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An Evaluation of Instructional Grouping and Achievement within an Accelerated Science Program

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AN EVALUATION OF INSTRUCTIONAL GROUPING AND ACHIEVEMENT WITHIN AN ACCELERATED SCIENCE PROGRAM

THESIS

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TABLE OF CONTENTS

LIST OF TABLES

TABLE

ABSTRACT

This thesis was designed to determine if an accelerated science program had an effect on the performance of accelerates and nonaccelerates on New York State Regents Exams.

Four groups of students representing 54 students were used in the study. Two groups were heterogeneous and two were homogeneous. A t - test analysis was performed to determine if a significant difference in Regents exams existed due to instructional grouping.

Results indicated that this study has shown that no statistically significant difference in scores occurred due to instructional grouping.

Chapter I

INTRODUCTION

Background of the Problem

It is the intent of this research study to demonstrate the effects of an accelerated science program on the Regents exam scores of accelerates and nonaccelerates. Specifically, the study will examine whether differences in Regents exam scores of various class sets can be attributed in any significant way to the way accelerates and nonaccelerates were grouped for instruction. The study was conducted at Oakfield-Alabama Central School (OACS) which is located in Oakfield, New York.

Purpose of the Study

This study is being conducted in order to determine which grouping scheme results in the best performance on Regents exams, both by accelerates and nonaccelerates. If scheduling permits, the goal of the accelerated program at OACS is to group accelerates homogeneously. With the possible exception of gifted students, most research seems to indicate that heterogeneous grouping enhances the academic and emotional development of all groups of students (Slavin, 1988; VanTassel, Willis & Meyer, 1989). It is the goal of this study to:

1. add to the research on grouping for instructional purposes, and
2. determine if accelerates achieve better in homogeneous classes, and
3. determine if nonaccelerates achieve better in heterogeneous classes.

Statement of the Problem

Data will be collected to test the following null hypotheses:

1. There shall exist no statistically significant difference between the Regents Chemistry exam scores of nonaccelerates taught in homogeneous classes and the Regents Chemistry exam scores of nonaccelerates taught in heterogeneous classes.

2. There shall exist no statistically significant difference between the Regents Biology exam score of accelerates taught in homogeneous classes and the Regents Biology exam scores of accelerates taught in heterogeneous classes.

The first hypothesis will be tested by comparing a group of 12 students who were enrolled in Regents Chemistry during the 1990-1991 school year (Group B) to a group of 24 students who were enrolled in Regents Chemistry during the 1989-1990 school year (Group A). Group B students were taught in a homogeneous nonaccelerated class, while Group A students were taught in heterogeneous classes.

To ensure that the two groups are statistically similar before instruction in chemistry began, the mean scores for the Regents Biology exam will be compared. A t - test will then be applied to see if the hypothesis should be retained.

The second hypothesis will be tested by comparing a group of 11 accelerated students who were enrolled in Regents Biology during the 1988-1989 school year (Group C) to a group of 7 accelerated students who were enrolled in Regents Biology during the 1989-1990 school year (Group D). Group C students were taught in a homogeneous biology class, while Group D students were taught in a heterogeneous biology class. The data analysis will be similar to that used for the first hypothesis, except that Regents Earth Science exam scores will be compared for Groups C and D to ensure that they were statistically similar as they entered Regents Biology.

Definition of Terms

For further clarity, the following terms are operationally defined:

1. Accelerate - A student who has been academically accelerated in the science curriculum. A student is selected as a candidate for the accelerated science program based on his/her 6th grade California Test of Basic Skills (CTBS) science battery score and the recommendation of the elementary school science coordinator. A student so selected completes the two year junior high science sequence (life science and physical science) during the 7th grade. To remain eligible for acceleration to earth science as an 8th grader, the student must maintain an 85 average in science during 7th grade.

2. Heterogeneous Class - A chemistry class that contains 11th grade students who have followed the usual course sequence in the science curriculum, as well as some 10th grade accelerates. A typical heterogeneous class would

consist of about fifteen 11th graders and about five 10th graders.

3. Homogeneous Accelerated Class - A class that contains only accelerates.

4. Homogeneous Nonaccelerated Class - A class that contains only students who have followed the usual course sequence in the science curriculum.

5. Nonaccelerate - A student who has followed the usual course sequence in the science curriculum.

Assumptions

The following were assumed to be true for this study:

1. Instructional formats were similar for both experimental and control groups

2. The instructor was the same for both experimental and control groups.

3. Experimental and control groups represented similar groups of students.

4. Population distributions were normal and population variations were equal for all sets of students.

5. Groups were independent of each other.

6. The instructional format was of the traditional competitive type for all groups.

Limitations

A major limitation of this study is showing that any observed effect on the performance of the nonaccelerates is directly attributable to the presence of accelerates in the class. Variables such as time of day, class personality, willingness to learn, teacher personality, and course content may account for a significant percentage of any observed effect. Also, sample sizes are small and any observed effect may not be representative of the population at large.

