34, while the small class had a mean score of 15.06. The computed t value of .82 was not significant.

In the second-semester experiment, the large class also exceeded the small class in mathematical ability, as reflected by the ACT scores. Mean scores: small class, 15.44; large class, 17.45. The computed t value of 1.18 was not significant. Some degree of mathematical proficiency is instrumental in the successful undertaking of an accounting

course, but the differences in mean scores did not seem to be sufficiently large to indicate a significant difference.

ACT_3 Scores

The ACT_3 scores (relating to the students' abilities in Social Science) favored, by a very small margin, the small class in the first-semester experiment. Mean scores: small class, 17.50; large class, 17.36. The t value of .09 did not approach the table t value of 2.00.

The ACT_3 scores for the second-semester experiment were much more favorable to the large class. Mean scores: small class, 15.56; large class, 18.96. The computed t value of 1.88 did approach the critical level of 2.00 but was not significant.

ACT_4 Scores

The ACT_4 scores (Natural Science) revealed that the small class was superior, again by a very small margin, in the first-semester experiment. Mean scores: small class, 17.94; large class, 17.56. The computed t value of .24 was not significant.

However, the large class exceeded the small class in the second-semester experiment. Mean scores: small class, 17.78; large class, 19.31. The computed t value of .95 was not significant.

ACT_5 Scores

The ACT_5 scores (the composite or mean of the ACT_1, ACT_2, ACT_3, and ACT_4 scores) were slightly in favor of the small class in the first-semester experiment. Mean scores: small class, 17.44; large class,

17.20. The computed *t* value of .23 was not significant.

Again, the large class exceeded the small class in the second-semester experiment. Mean scores: small class, 16.11; large class, 18.29. The computed *t* value of 1.71 was not significant although it did approach the 2.00 level.

Post-Test Scores (Unadjusted for Covariables)

The small class was significantly superior to the large class in the first-semester experiment when no adjustments were made for the covariables. Mean scores: small class, 65.69; large class, 58.98. The computed *t* value of 2.06 exceeded the critical-ratio level of 2.00--thus, when no other factors than the unadjusted mean scores were considered, there was a statistically significant difference in favor of the small class.

The small class was also superior to the large class in the second-semester experiment, when only the mean scores were compared--but by a much smaller margin. Mean scores: small class, 56.61; large class, 56.04. The computed *t* value of .15 was not significant.

Post-Test Scores (Adjusted for Covariables)

When the post-test scores were adjusted utilizing the analysis of covariance technique, it was discovered that the first-semester experiment did not result in a statistically significant difference. Mean scores: small class, 63.46; large class, 59.69. The computed *t* value of 1.15 was not significant.

The adjusted mean scores for the second-semester experiment were: small class, 57.34; large class, 55.78. The computed *t* value of .40

was not significant.

The F Values (computed by the analysis of covariance technique) revealed these results: first-semester experiment, 1.595; second-semester experiment, 0.189. The F Value would have had to exceed 4.00 in order to be significant at the .05 level of confidence.

The results indicated that in this particular experiment there was no statistically significant difference in the academic achievement of the classes investigated. The difference in academic achievement (although not statistically significant) was in favor of the small class during each of the two semesters.

Absences

The first-semester experiment indicated no significant difference in absenteeism when the means were compared. Mean scores: small class, 2.44; large class, 2.54. The computed *t* value of .17 was not significant.

The second-semester experiment revealed a significant difference in absenteeism. Mean scores: small class, 2.56; large class, 5.20. The computed *t* value of 2.09 was significant at the .05 level. It should be mentioned that five students in the large class were seriously injured in automobile accidents but were able to complete the course although they were absent many times. Also, a minor epidemic of influenza seemed to cause more absences in the large class than in the small class. (This statement reflects an observation of the author and is not based on fact.)

Analysis of Student Opinionnaire

The following observations are judgemental in nature, and it should be recognized that the response of a student in a small class will affect the results much more than the response of a student in a large class. Since this opinionnaire is ancillary to the main topic, no attempt was made to utilize critical-level statistical techniques.

Q1. Approximately how many large classes have you attended in college?

During the first-semester experiment it was discovered that the students in the small class had been enrolled in an average of 3.44 large classes. The students in the large class had been enrolled in an average of 6.89 large classes. The second-semester data indicated that the students in the small class had been enrolled in 7.05 large classes while the students in the large class had been enrolled in an average of 7.18 large classes.

Q2. Approximately how many small classes have you attended in college?

In the first-semester experiment, the students in the small class had been enrolled in an average of 4.44 small classes. The students in the large class had been enrolled in an average of 5.26 small classes. The second-semester data indicated that the students in the small class had been enrolled in an average of 8.21 small classes while the students in the large class had been enrolled in an average of 5.92 small classes.

Q3. How secure did you feel in this class?

The students in the smaller classes tended to be more secure than

TABLE IV

ANALYSIS OF STUDENT OPINIONNAIRE ON A PERCENTAGE BASIS

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q3	How secure did you feel in this class?		Very Secure	Moderately Secure	Very Insecure	
	First Semester:					
	(a) Large Class	53	09.40	84.90	05.70	100
	(b) Small Class	16	31.20	68.80	00.00	100
	Second Semester:					
	(a) Large Class	51	29.41	62.75	07.84	100
	(b) Small Class	19	52.63	47.37	00.00	100
Q4	How many distractions were there in your class?		Many	Some	Very Few	
	First Semester:					
	(a) Large Class	53	00.00	34.00	66.00	100
	(b) Small Class	16	00.00	06.25	93.75	100
	Second Semester:					
	(a) Large Class	51	01.96	47.06	50.98	100
	(b) Small Class	19	00.00	10.53	89.47	100
Q5	How difficult was it to concentrate in your class?		Very Difficult	Sometimes Difficult	Rarely Difficult	
	First Semester:					
	(a) Large Class	53	05.70	49.00	45.30	100
	(b) Small Class	16	00.00	25.00	75.00	100
	Second Semester:					
	(a) Large Class	51	00.00	45.10	54.90	100
	(b) Small Class	19	00.00	31.58	68.42	100

TABLE IV (Continued)

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q6	Did you feel that you had adequate personal contact with your instructor?		Frequently	Sometimes	Very Little	
	First Semester:					
	(a) Large Class	53	34.00	39.60	26.40	100
	(b) Small Class	16	62.50	25.00	12.50	100
	Second Semester:					
	(a) Large Class	51	29.41	49.02	21.57	100
	(b) Small Class	19	63.16	36.84	00.00	100
Q7	How highly motivated were you to prepare the outside assignments for this course?		Highly Motivated	Moderately Motivated	Seldom Motivated	
	First Semester:					
	(a) Large Class	53	30.19	52.83	16.98	100
	(b) Small Class	16	31.20	68.80	00.00	100
	Second Semester:					
	(a) Large Class	51	33.33	50.98	15.69	100
	(b) Small Class	19	36.84	52.63	10.53	100

TABLE IV (Continued)

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q8	How important (as an individual) did you feel in this class?		Very Important	Important	Very Unimportant	
	First Semester:					
	(a) Large Class	53	01.88	39.62	58.50	100
	(b) Small Class	16	18.70	68.80	12.50	100
	Second Semester:					
	(a) Large Class	51	01.96	60.79	37.25	100
	(b) Small Class	19	10.53	68.42	21.05	100
Q9	Did you feel that you were able to interrupt your instructor in order to ask questions as often as you liked?		Frequently	Sometimes	Rarely	
	First Semester:					
	(a) Large Class	53	56.60	22.60	20.80	100
	(b) Small Class	16	56.25	37.50	06.25	100
	Second Semester:					
	(a) Large Class	51	64.71	25.49	09.80	100
	(b) Small Class	19	73.69	21.05	05.26	100

TABLE IV (Continued)

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q10	Approximately how many personal consultations did you have with your instructor?		5 or More	Between 1 and 5	None	
	First Semester:					
	(a) Large Class	53	05.66	33.96	60.38	100
	(b) Small Class	16	00.00	25.00	75.00	100
	Second Semester:					
	(a) Large Class	51	00.00	45.10	54.90	100
	(b) Small Class	19	00.00	31.58	68.42	100
Q11	How frequently did you find yourself daydreaming in class?		Very Rarely	Sometimes	Frequently	
	First Semester:					
	(a) Large Class	53	45.30	45.30	09.40	100
	(b) Small Class	16	62.50	18.75	18.75	100
	Second Semester:					
	(a) Large Class	51	39.22	52.94	07.84	100
	(b) Small Class	19	63.16	36.84	00.00	100

TABLE IV (Continued)

Question	Number Responding	Percentage Rating by Class and Semester			
		%	%	%	Total
Q12 How effective do you think the instruction was in this course?		Very Effective	Sometimes Effective	Rarely Effective	
First Semester:					
(a) Large Class	53	77.40	22.60	00.00	100
(b) Small Class	16	93.75	06.25	00.00	100
Second Semester:					
(a) Large Class	51	78.43	17.65	03.92	100
(b) Small Class	19	89.47	10.53	00.00	100
Q13 How formal was the instructor in presenting the lectures?		Very Formal	Formal	Very Informal	
First Semester:					
(a) Large Class	53	09.40	43.40	47.20	100
(b) Small Class	16	18.75	31.25	50.00	100
Second Semester:					
(a) Large Class	51	09.80	52.95	37.25	100
(b) Small Class	19	05.26	52.63	42.11	100
Q14 How good was the instructor in dealing with students?		Very Good	Sometimes Good	Poor	
First Semester:					
(a) Large Class	53	88.70	07.50	03.80	100
(b) Small Class	16	87.50	12.50	00.00	100
Second Semester:					
(a) Large Class	51	88.24	09.80	01.96	100
(b) Small Class	19	89.47	10.53	00.00	100

TABLE IV (Continued)

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q15	If you had the opportunity to move to another section of this course early in the semester, how would you have felt about moving?		Would Liked to Have Moved	Would Have Made No Difference	Would Have Wanted to Remain	
	First Semester:					
	(a) Large Class	53	09.40	15.10	75.50	100
	(b) Small Class	16	12.50	00.00	87.50	100
	Second Semester:					
	(a) Large Class	51	05.88	11.77	82.35	100
	(b) Small Class	19	05.26	15.79	78.95	100
Q16	How well did you like this class?		Liked it Very Much	Neither Liked Nor Disliked it	Disliked it Very Much	
	First Semester:					
	(a) Large Class	53	64.10	32.10	03.80	100
	(b) Small Class	16	75.00	12.50	12.50	100
	Second Semester:					
	(a) Large Class	51	66.67	23.53	09.80	100
	(b) Small Class	19	73.68	26.32	00.00	100

TABLE IV (Continued)

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q17	If you take the second course in Principles of Accounting, in what size class would you prefer to enroll?		One Smaller Than This One	One About This Size	One As Large or Larger	
	First Semester:					
	(a) Large Class	53	58.50	39.60	01.90	100
	(b) Small Class	16	12.50	68.80	18.70	100
	Second Semester:					
	(a) Large Class	51	45.10	39.22	15.68	100
	(b) Small Class	19	00.00	94.74	05.26	100
Q18	In which size class do you feel you can earn the highest possible grade?		10 to 25	26 to 69	70 or More	
	First Semester:					
	(a) Large Class	53	50.90	32.10	17.00	100
	(b) Small Class	16	81.25	18.75	00.00	100
	Second Semester:					
	(a) Large Class	51	31.37	37.26	31.37	100
	(b) Small Class	19	84.21	15.79	00.00	100

TABLE IV (Continued)

	Question	Number Responding	Percentage Rating by Class and Semester			
			%	%	%	Total
Q19	How valuable were the lectures by the instructor?		Very Valuable	Moderately Valuable	Of Little or No Value	
	First Semester:					
	(a) Large Class	53	75.50	24.50	00.00	100
	(b) Small Class	16	93.75	06.25	00.00	100
	Second Semester:					
	(a) Large Class	51	70.59	27.45	01.96	100
	(b) Small Class	19	84.21	15.79	00.00	100
Q20	How valuable was the question-and-answer method used during selected periods?		Very Valuable	Moderately Valuable	Of Little or No Value	
	First Semester:					
	(a) Large Class	53	43.40	47.20	09.40	100
	(b) Small Class	16	50.00	50.00	00.00	100
	Second Semester:					
	(a) Large Class	51	29.41	64.71	05.88	100
	(b) Small Class	19	68.42	31.58	00.00	100

the students in the larger classes. A number of students in the large classes indicated they were very insecure, but the majority of all students seemed to be moderately secure.

Q4. How many distractions were there in your class?

The evidence indicated that there were fewer distractions in the small classes by a large margin. In the large classes students were more likely to enter the classroom after the discussion was in progress. Also, in the large classes, the greater number of students between a student and the instructor may have created distractions.

Q5. How difficult was it to concentrate in your class?

The students in the small classes seemed to have less difficulty in concentrating. This may have been because of the smaller number of students involved in the small classes and the reduced number of distractions.

Q6. Did you feel that you had adequate personal contact with your instructor?

The students in the small classes were more inclined to feel that they had adequate personal contact with the instructor. Approximately 20 per cent of the students in the large classes indicated they had very little personal contact with the instructor.

Q7. How highly motivated were you to prepare the outside assignments for this course?

The responses to this question were approximately the same. It

appears that size of class did not seem to affect the students' motivation to prepare outside assignments.

Q8. How important (as an individual) did you feel in this class?

The evidence indicated that the students in the small classes tended to feel more important than the students in the large classes. Approximately 40 per cent of all students in the large classes indicated that they felt very unimportant.

Q9. Did you feel that you were able to interrupt your instructor in order to ask questions as often as you liked?

Differences ascribed to answers to this item were negligible. It appeared that the students in all classes felt that they could usually ask the questions they desired. There was a slight advantage in favor of the small classes. The instructor noted that most questions were asked by a relatively few number of students in all sections. Some students did not ask a question during the semester.

Q10. Approximately how many personal consultations did you have with your instructor?

Responses to this item revealed that the students in the large classes had more outside consultations with the instructor. The difference, although slight, may have indicated that the students in the small classes had adequate personal contact during the laboratory periods.

Q11. How frequently did you find yourself daydreaming in class?

Here the responses indicated that the students in the large classes engaged in daydreaming more often than those in the small classes. The students in the large classes may have felt that the greater number of students and distance from the instructor allowed them to be non-attentive with less likelihood of detection.

Q12. How effective do you think the instruction was in this course?

The evidence seems to indicate that the students in the small classes thought the instruction was much more effective. The students in the small classes may have experienced a more personal relationship with the instructor and felt that they were receiving a greater degree of attention and supervision than the students in the large classes.

Q13. How formal was the instructor in presenting the lectures?

The responses to this item are difficult to interpret. The difference in the results are negligible and may have resulted from a misunderstanding of the term formal. One student may have regarded a lecture as formal while another student may have thought it to be informal.

Q14. How good was the instructor in dealing with students?

The responses to this item were almost identical. The majority of students in all the classes felt the instructor was very good in dealing with students.

Q15. If you had the opportunity to move to another section of this course early in the semester, how would you have felt about moving?

Answers to this question revealed a favorable acceptance of the classes in which the students were enrolled. If given the opportunity to move to another section early in the semester, the majority preferred to remain in their respective classes.

Q16. How well did you like this class?

The responses indicated that the students in the small classes were slightly more favorably disposed toward their own class. The majority of all students indicated a favorable attitude toward the class in which they were enrolled.

Q17. If you take the second course in Principles of Accounting, in what size class would you prefer to enroll?

A greater percentage of the students in the large class indicated they would prefer to enroll in a smaller section for the second course of accounting. The majority of students in the small classes were relatively content with the size of the class in which they were enrolled.

Q18. In which size class do you feel you can earn the highest possible grade?

The majority of students felt they could earn the highest grades in a class of from 10 to 25 students. It was interesting to note, however, that approximately 30 per cent of the large-class students in the second experiment felt they could earn the highest grade in a class of 70 or more.

Q19. How valuable were the lectures by the instructor?

The students in the small class rated the lectures as being more valuable. Only a very slight percentage of the students in the large class felt the lectures were of little or no value.

Q20. How valuable was the question-and-answer method used during selected periods?

The question-and-answer method was felt to be more valuable by the small classes. Possibly this was because they were afforded more opportunities to participate in the discussion.

CHAPTER V

SUMMARY OF PROBLEM, FINDINGS, AND SUGGESTIONS FOR FURTHER RESEARCH

The purpose of this study was to ascertain if class size affects academic achievement in elementary accounting. The study was conducted during two consecutive semesters at Northeastern State College. Prior knowledge of accounting was determined by administering a pre-test during the first class meeting. The same test was administered during the last class meeting as a post-test. The pre-test scores and the scores made on the American College Test were utilized in equating the groups through the analysis of covariance technique.

Four classes of elementary accounting students were involved in the study. A large class, beginning with 70 or more students, and a small class, beginning with 25 or fewer students, were used in the experiment during each of the two semesters. Initially, a total of 195 students--47 female students and 148 male students were enrolled to participate in the experiment. However, the attrition or drop-out rate lowered the actual number of participants to 135, with 34 female students and 101 male students present for the post-test. Any student not taking the post-test was, out of necessity, dropped from the study.

This study, in common with many other studies relative to class size, did not produce evidence that small classes achieve more when academic achievement is the criterion of measurement. The null

hypothesis that there will be no significant difference in learning between students who are in small classes of elementary accounting and those who are in large classes was accepted. When only academic achievement was considered, there was no statistically significant difference in the results of the experiment. Although the small classes exceeded the large classes on both the pre- and post-test, the difference was not sufficient to be significant at the .05 level when the mean scores were adjusted for the covariates.

In an attempt to eliminate the possibility that the time of day may have influenced the results, the time of meeting for the large class and the small class was reversed during the second experiment. The small class met at nine o'clock during the first-semester experiment and the large class met at ten o'clock. During the second semester, the large class met at nine o'clock and the small class met at ten o'clock. The same instructor taught all the classes, utilizing the same materials and equipment. Lecture notes were prepared and carefully followed to insure that the same material was presented to all classes.

An opinionnaire was administered to all of the experimental classes in an attempt to gain some knowledge about variables other than class size. This aspect of the study, although ancillary to the main research topic, provided some information relative to each student's image of himself, the instructor, and the class. The opinionnaire revealed that students in the small class generally felt more secure and more important than the students in the large classes. There were fewer distractions (such as coughing, tardiness, etc.) in the small classes. The students in the small classes thought the instruction was more

effective than the students in the large classes. The instructor became very aware of the fact that academic achievement alone does not constitute the student's total educational experiences. In the small classes more was known about each student's health, socio-economic background, hopes, fears, and frustrations. In the large classes, much less was known about these factors. In fact, many of the students in the large classes did not ask a question or make a comment during the semester.

It is difficult to generalize from the results of this study; however, they are valid for the specific time and place of the experiment. They are applicable to the specific courses investigated at Northeastern State College during the academic year 1968-1969. It is impossible to state, with a great degree of exactitude, that a replication of this study would produce the same or similar results. There seems to be a general consensus of opinion, based on the review of literature and this study, that class size does not materially affect academic achievement. Variables, other than class size, may well exert more of an influence on the student's potential success and happiness than the size of the class in which he is enrolled. It is very possible, as cited in the review of literature, that smaller classes foster more creativity and independent thinking on the part of the students.

The suggestions for further research are:

(1) A similar experiment should be conducted on a larger scale. Increasing the size of the large classes to 100 or more students and comparing it with small classes of 25 or fewer students may produce different results.

(2) A similar experiment should be conducted in which the classes,

both large and small, meet three days per week for lectures and demonstrations. Students could then be divided into smaller sections for laboratory sessions.

(3) A similar experiment should be conducted in which the opinionnaire becomes the main research topic. By expanding the opinionnaire and providing a greater latitude for responses to each item, it would be possible to apply critical-level statistical techniques to the results. Much might be learned about variables other than class size.

(4) An experiment should be conducted in which the lecture and demonstration portions of the course are recorded on video-tape for closed-circuit television presentation. The instructor could attend laboratory sessions to answer questions.

(5) A study of the students' individual American College Test scores should be conducted as a potential indicator of success in accounting.

(6) A follow-up study of students who were in small and large classes of accounting should be conducted in an attempt to determine if size of class affects interest in pursuing more courses in the same area.

(7) Instructors should be alert to developments in their classes that may lead to research topics and better instructional methods.

Although this study produced no statistically significant difference in academic achievement when comparing large and small classes, the author is aware that there are other variables influencing the students' total educational experiences. Variables other than class size should be investigated in an attempt to determine the optimum educational atmosphere to enhance the opportunities for the student to develop as a useful, happy, and productive citizen.

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APPENDIX A

PRE- AND POST-TEST

NAME-_____

ACCOUNTING 213

This examination is administered to determine the existing knowledge of accounting principles and concepts of enrolling students. It will not be used in determining grades. Read the instructions of each section carefully before attempting to answer the questions.

SECTION A

Instructions: The assets, liabilities, and capital titles for Lee Services, owned by T. Lee, are given in equation form below. At the left of the equation is a partial list of transactions completed during the month. Indicate the effect of each transaction upon the items in the equation by writing the plus sign (+) below the item that is increased and the minus sign (−) below the item that is decreased.

	Cash	+ Accts Rec.	+ Supplies	+ Equip	− Accum. Deprec.	= Accts Pay	+ Cap.
0. Lee invested additional cash in the business. . . .	+						+
1. Paid rent for month	−						−
2. Purchased supplies for cash.	−		+				
3. Purchased equipment on account				+		+	
4. Paid creditor on account. . .	−					−	
5. Lee withdrew cash for personal use . . .	−						−

SECTION B

Instructions: Indicate how each of the increases and decreases listed below is recorded in the account by placing a check mark in the debit column or the credit column at the right.

		Debit	Credit
0.	An increase in cash	✓	
1.	A decrease in Accounts Payable		
2.	An increase in Sales		
3.	A decrease in store equipment		
4.	An increase in utilities expense		
5.	An increase in R. J. West, Capital		
6.	An increase in Accounts Receivable		
7.	An increase in notes payable		
8.	A decrease in prepaid insurance		
9.	An increase in R. J. West, Drawing		
10.	A decrease in advertising expense		

SECTION C

Instructions: The customary captions used in classifying accounts are listed below. A number of account titles are presented above the captions. Classify each account by inserting the appropriate letter in the classification column and indicate the normal balance by inserting Dr or Cr in the Normal Balance column.

		Classification	Normal Balance
0.	Cash	B	Dr
1.	Building		
2.	Accounts Receivable		
3.	Sales		
4.	Prepaid Insurance		
5.	D. M. Harley, Drawing		
6.	Delivery Expense		
7.	Mortgage Note Payable (due in 5 years)		
8.	Commissions Earned		
9.	Notes Payable (short term)		
10.	Land		

A. Capital
B. Current Assets
C. Current Liabilities
D. Expenses
E. Long-term Liabilities
F. Plant Assets
G. Revenue

SECTION D

Instructions: Indicate the accounts to be debited and credited in recording the transactions and corrections given below by inserting the letter designations for the accounts in the appropriate columns.

		Debit	Credit
0.	Adams invested cash in his business enterprise	G	D
1.	Paid rent for the current month		
2.	Recorded sales to customers on account		
3.	Purchased equipment, paying one-fourth in cash, and giving a note for the balance		

		Debit	Credit
4.	Discovered that supplies purchased on account had been journalized and posted as a purchase of prepaid insurance.	_____	_____
5.	Paid 3-year insurance premium on building	_____	_____
6.	Received payment on account from a customer	_____	_____
7.	Returned for credit supplies purchased on account .	_____	_____
8.	Paid wages expense.	_____	_____
9.	Paid cash to creditors on account	_____	_____
10.	Withdrew cash for personal use.	_____	_____

A.	Accounts Payable	J.	Insurance Expense
B.	Accounts Receivable	K.	Notes Payable
C.	Accumulated Deprec.-Building	L.	Notes Receivable
D.	A. Adams, Capital	M.	Prepaid Insurance
E.	A. Adams, Drawing	N.	Prepaid Rent
F.	Building	O.	Rent Expense
G.	Cash	P.	Sales
H.	Depreciation Expense-Building	Q.	Supplies
I.	Equipment	R.	Wages Expense

SECTION E

Instructions: Below are listed several journals, each of which is designated by one or two letters. Indicate the journal in which each transaction can be recorded most conveniently by inserting the appropriate letter abbreviations in the column at the right.

		Journal Used
0.	Paid cash for weekly salary	CP
1.	Paid a creditor for merchandise purchased on account. . .	_____
2.	Sold office supplies at cost as an accommodation, on account	_____
3.	Owner withdrew cash for personal use.	_____
4.	Received a check from a debtor in payment of an account .	_____
5.	Returned damaged merchandise purchased on account	_____
6.	Purchased office supplies on account.	_____

JOURNALS:	S. Sales Journal	CP.	Cash Payments Journal
	P. Purchases Journal	J.	General Journal (two column)
	CR. Cash Receipts Journal		

SECTION F

Instructions: Below is a list of items reported on one or more of the three financial statements prepared at the end of the accounting period. The capital statement and the various sections of the other statements are listed below. Indicate the location of each item by inserting the appropriate letter or letters in the Answers column.

		Answers
0.	Cash	I
1.	Interest payable	
2.	Merchandise inventory at beginning of period	
3.	Mortgage note payable (due in 10 years)	
4.	Delivery expense	
5.	Capital balance at end of period	
6.	Depreciation expense-building	
7.	Building	
8.	Merchandise inventory at end of period	
9.	Withdrawals by owner	
10.	Purchases discount	
11.	Sales returns and allowances	
12.	Gain on sale of plant assets	
13.	Prepaid insurance	
14.	Capital balance at beginning of period	
15.	Interest expense	
16.	Accumulated depreciation-store equipment	

Income Statement

A. Cost of merchandise sold
B. General expenses
C. Other expense
D. Other income
E. Revenue from sales
F. Selling expenses

G. Capital Statement

Balance Sheet

H. Capital
I. Current assets
J. Current liabilities
K. Long-term liabilities
L. Plant assets

SECTION G

Instructions: Answer the following questions by writing the appropriate amounts or words in the Answers column.

		Answers
0.	In what journal are closing entries recorded?	General Journal
1.	Immediately after reversing entries have been posted, the salary expense account has a credit balance of $430. Is the item an asset, a liability, a revenue, an expense, or capital?	
2.	A capital statement reveals a beginning balance of $20,000, a net reduction of $1,500 resulting from the correction of errors, net income of $13,000, and owner's withdrawals of $8,000. What is the capital balance at the end of the period?	
3.	The subtotals of the income statement columns of a work sheet are $210,000 (Dr.) and $190,000 (Cr.) Have operations resulted in a net income or a net loss?	
4.	The subtotal of the balance sheet Dr. column of the work sheet in No. 3 is $140,000. What is the subtotal of the balance sheet Cr. column, assuming there are no errors?	

Answers

5. Salaries accrued on the last day of the fiscal year total $520, the salaries paid on the first pay-day in the following year total $1,800. Assuming no unusual circumstances, what is the salary expense thus far in the following year? . . . . . _____
6. Accrued taxes of $900 at the end of the period were overlooked and no adjusting entry was recorded. Did the error understate or overstate reported net income of the period?. . . . . _____
7. In writing off an uncollectible account by the direct write-off method the account debited is. . _____
8. Allowance for doubtful accounts is classified on the balance sheet under the caption. . . . . _____
9. The inventory system that continuously discloses the amount of the inventory is called. . . _____
10. The inventory method that considers the inventory to be composed of the units acquired earliest is called. . . . . _____
11. Analysis of receivables at the end of the fiscal year indicates doubtful accounts of $3,000. The allowance account before adjustment has a debit balance of $250. The amount to be added to the allowance account is. . . . . _____
12. A plant asset purchased for $15,000 has an estimated life of 10 years. Depreciation for the second year of use, determined by the declining-balance method at twice the straight-line rate is. . . . . _____
13. A plant asset with a cost of $6,000, estimated life of 10 years, and residual value of $1,200, is to be depreciated by the straight-line method. The annual depreciation rate stated as a percent of cost is. . . . . _____

SECTION H

Instructions: Compute the amounts described in each of the problems and insert them in the Answers column.

Answers

0. The interest on $1,000 for one year at 6% . . . . $ 60
1. The interest on $1,800 for 60 days at 5%. . . . . $ _____
2. The interest on $8,000 for 96 days at 6%. . . . . $ _____
3. The interest on $12,000 for 120 days at 7%. . . . $ _____
4. The interest charged by the bank, at the rate of 6%, on our non-interest-bearing, 60-day note payable for $3,000. . . . . $ _____
5. The amount received from the bank on the note in No. 4. . . . . $ _____
6. The maturity value of a $2,000, 60-day note receivable, bearing interest at 6%. . . . . $ _____

		Answers
7.	The amount charged by the bank in discounting the note in No. 6 at 6%, 30 days before maturity. . .	$
8.	The credit to the interest income account in discounting the note in No. 7.	$

SECTION I

Instructions: Indicate the titles of the accounts to be debited and credited in recording the selected transactions described below by inserting in the appropriate columns and the letters of the account titles listed below. The transactions were completed by an enterprise that uses a voucher system and records purchases invoices at the net amount.

		Debit	Credit
0.	Prepared voucher for store supplies purchased from Collins Co., terms n/30	M	A
1.	Prepared voucher to establish petty cash fund . .		
2.	Issued check in payment of voucher recorded in No. 1		
3.	Prepared voucher for merchandise purchased from Downs and Co., terms 1/10, n/30		
4.	Issued check in payment of voucher recorded in No. 3 after discount period had expired		
5.	Recorded and deposited cash from sales for the day which according to the cash register tapes exceeded the amount of cash on hand		
6.	Prepared voucher to reimburse the petty cash fund for disbursements made for office supplies, miscelaneous selling expense, and miscellaneous general expense		

A.	Accounts Payable	H.	Office Supplies
B.	Accounts Receivable	I.	Petty Cash
C.	Cash in Bank	J.	Purchases
D.	Cash Short and Over	K.	Purchases Discount
E.	Discounts Lost	L.	Sales
F.	Miscellaneous General Expense	M.	Store Supplies
G.	Miscellaneous Selling Expense		

SOLUTIONS TO PRE- AND POST-TEST

SECTION A

1. Cash − ; Capital − .
2. Cash − ; Supplies + .
3. Equipment + ; Accounts Payable + .
4. Cash − ; Accounts Payable − .
5. Cash − ; Capital − .

SECTION B

1. Debit
2. Credit
3. Credit
4. Debit
5. Credit
6. Debit
7. Credit
8. Credit
9. Debit
10. Credit

SECTION C

	Classification	Normal Balance
1.	F	Debit
2.	B	Debit
3.	G	Credit
4.	B	Debit
5.	A	Debit
6.	D	Debit
7.	E	Credit
8.	G	Credit
9.	C	Credit
10.	F	Debit

SECTION D

	Debit	Credit
1.	O	G
2.	B	P
3.	I	G, K

	Debit	Credit
4.	Q	M
5.	M	G
6.	G	B
7.	A	Q
8.	R	G
9.	A	G
10.	E	G

SECTION E

1. CP.
2. J.
3. CP.
4. CR.
5. J.
6. P.

SECTION F

1. J.
2. A.
3. K.
4. F.
5. G., H.
6. B.
7. L.
8. I., A.
9. G.
10. A.
11. E.
12. D.
13. I.
14. G.
15. C.
16. L.

SECTION G

1. Liability
2. $23,500
3. Loss (Net Loss)
4. $160,000
5. $1,280
6. Overstate
7. Bad Debts Expense or Uncollectible Accounts Expense
8. Current Assets
9. Perpetual
10. Last-in-First-out (Lifo)
11. $3,250
12. $2,400
13. 8%

SECTION H

1. $ 15.00
2. $ 128.00
3. $ 280.00
4. $ 30.00
5. $2,970.00
6. $2,020.00
7. $ 10.10
8. $ 9.90

SECTION I

	Debit	Credit
1.	I	A
2.	A	C
3.	J	A
4.	E, A	C
5.	C, D	L
6.	H, F, G	A

APPENDIX B

STATISTICAL COMPUTATIONS IN DETERMINING RELIABILITY OF PRE- AND POST-TEST

TABLE V

RELIABILITY OF PRE- AND POST-TEST

The Kuder-Richardson formula for determining the reliability of a test is:

$$r_{1I} = \frac{n\sigma^2 t - M(n - M)}{\sigma^2 t(n - 1)}$$

r_{1I} = reliability of the whole test;

n = number of items in the test;

$\sigma^2 t$ = variance of the t

M = mean of the t

$\Sigma x^2 = 4455.28$

$$\sigma^2 = \frac{4455.28}{50}$$

$$r_{1I} = \frac{97(89.105) -}{89.10} =$$

$$\frac{8643.185 - 24.120(72.880)}{8554.080} =$$

$$\frac{8643.185 - 1757.86560}{8554.080} =$$

$$\frac{6885.3194}{8554.080} = .80$$

TABLE V

RELIABILITY OF PRE- AND POST-TEST

The Kuder-Richardson formula for determining the reliability of a test is:

$$r_{1I} = \frac{n\sigma^2 t - M(n - M)}{\sigma^2 t(n - 1)}$$

r_{1I} = reliability of the whole test;

n = number of items in the test;

$\sigma^2 t$ = variance of the test scores;

M = mean of the test scores.

$\Sigma x^2 = 4455.28$ Mean = 24.120

$$\sigma^2 = \frac{4455.28}{50} = 89.105$$

$$r_{1I} = \frac{97(89.105) - 24.120(97 - 24.120)}{89.105(97 - 1)} =$$

$$\frac{8643.185 - 24.120(72.880)}{8554.080} =$$

$$\frac{8643.185 - 1757.86560}{8554.080} =$$

$$\frac{6885.3194}{8554.080} = .80$$

APPENDIX C

STATISTICAL DATA FOR FIRST-SEMESTER EXPERIMENT AND COMPUTATION OF *t* VALUES

TABLE VI

SMALL CLASS DATA--FIRST SEMESTER

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classification	Absences	Post-Test
1	25	20	21	19	21	20	18	yes	1	6	51
2	26	16	02	16	09	11	18	yes	1	4	69
3	33	18	14	19	20	18	20	yes	2	4	53
4	33	24	16	20	26	22	18	yes	1	3	74
5	51	13	16	02	13	11	18	yes	1	1	76
6	08	17	13	19	16	16	27	no	1	1	61
7	25	23	06	22	17	17	20	no	3	5	59
8	32	28	19	24	27	24	20	yes	3	2	76
9	25	16	12	11	09	12	19	yes	2	3	67
10	11	10	13	21	14	15	18	no	1	0	57
11	41	19	10	10	10	12	18	yes	1	0	75
12	55	21	18	23	24	22	18	yes	1	4	74
13	36	23	16	17	26	21	18	yes	1	0	63
14	13	13	25	12	20	18	17	no	1	1	65
15	28	22	14	26	13	19	19	yes	2	5	56
16	24	16	26	19	22	21	18	yes	1	0	75

TABLE VII

LARGE CLASS DATA--FIRST SEMESTER

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classification	Absences	Post-Test
1	12	20	17	18	17	18	19	yes	2	5	50
2	30	16	17	19	21	18	19	yes	2	2	58
3	36	23	19	18	17	19	18	yes	1	3	79
4	46	18	13	22	17	18	17	yes	1	1	76
5	32	17	13	19	19	17	23	no	1	0	75
6	28	19	13	23	18	18	21	repeat	3	8	31
7	35	18	14	26	24	21	28	no	2	1	67
8	35	15	13	14	08	13	20	no	3	3	62
9	07	20	29	19	23	23	18	no	1	0	70
10	37	22	11	22	15	18	18	yes	2	0	89
11	11	22	25	18	17	21	18	no	2	5	62
12	30	13	09	17	26	16	18	yes	1	4	49
13	08	17	29	10	15	18	19	no	2	1	47
14	19	17	11	17	15	15	20	yes	2	4	44
15	29	20	21	12	18	18	21	yes	3	8	55
16	30	17	16	21	20	19	19	yes	1	4	59
17	16	15	10	18	14	14	23	no	2	0	56
18	19	07	13	07	12	10	19	no	2	0	58
19	16	13	15	15	19	16	20	no	3	3	46
20	10	21	20	17	17	19	18	yes	2	1	54
21	22	15	20	21	19	19	27	no	2	0	62
22	16	18	22	18	16	19	18	no	1	5	43
23	15	18	22	18	19	19	18	no	1	3	50

TABLE VII (Continued)

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classification	Absences	Post-Test
24	39	22	18	18	12	18	18	yes	1	2	70
25	15	20	02	17	17	14	32	no	1	0	60
26	33	09	13	20	19	15	18	yes	1	3	60
27	27	18	13	15	25	18	19	yes	2	5	66
28	33	24	19	29	26	25	18	yes	1	0	85
29	25	12	17	14	17	15	23	no	3	0	68
30	36	18	19	21	22	20	22	no	4	3	62
31	29	18	11	11	12	13	26	no	2	3	54
32	29	19	18	28	19	21	18	no	1	4	48
33	27	06	23	16	21	17	26	no	4	4	72
34	22	19	20	19	26	21	19	no	2	4	59
35	22	09	06	17	11	11	25	no	2	1	46
36	24	25	12	17	16	18	19	yes	2	3	59
37	15	13	13	16	13	14	19	yes	2	4	40
38	19	21	14	20	16	18	21	no	2	4	41
39	13	17	20	21	26	21	20	no	3	4	50
40	26	09	16	18	09	13	22	yes	2	2	48
41	31	15	12	12	17	14	19	yes	1	3	50
42	35	18	16	07	05	12	17	yes	1	2	62
43	24	08	15	09	06	10	26	no	3	0	48
44	09	15	21	17	19	18	25	no	2	0	52
45	24	13	15	09	15	13	19	yes	2	0	64
46	40	15	16	15	19	16	18	yes	1	1	67

TABLE VII (Continued)

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classi-fication	Absences	Post-Test
47	23	19	23	15	24	20	22	no	1	4	76
48	21	22	19	25	22	22	18	yes	2	6	69
49	13	24	17	25	22	22	22	no	1	3	67
50	13	18	17	08	16	15	24	no	3	1	64

TABLE VIII

PRE-TEST SCORES--FIRST SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	12	144	25	625
2	30	900	26	676
3	36	1,296	33	1,089
4	46	2,116	33	1,089
5	32	1,024	51	2,601
6	28	784	08	64
7	35	1,225	25	625
8	35	1,225	32	1,024
9	07	49	25	625
10	37	1,369	11	121
11	11	121	41	1,681
12	30	900	55	3,025
13	08	64	36	1,296
14	19	361	13	169
15	29	841	28	784
16	30	900	24	576
17	16	256		
18	19	361		
19	16	256		
20	10	100		
21	22	484		
22	16	256		
23	15	225		
24	39	1,521		
25	15	225		
26	33	1,089		
27	27	729		
28	33	1,089		
29	25	625		
30	36	1,296		
31	29	841		
32	29	841		
33	27	729		
34	22	484		
35	22	484		
36	24	576		
37	15	225		
38	19	361		
39	13	169		
40	26	676		
41	31	961		
42	35	1,225		

TABLE VIII (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	24	576		
44	09	81		
45	24	576		
46	40	1,600		
47	23	529		
48	21	441		
49	13	169		
50	13	169		
Total	1,206	33,544	466	16,070
Mean	24.120		29.1250	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$$

$$\Sigma x^2 = 4455.28$$

$$\Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma y^2 = 2497.750$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{24.120 - 29.1250}{\sqrt{\left(\frac{4455.28 + 2497.750}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = 1.67$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE IX

A_1 SCORES--FIRST SEMESTER

Student Number	Large Class		Small Class	
	X	X^2	Y	Y^2
1	20	400	20	400
2	16	256	16	256
3	23	529	18	324
4	18	324	24	576
5	17	289	13	169
6	19	361	17	289
7	18	324	23	529
8	15	225	28	784
9	20	400	16	256
10	22	484	10	100
11	22	484	19	361
12	13	169	21	441
13	17	289	23	529
14	17	289	13	169
15	20	400	22	484
16	17	289	16	256
17	15	225		
18	07	49		
19	13	169		
20	21	441		
21	15	225		
22	18	324		
23	18	324		
24	22	484		
25	20	400		
26	09	81		
27	18	324		
28	24	576		
29	12	144		
30	18	324		
31	18	324		
32	19	361		
33	06	36		
34	19	361		
35	09	81		
36	25	625		
37	13	169		
38	21	441		
39	17	289		
40	09	81		
41	15	225		
42	18	324		

TABLE IX (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	08	64		
44	15	225		
45	13	169		
46	15	225		
47	19	361		
48	22	484		
49	24	576		
50	18	324		
Total	847	15,347	299	5,923
Mean	16.940		18.6875	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 998.820 \qquad \Sigma y^2 = 335.4375$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{16.940 - 18.6875}{\sqrt{\left(\frac{998.820 + 335.4375}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = 1.33$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE X

A_2 SCORES--FIRST SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	17	289	21	441
2	17	289	02	4
3	19	361	14	196
4	13	169	16	256
5	13	169	16	256
6	13	169	13	169
7	14	196	06	36
8	13	169	19	361
9	29	841	12	144
10	11	121	13	169
11	25	625	10	100
12	09	81	18	324
13	29	841	16	256
14	11	121	25	625
15	21	441	14	196
16	16	256	26	676
17	10	100		
18	13	169		
19	15	225		
20	20	400		
21	20	400		
22	22	484		
23	22	484		
24	18	324		
25	02	4		
26	13	169		
27	13	169		
28	19	361		
29	17	289		
30	19	361		
31	11	121		
32	18	324		
33	23	529		
34	20	400		
35	06	36		
36	12	144		
37	13	169		
38	14	196		
39	20	400		
40	16	256		
41	12	144		
42	16	256		

TABLE X (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	15	225		
44	21	441		
45	15	225		
46	16	256		
47	23	529		
48	19	361		
49	17	289		
50	17	289		
Total	817	14,667	241	4,209
Mean	16.340		15.0625	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 1317.220 \qquad \Sigma y^2 = 578.9375$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_2} + \frac{1}{n_2}\right)}} \qquad t = \frac{16.340 - 15.0625}{\sqrt{\left(\frac{1317.220 + 578.9375}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = .82$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XI

A_3 SCORES--FIRST SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	18	324	19	361
2	19	361	16	256
3	18	324	19	361
4	22	484	20	400
5	19	361	02	4
6	23	529	19	361
7	26	676	22	484
8	14	196	24	576
9	19	361	11	121
10	22	484	21	441
11	18	324	10	100
12	17	289	23	529
13	10	100	17	289
14	17	289	12	144
15	12	144	26	676
16	21	441	19	361
17	18	324		
18	07	49		
19	15	225		
20	17	289		
21	21	441		
22	18	324		
23	18	324		
24	18	324		
25	17	289		
26	20	400		
27	15	225		
28	29	841		
29	14	196		
30	21	441		
31	11	121		
32	28	784		
33	16	256		
34	19	361		
35	17	289		
36	17	289		
37	16	256		
38	20	400		
39	21	441		
40	18	324		
41	12	144		
42	07	49		

TABLE XI (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	09	81		
44	17	289		
45	09	81		
46	15	225		
47	15	225		
48	25	625		
49	25	625		
50	08	64		
Total	868	16,308	280	5,464
Mean	17.360		17.50	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$$

$$\Sigma x^2 = 1239.520$$

$$\Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma y^2 = 564.0$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{17.360 - 17.50}{\sqrt{\left(\frac{1239.520 + 564.0}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = .09$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XII

A_4 SCORES--FIRST SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	17	289	21	441
2	21	441	09	81
3	17	289	20	400
4	17	289	26	676
5	19	361	13	169
6	18	324	16	256
7	24	576	17	289
8	08	64	26	676
9	23	529	09	81
10	15	225	14	196
11	17	289	10	100
12	26	676	24	576
13	15	225	27	729
14	15	225	20	400
15	18	324	13	169
16	20	400	22	484
17	14	196		
18	12	144		
19	19	361		
20	17	289		
21	19	361		
22	16	256		
23	19	361		
24	12	144		
25	17	289		
26	19	361		
27	25	625		
28	26	676		
29	17	289		
30	22	484		
31	12	144		
32	19	361		
33	21	441		
34	26	676		
35	11	121		
36	16	256		
37	13	169		
38	16	256		
39	26	676		
40	09	81		
41	17	289		
42	05	25		

TABLE XII (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	06	36		
44	19	361		
45	15	225		
46	19	361		
47	24	576		
48	22	484		
49	22	484		
50	16	256		
Total	878	16,640	287	5,723
Mean	17.560		17.9375	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$$

$$\Sigma x^2 = 1222.320$$

$$\Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma y^2 = 574.9375$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{17.560 - 17.9375}{\sqrt{\left(\frac{1222.320 + 574.9375}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = .24$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XIII

A_5 SCORES--FIRST SEMESTER

Student Number	Large Class		Small Class	
	X	X^2	Y	Y^2
1	18	324	20	400
2	18	324	11	121
3	19	361	18	324
4	18	324	22	484
5	17	289	11	121
6	18	324	16	256
7	21	441	17	289
8	13	169	24	576
9	23	529	12	144
10	18	324	15	225
11	21	441	12	144
12	16	256	22	484
13	18	324	21	441
14	15	225	18	324
15	18	324	19	361
16	19	361	21	441
17	14	196		
18	10	100		
19	16	256		
20	19	361		
21	19	361		
22	19	361		
23	19	361		
24	18	324		
25	14	196		
26	15	225		
27	18	324		
28	25	625		
29	15	225		
30	20	400		
31	13	169		
32	21	441		
33	17	289		
34	21	441		
35	11	121		
36	18	324		
37	14	196		
38	18	324		
39	21	441		
40	13	169		
41	14	196		
42	12	144		

TABLE XIII (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	10	100		
44	18	324		
45	13	169		
46	16	256		
47	20	400		
48	22	484		
49	22	484		
50	15	225		
Total	860	15,352	279	5,135
Mean	17.20		17.4375	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 560.0 \qquad \Sigma y^2 = 269.9375$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{17.20 - 17.4375}{\sqrt{\left(\frac{560.0 + 269.9375}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = .23$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XIV

POST-TEST SCORES--FIRST SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	50	2,500	51	2,601
2	58	3,364	69	4,761
3	79	6,241	53	2,809
4	76	5,776	74	5,476
5	75	5,625	76	5,776
6	31	961	61	3,721
7	67	4,489	59	3,481
8	62	3,844	76	5,776
9	70	4,900	67	4,489
10	89	7,921	57	3,249
11	62	3,844	75	5,625
12	49	2,401	74	5,476
13	47	2,209	63	3,969
14	44	1,936	65	4,225
15	55	3,025	56	3,136
16	59	3,481	75	5,625
17	56	3,136		
18	58	3,364		
19	46	2,116		
20	54	2,916		
21	62	3,844		
22	43	1,849		
23	50	2,500		
24	70	4,900		
25	60	3,600		
26	60	3,600		
27	66	4,356		
28	85	7,225		
29	68	4,624		
30	62	3,844		
31	54	2,916		
32	48	2,304		
33	72	5,184		
34	59	3,481		
35	46	2,116		
36	59	3,481		
37	40	1,600		
38	41	1,681		
39	50	2,500		
40	48	2,304		
41	50	2,500		
42	62	3,844		

TABLE XIV (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	48	2,304		
44	52	2,704		
45	64	4,096		
46	67	4,489		
47	76	5,776		
48	69	4,761		
49	67	4,489		
50	64	4,096		
Total	2,949	181,017	1,051	70,195
Mean	58.980		65.6875	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 7084.980 \qquad \Sigma y^2 = 1157.4382$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{58.980 - 65.6875}{\sqrt{\left(\frac{7084.980 + 1157.4382}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = 2.06^*$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is significant when the co-variables are not considered.

TABLE XV

POST-TEST SCORES--FIRST SEMESTER (ADJUSTED)

Post-test scores adjusted through the analysis of covariance technique reveal these changes in mean scores:

Large Class: Unadjusted Mean----58.9800
Adjusted Mean----59.6940

Small Class: Unadjusted Mean----65.6875
Adjusted Mean----63.4561

Computation of t Value

$$t = \frac{59.6940 - 63.4561}{\sqrt{\left(\frac{7084.980 + 1157.4382}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$$t = 1.15$$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant when the means are adjusted through the analysis of covariance technique.

TABLE XVI

ABSENCES--FIRST SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	5	25	6	36
2	2	4	4	16
3	3	9	4	16
4	1	1	3	9
5	0	0	1	1
6	8	64	1	1
7	1	1	5	25
8	3	9	2	4
9	0	0	3	9
10	0	0	0	0
11	5	25	0	0
12	4	16	4	16
13	1	1	0	0
14	4	16	1	1
15	8	64	5	25
16	4	16	0	0
17	0	0		
18	0	0		
19	3	9		
20	1	1		
21	0	0		
22	5	25		
23	3	9		
24	2	4		
25	0	0		
26	3	9		
27	5	25		
28	0	0		
29	0	0		
30	3	9		
31	3	9		
32	4	16		
33	4	16		
34	4	16		
35	1	1		
36	3	9		
37	4	16		
38	4	16		
39	4	16		
40	2	4		
41	3	9		
42	2	4		

TABLE XVI (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	0	0		
44	0	0		
45	0	0		
46	1	1		
47	4	16		
48	6	36		
49	3	9		
50	1	1		
Total	127	537	39	159
Mean	2.540		2.4375	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 214.420 \qquad \Sigma y^2 = 63.9375$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{2.540 - 2.4375}{\sqrt{\left(\frac{214.420 + 63.9375}{50 + 16 - 2}\right)\left(\frac{1}{50} + \frac{1}{16}\right)}}$$

$t = .17$

With 64 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

APPENDIX D

STATISTICAL DATA FOR SECOND-SEMESTER EXPERIMENT AND COMPUTATION OF $\underline{t}$ VALUES

TABLE XVII

SMALL CLASS DATA--SECOND SEMESTER

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classi-fication	Absences	Post-Test
1	40	07	05	10	10	08	24	no	2	0	54
2	21	21	20	17	15	18	22	yes	3	0	62
3	13	11	18	05	09	11	20	no	2	2	67
4	20	22	15	17	18	18	17	no	1	1	69
5	21	09	10	13	09	10	19	yes	2	1	49
6	20	15	16	21	20	18	18	yes	1	0	74
7	14	21	20	12	22	19	20	no	2	4	42
8	16	20	05	23	17	16	21	no	3	3	42
9	19	18	17	18	18	18	19	no	1	1	74
10	14	13	10	15	18	14	20	no	2	5	51
11	16	14	18	01	14	12	19	no	2	1	53
12	07	12	20	19	20	18	19	no	1	3	52
13	25	18	13	25	23	20	19	no	2	12	60
14	23	08	14	07	13	11	19	yes	1	5	59
15	09	11	16	13	26	17	19	no	2	1	54
16	30	20	14	22	21	19	19	yes	2	2	54
17	03	19	23	16	27	21	18	no	1	2	57
18	15	16	24	26	20	22	19	no	1	3	46

TABLE XVIII

LARGE CLASS DATA--SECOND SEMESTER

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classification	Absences	Post-Test
1	31	12	30	11	07	15	24	no	3	0	70
2	15	16	20	13	15	16	19	no	2	4	55
3	16	16	17	25	26	21	19	yes	2	16	49
4	25	30	29	27	30	29	19	no	2	10	75
5	22	15	19	31	31	24	21	no	3	2	50
6	05	17	16	24	24	20	20	no	2	2	50
7	27	13	21	19	21	19	22	no	3	21	58
8	07	15	22	17	20	19	20	no	3	1	47
9	13	21	25	23	25	24	18	no	1	9	43
10	16	17	08	20	13	15	22	yes	2	0	39
11	11	21	25	25	27	25	19	no	2	4	69
12	15	16	18	20	20	19	20	yes	3	11	53
13	17	23	21	28	21	23	18	yes	2	5	70
14	10	15	17	09	15	14	22	yes	1	14	46
15	23	16	13	19	16	16	19	yes	1	7	32
16	14	21	17	25	19	21	21	no	2	2	77
17	04	24	16	24	20	21	20	no	2	5	39
18	25	15	18	12	13	15	19	yes	1	6	53
19	18	13	18	19	22	18	25	no	2	4	73
20	04	19	12	22	20	18	20	no	3	2	37
21	12	09	16	12	16	13	19	yes	2	1	50
22	24	14	19	18	22	18	19	yes	2	2	56
23	09	17	19	19	21	19	22	yes	1	4	63
24	13	10	17	15	12	14	22	no	3	2	56

TABLE XVIII (Continued)

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classification	Absences	Post-Test
25	10	16	25	23	28	23	19	no	2	8	60
26	16	16	11	13	16	14	21	no	3	4	47
27	30	26	16	30	28	25	20	yes	3	1	66
28	48	12	19	06	10	12	20	yes	1	6	78
29	11	17	17	19	13	17	19	no	2	9	27
30	10	17	24	24	25	23	23	no	2	21	58
31	23	10	20	14	20	16	22	yes	2	1	46
32	31	12	08	23	23	17	24	no	2	2	69
33	08	17	01	08	15	10	19	no	2	1	44
34	06	14	15	18	17	16	19	no	2	2	63
35	38	26	26	25	27	26	18	yes	1	0	84
36	22	14	21	17	17	17	21	yes	1	4	65
37	00	19	21	22	11	18	19	no	2	10	50
38	19	21	25	24	26	24	18	no	1	12	65
39	26	09	04	08	07	07	21	yes	4	7	33
40	09	14	12	18	08	13	21	yes	2	5	55
41	14	18	19	19	25	20	19	no	2	2	76
42	08	17	17	12	17	16	18	no	1	13	31
43	11	23	26	24	29	26	19	no	1	3	70
44	16	17	06	12	17	13	18	yes	1	4	22
45	14	24	14	17	17	18	20	yes	2	0	75
46	04	15	02	21	19	14	19	yes	2	1	51
47	21	21	20	26	19	22	20	no	2	4	32
48	14	07	08	03	14	08	20	yes	2	0	60
49	30	15	18	12	13	15	24	no	4	5	87

TABLE XVIII (Continued)

Student Number	Pre-Test	A_1	A_2	A_3	A_4	A_5	Age	Prior Accounting Instruction	Classi-fication	Absences	Post-Test
50	14	19	22	24	25	23	18	no	1	3	59
51	17	24	20	28	23	24	19	yes	2	3	75

TABLE XIX

PRE-TEST SCORES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	31	961	40	1,600
2	15	225	21	441
3	16	256	13	169
4	25	625	20	400
5	22	484	21	441
6	05	25	20	400
7	27	729	14	196
8	07	49	16	256
9	13	169	19	361
10	16	256	14	196
11	11	121	16	256
12	15	225	07	49
13	17	289	25	625
14	10	100	23	529
15	23	529	09	81
16	14	196	30	900
17	04	16	03	9
18	25	625	15	225
19	18	324		
20	04	16		
21	12	144		
22	24	576		
23	09	81		
24	13	169		
25	10	100		
26	16	256		
27	30	900		
28	48	2,304		
29	11	121		
30	10	100		
31	23	529		
32	31	961		
33	08	64		
34	06	36		
35	38	1,444		
36	22	484		
37	00	000		
38	19	361		
39	26	676		
40	09	81		
41	14	196		
42	08	64		

TABLE XIX (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	11	121		
44	16	256		
45	14	196		
46	04	16		
47	21	441		
48	14	196		
49	30	900		
50	14	196		
51	17	289		
Total	846	18,478	326	7,134
Mean	16.5882		18.1111	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 4444.353 \qquad \Sigma y^2 = 1229.778$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{16.588 - 18.111}{\sqrt{\left(\frac{4444.353 + 1229.778}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = .60$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XX

A_1 SCORES--SECOND SEMESTER

Student Number	Large Class X	X^2	Small Class Y	Y^2
1	12	144	07	49
2	16	256	21	441
3	16	256	11	121
4	30	900	22	484
5	15	225	09	81
6	17	289	15	225
7	13	169	21	441
8	15	225	20	400
9	21	441	18	324
10	17	289	13	169
11	21	441	14	196
12	16	256	12	144
13	23	529	18	324
14	15	225	08	64
15	16	256	11	121
16	21	441	20	400
17	24	576	19	361
18	15	225	16	256
19	13	169		
20	19	361		
21	09	81		
22	14	196		
23	17	289		
24	10	100		
25	16	256		
26	16	256		
27	26	676		
28	12	144		
29	17	289		
30	17	289		
31	10	100		
32	12	144		
33	17	289		
34	14	196		
35	26	676		
36	14	196		
37	19	361		
38	21	441		
39	09	81		
40	14	196		
41	18	324		
42	17	289		

TABLE XX (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	23	529		
44	17	289		
45	24	576		
46	15	225		
47	21	441		
48	07	49		
49	15	225		
50	19	361		
51	24	576		
Total	865	15,813	275	4,601
Mean	16.9608		15.2777	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 1141.922 \qquad \Sigma y^2 = 399.612$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{16.9608 - 15.2777}{\sqrt{\left(\frac{1141.922 + 399.612}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = 1.28$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XXI

A_2 SCORES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	30	900	05	25
2	20	400	20	400
3	17	289	18	324
4	29	841	15	225
5	19	361	10	100
6	16	256	16	256
7	21	441	20	400
8	22	484	05	25
9	25	625	17	289
10	08	64	10	100
11	25	625	18	324
12	18	324	20	400
13	21	441	13	169
14	17	289	14	196
15	13	169	16	256
16	17	289	14	196
17	16	256	23	529
18	18	324	24	576
19	18	324		
20	12	144		
21	16	256		
22	19	361		
23	19	361		
24	17	289		
25	25	625		
26	11	121		
27	16	256		
28	19	361		
29	17	289		
30	24	576		
31	20	400		
32	08	64		
33	01	1		
34	15	225		
35	26	676		
36	21	441		
37	21	441		
38	25	625		
39	04	16		
40	12	144		
41	19	361		
42	17	289		

TABLE XXI (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	26	676		
44	06	36		
45	14	196		
46	02	4		
47	20	400		
48	08	64		
49	18	324		
50	22	484		
51	20	400		
Total	890	17,608	278	4,790
Mean	17.4510		15.4444	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 2076.627 \qquad \Sigma y^2 = 496.445$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{17.4510 - 15.4444}{\sqrt{\left(\frac{2076.627 + 496.445}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = 1.18$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XXII

A_3 SCORES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	11	121	10	100
2	13	169	17	289
3	25	625	05	25
4	27	729	17	289
5	31	961	13	169
6	24	576	21	441
7	19	361	12	144
8	17	289	23	529
9	23	529	18	324
10	20	400	15	225
11	25	625	01	1
12	20	400	19	361
13	28	784	25	625
14	09	81	07	49
15	19	361	13	169
16	25	625	22	484
17	24	576	16	256
18	12	144	26	676
19	19	361		
20	22	484		
21	12	144		
22	18	324		
23	19	361		
24	15	225		
25	23	529		
26	13	169		
27	30	900		
28	06	36		
29	19	361		
30	24	576		
31	14	196		
32	23	529		
33	08	64		
34	18	324		
35	25	625		
36	17	289		
37	22	484		
38	24	576		
39	08	64		
40	18	324		
41	19	361		
42	12	144		

TABLE XXII (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	24	576		
44	12	144		
45	17	289		
46	21	441		
47	26	676		
48	03	9		
49	12	144		
50	24	576		
51	28	784		
Total	967	20,445	280	5,156
Mean	18.9608		15.5555	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 2109.922 \qquad \Sigma y^2 = 800.445$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{18.9608 - 15.5555}{\sqrt{\left(\frac{2109.922 + 800.445}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = 1.88$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XXIII

A_4 SCORES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	07	49	10	100
2	15	225	15	225
3	26	676	09	81
4	30	900	18	324
5	31	961	09	81
6	24	576	20	400
7	21	441	22	484
8	20	400	17	289
9	25	625	18	324
10	13	169	18	324
11	27	729	14	196
12	20	400	20	400
13	21	441	23	529
14	15	225	13	169
15	16	256	26	676
16	19	361	21	441
17	20	400	27	729
18	13	169	20	400
19	22	484		
20	20	400		
21	16	256		
22	22	484		
23	21	441		
24	12	144		
25	28	784		
26	16	256		
27	28	784		
28	10	100		
29	13	169		
30	25	625		
31	20	400		
32	23	529		
33	15	225		
34	17	289		
35	27	729		
36	17	289		
37	11	121		
38	26	676		
39	07	49		
40	08	.64		
41	25	625		
42	17	289		

TABLE XXIII (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	29	841		
44	17	289		
45	17	289		
46	19	361		
47	19	361		
48	14	196		
49	13	169		
50	25	625		
51	23	529		
Total	985	20,875	320	6,172
Mean	19.3137		17.7777	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 1850.980 \qquad \Sigma y^2 = 483.111$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{19.3137 - 17.7777}{\sqrt{\left(\frac{1850.980 + 483.111}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = .95$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XXIV

A_5 SCORES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	15	225	08	64
2	16	256	18	324
3	21	441	11	121
4	29	841	18	324
5	24	576	10	100
6	20	400	18	324
7	19	361	19	361
8	19	361	16	256
9	24	576	18	324
10	15	225	14	196
11	25	625	12	144
12	19	361	18	324
13	23	529	20	400
14	14	196	11	121
15	16	256	17	289
16	21	441	19	361
17	21	441	21	441
18	15	225	22	484
19	18	324		
20	18	324		
21	13	169		
22	18	324		
23	19	361		
24	14	196		
25	23	529		
26	14	196		
27	25	625		
28	12	144		
29	17	289		
30	23	529		
31	16	256		
32	17	289		
33	10	100		
34	16	256		
35	26	676		
36	17	289		
37	18	324		
38	24	576		
39	07	49		
40	13	169		
41	20	400		
42	16	256		

TABLE XXIV (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	26	676		
44	13	169		
45	18	324		
46	14	196		
47	22	484		
48	08	64		
49	15	225		
50	23	529		
51	24	576		
Total	933	18,229	290	4,958
Mean	18.2941		16.1111	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n}$$

$$\Sigma x^2 = 1160.588$$

$$\Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma y^2 = 285.778$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{18.2941 - 16.1111}{\sqrt{\left(\frac{1160.588 + 285.778}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = 1.71$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XXV

POST-TEST SCORES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	70	4,900	54	2,916
2	55	3,025	62	3,844
3	49	2,401	67	4,489
4	75	5,625	69	4,761
5	50	2,500	49	2,401
6	50	2,500	74	5,476
7	58	3,364	42	1,764
8	47	2,209	42	1,764
9	43	1,849	74	5,476
10	39	1,521	51	2,601
11	69	4,761	53	2,809
12	53	2,809	52	2,704
13	70	4,900	60	3,600
14	46	2,116	59	3,481
15	32	1,024	54	2,916
16	77	5,929	54	2,916
17	39	1,521	57	3,249
18	53	2,809	46	2,116
19	73	5,329		
20	37	1,369		
21	50	2,500		
22	56	3,136		
23	63	3,969		
24	56	3,136		
25	60	3,600		
26	47	2,209		
27	66	4,356		
28	78	6,084		
29	27	729		
30	58	3,364		
31	46	2,116		
32	69	4,761		
33	44	1,936		
34	63	3,969		
35	84	7,056		
36	65	4,225		
37	50	2,500		
38	65	4,225		
39	33	1,089		
40	55	3,025		
41	76	5,776		
42	31	961		

TABLE XXV (Continued)

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
43	70	4,900		
44	22	484		
45	75	5,625		
46	51	2,601		
47	32	1,024		
48	60	3,600		
49	87	7,569		
50	59	3,481		
51	75	5,625		
Total	2,858	172,092	1,019	59,283
Mean	56.0392		56.6111	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 11931.922 \qquad \Sigma y^2 = 1596.278$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{56.0392 - 56.6111}{\sqrt{\left(\frac{11931.922 + 1596.278}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = .15$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant.

TABLE XXVI

POST-TEST SCORES--SECOND SEMESTER (ADJUSTED)

Post-test scores adjusted through the analysis of covariance technique reveal these changes in mean scores:

Large Class: Unadjusted Mean----56.0392
Adjusted Mean----55.7826

Small Class: Unadjusted Mean----56.6111
Adjusted Mean----57.3380

Computation of t Value

$$t = \frac{55.7826 - 57.3380}{\sqrt{\left(\frac{11931.922 + 1596.278}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$$t = .40$$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is not significant when the means are adjusted through the analysis of covariance technique.

TABLE XXVII

ABSENCES--SECOND SEMESTER

Student Number	Large Class X	Large Class X^2	Small Class Y	Small Class Y^2
1	0	0	0	0
2	4	16	0	0
3	16	256	2	4
4	10	100	1	1
5	2	4	1	1
6	2	4	0	0
7	21	441	4	16
8	1	1	3	9
9	9	81	1	1
10	0	0	5	25
11	4	16	1	1
12	11	121	3	9
13	5	25	12	144
14	14	196	5	25
15	7	49	1	1
16	2	4	2	4
17	5	25	2	4
18	6	36	3	9
19	4	16		
20	2	4		
21	1	1		
22	2	4		
23	4	16		
24	2	4		
25	8	64		
26	4	16		
27	1	1		
28	6	36		
29	9	81		
30	21	441		
31	1	1		
32	2	4		
33	1	1		
34	2	4		
35	0	0		
36	4	16		
37	10	100		
38	12	144		
39	7	49		
40	5	25		
41	2	4		
42	13	169		

TABLE XXVII (Continued)

Student Number	Large Class X	X^2	Small Class Y	Y^2
43	3	9		
44	4	16		
45	0	0		
46	1	1		
47	4	16		
48	0	0		
49	5	25		
50	3	9		
51	3	9		
Total	265	2,661	46	254
Mean	5.1961		2.5555	

Computation of t Value

$$\Sigma x^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \qquad \Sigma y^2 = \Sigma Y^2 - \frac{(\Sigma Y)^2}{n}$$

$$\Sigma x^2 = 1284.039 \qquad \Sigma y^2 = 136.445$$

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \qquad t = \frac{5.1961 - 2.5555}{\sqrt{\left(\frac{1284.039 + 136.445}{51 + 18 - 2}\right)\left(\frac{1}{51} + \frac{1}{18}\right)}}$$

$t = 2.09$

With 67 degrees of freedom and utilizing a two-tailed test, a t value must be 2.00 (or greater) to be significant at the .05 level. This t value is significant.

APPENDIX E

ANALYSIS OF COVARIANCE TABLES FOR FIRST- AND SECOND-SEMESTER EXPERIMENTS

TABLE XXVIII

ANALYSIS OF COVARIANCE TABLE (FIRST SEMESTER)

Source	DF	YY	Sum-Squares (Due)	Sum-Squares (About)	DF	Mean-Square
Treatment (Between)	1	545.3750				
Error (Within)	64	8242.4375	2456.1350	5786.3008	58	99.7638
Treatment + Error (Total)	65	8787.8125	2842.4280	5945.3828	59	
Difference for Testing Adjusted Treatment Means				159.0820	1	159.0820

Null Hypothesis: No difference among treatments after adjusting with covariates. F (1,58) = 1.595. The F value must exceed 4.00 to be significant at the .05 level.

TABLE XXIX

ANALYSIS OF COVARIANCE TABLE (SECOND SEMESTER)

Source	DF	YY	Sum-Squares (Due)	Sum-Squares (About)	DF	Mean-Square
Treatment (Between)	1	4.3125				
Error (Within)	67	13528.2500	3928.7461	9599.5039	61	157.3689
Treatment + Error (Total)	68	13532.5625	3903.2383	9629.3242	62	
Difference for Testing Adjusted Treatment Means				29.8203	1	29.8203

Null Hypothesis: No difference among treatments after adjusting with covariates. F (1,61) = 0.189. The F value must exceed 4.00 to be significant at the .05 level.

APPENDIX F

CORRESPONDENCE TO AND FROM

VALIDATING PANEL

Memorandum I

To: J. Moffitt, Wm. Harris, W. Moffitt, and Whisenhunt

From: Ray A. Stearns

Date: August 10, 1968

Re: Validation of Accounting Test

You may recall our conversation in which I asked you to serve as a member of a validating committee composed of Certified Public Accountants relative to a research project I am pursuing.

The project involves an experiment in class size in elementary accounting to determine if a small class or a large class will achieve the greatest gain in accounting knowledge.

Enclosed you will find a test I have constructed that is designed to measure the accounting knowledge of students prior to instruction in the first course of accounting at Northeastern State College.

I would be interested in any comments and recommendations you might have to improve the reliability and validity of this test. The test will be administered to the classes on the first day of attendance to determine the extent of prior knowledge of accounting. The same test will be administered at the end of the semester to determine the average gain in accounting knowledge for the class as a whole.

I will be greatly indebted to you if you will consent to assist me in this research project.

R. A. S.

Memorandum II

To: Ray A. Stearns

From: J. Moffitt, Wm. Harris, W. Moffitt, and Whisenhunt

We have examined the accounting pre-test that you have forwarded and after a thorough examination feel that we can make these observations:

a. The test seems to be quite thorough in that it contains information that could be acquired only by formal or practical accounting experience. Since we are personally familiar with the particular accounting course to which you refer and have a copy of the textbook used in that course, we feel that the pre-test is a very adequate examination to ascertain accounting knowledge prior to instruction in the course.

b. One observation that came to us immediately was that the test would be quite rigorous for a person who has absolutely no prior knowledge of accounting. However, as you explain it, the purpose of the pre-test <u>is</u> to ascertain prior accounting knowledge.

c. Several of the questions relating to the determination of interest and proceeds could be answered as a result of prior mathematical instruction. However, since this type of information is presented in the elementary course of accounting, and since there are so few of these questions, we feel that it will not affect the validity of the pre-test.

Therefore, it is our professional opinion that the accounting pre-test you have enclosed will be valid and reliable for the purpose of your research project.

APPENDIX G

STUDENT OPINIONNAIRE AND DATA SHEET

STUDENT OPINIONNAIRE FOR THE EVALUATION OF PRINCIPLES OF ACCOUNTING 213

Directions to the Student: DO NOT SIGN YOUR NAME ON THIS PAPER. This is not a test and will not affect your grade in any way. Please be sure to answer every question. This opinionnaire is designed to determine what you think and feel about attending a "small" class or a "large" class at this college. To aid you in your responses a "small" class will be defined as 25 or fewer students and a "large" class will be defined as 70 or more students.

1. Approximately how many large classes have you attended in college? . . . . . _____
2. Approximately how many small classes have you attended in college? . . . . . _____
3. How secure did you feel in this class? (Did you feel any degree of uneasiness because of being in a class of this size?) (a) very secure; (b) moderately secure; or (c) very insecure. . . . . _____
4. How many distractions were there in your class? (a) many; (b) some; or (c) very few . . . . . _____
5. How difficult was it to concentrate in your class? (a) very difficult; (b) sometimes difficult; or (c) rarely difficult . . . . . _____
6. Did you feel that you had adequate personal contact with your instructor? (a) frequently; (b) sometimes; or (c) very little . . . . . _____
7. How highly motivated were you to prepare the outside assignments for this course? (a) highly motivated; (b) moderately motivated; or (c) seldom motivated. . . . . _____
8. How important (as an individual) did you feel in this class? (a) very important; (b) important; or (c) very unimportant . . . . . _____
9. Did you feel that you were able to interrupt your instructor in order to ask questions as often as you liked? (a) frequently; (b) sometimes; or (c) rarely. . . . . _____
10. Approximately how many personal consultations (office visits for help with course work,--not merely to inquire about marks) did you have with your instructor? (a) 5 or more; (b) between 1 and 5); or (c) none . . . . . _____
11. How frequently did you find yourself daydreaming in class? (a) very rarely; (b) sometimes; or (c) frequently . . . . . _____
12. How effective do you think the instruction was in this course? (a) very effective; (b) sometimes effective; or (c) rarely effective. . . . . _____
13. How formal was the instructor in presenting the lectures? (a) very formal; (b) formal; or (c) very informal . . . . . _____
14. How good was the instructor in dealing with students? (a) very good; (b) sometimes good; or (c) poor. . . . . _____
15. If you had the opportunity to move to another section of this course early in the semester, how would you have felt about moving? (a) would liked to have moved; (b) would have made no difference to me; or (c) would have wanted to remain. . . . . _____

16. How well did you like this class? (a) liked it very much; (b) neither liked nor disliked it; or (c) disliked it very much. . . . . _____
17. If you take the second course in Principles of Accounting, in what size class would you prefer to enroll? (a) a class smaller than this one; (b) a class about this size; or (c) a class as large or larger than this one . . . . . _____
18. In which size class do you feel you can earn the highest possible grade? (a) 10 to 25; (b) 26 to 69; or (c) 70 or more. . . . . _____
19. How valuable were the lectures by the instructor? (a) very valuable; (b) moderately valuable; or (c) of little or no value . . . . . _____
20. How valuable was the question-and-answer method used during selected periods? (a) very valuable; (b) moderately valuable; or (c) of little or no value. . . . . _____

DATA SHEET

NAME_____ AGE_____
(last) (first) (middle)

FROM WHAT HIGH SCHOOL DID YOU GRADUATE?_____

WHAT WAS YOUR GRADE POINT AVERAGE IN HIGH SCHOOL? (If Known)_____

DID YOU TAKE HIGH SCHOOL BOOKKEEPING? _____ IF SO, WHAT GRADE DID YOU EARN IN THE COURSE? _____ HAVE YOU ENROLLED PREVIOUSLY IN ANY COLLEGE ACCOUNTING COURSE? _____ IF SO, WITH WHAT RESULTS? (Did you pass the course, withdraw from the course, etc.) _____

HOW LONG DID YOU ATTEND THE ACCOUNTING COURSE? (Approximately) _____

IN WHAT AREA OF COLLEGE DO YOU PLAN TO MAJOR? (If Known) _____

VITA

Ray Allen Stearns

Candidate for the Degree of

Doctor of Education

Thesis: AN EXPERIMENT WITH CLASS SIZE IN THE TEACHING OF ELEMENTARY ACCOUNTING

Major Field: Business Education

Biographical:

Personal Data: Born July 20, 1933, at Osage, Oklahoma, the son of Chester R. and Freda Stearns.

Education: Attended elementary school at Barnsdall 55 in Osage County and was graduated from Sperry High School, Sperry, Oklahoma, in May, 1951. Received the Bachelor of Science degree from Central State College, Edmond, Oklahoma, in May, 1955, with a major in Business Administration. Received the Master of Science degree from Oklahoma State University in July, 1962, with a major in Business Education. Completed requirements for the Doctor of Education degree in August, 1969.

Professional Experience: Taught three years at Hominy High School, Hominy, Oklahoma, in the Business Education area. Taught half-time at Oklahoma State University during 1961-1962 and 1967-1968. Served as an instructor and assistant professor at Northeastern State College from 1962-1969.

Professional Organizations: Member of Pi Omega Pi, Delta Pi Epsilon, National Business Education Association, Oklahoma Business Education Association, and Oklahoma Education Association.