Summary

This chapter has summarized the intent of this thesis as one of studying the effects of an accelerated science program on both accelerates and nonaccelerates. The grouping scheme used was described, along with a definition of terms, and the limitations inherent for this study.

Chapter II

REVIEW OF LITERATURE

This chapter includes research related to two topics. The first section describes research related to grouping strategies as they specifically relate to accelerated programs. The second section summarizes the effects of accelerated programs on accelerates and nonaccelerates.

The intent of this study is to test two null hypotheses that apply to the accelerated science program at Oakfield-Alabama Central School. These are that:

1. there shall exist no statistically significant difference between the Regents Chemistry exam scores of nonaccelerates taught in homogeneous classes and those of nonaccelerates taught in heterogeneous classes, and

2. there shall exist no statistically significant difference between the Regents Biology exam scores of accelerates taught in homogeneous classes and those of accelerates taught in heterogeneous classes.

Historical Background on Accelerated Programs

The views, feelings and experiences of educators are understandably varied when discussing grouping of students by ability for instructional purposes. A personal bias may be the result of one's own relatively narrow perspective, rather than on objective evidence. Experimental research on

grouping has been on going for many years, with citations in the literature dating as far back as 50 or 60 years (Purdom 1919; Miller & Otto, 1930; Hartill, 1936; Holy & Sutton, 1930).

Two common arguments in favor of grouping are:

1. that students achieve better when grouped with students of similar ability, and

2. that it increases the probability that the pace of instruction is adequate for all students.

The most common arguments against the use of grouping are:

1. that emotional damage occurs to students of below average ability (Slavin, 1988), and

2. that maximum achievement occurs when students are grouped heterogeneously (Slavin, 1988; Johnson & Johnson, 1984), and

3. that no achievement gains occur from grouping (Slavin, 1988).

In the past ten years, two major syntheses have been done on the effects of grouping. Slavin (1988, 1987a) conducted a "best-evidence synthesis" wherein he drew summarizing conclusions from research studies on grouping, going back some 60 years. His synthesis tends to focus on research done with elementary students, though he does refer to a few studies involving secondary students. Kulik and Kulik (1982) did what they called a "meta-analysis" on the effects of grouping secondary students. They refer to a "meta-analysis" as a synthesis of the research where only objective conclusions are drawn. They state that their conclusions can be directly substantiated by concrete data from several studies.

Slavin (1988) found that achievement gain was zero when students were grouped homogeneously for the entire school day. This conclusion applied to elementary students of all abilities. Slavin does note that grouping had a positive effect on the achievement of students only under the following circumstances.

1. Students were grouped heterogeneously most of the day.

2. Grouped instruction is designed to minimize heterogeneity in specific subject areas.

3. Grouped instruction is used for a maximum of two subject areas per day.

4. Teachers carefully monitor the pace and level of instruction for groups.

5. Assignment to a group is reassessed frequently based upon performance, attitude and motivation.

Goodlad (1960) suggested that ability grouping has little effect on student achievement at the high school level because students are grouped early in high school into either academic, general or vocational tracks. His observation was that guidance persons tend to group students based on general ability, sometimes with no regard to ability in specific subject areas. As a result, heterogeneity may still be high within a specific subject area, even though the intention is to create a homogeneous group by ability.

Goodlad's hypothesis seems to be verified by the "meta-analysis" of Kulik and Kulik (1982). Their research focused on the effects of grouping high school students. They found that grouping produced almost no gain in academic

achievement when considering the student body as a whole. When all the literature they reviewed was analyzed, they found that the average gain per student was 0.10 of 1 standard deviation, or, said another way, average achievement increased from the 50th to the 54th percentile. Their synthesis of the literature also revealed that students of similar ability achieve at similar levels, regardless of whether they were grouped homogeneously or heterogeneously for instruction.

Kulik and Kulik also looked at the effect that grouping had on students of specific ability levels. They found that significant achievement gains were made when gifted students were grouped separately. This prompted a second "meta-analysis" (Kulik & Kulik, 1984) which is referred to later.

It would appear that the most up to date synthesis of the literature does not support the use of grouping in an all encompassing way. Successful results with grouping seem restricted to cases where students spend most of the school day mixed heterogeneously by ability, and receive instruction in ability groups in a maximum of two subject areas (Slavin, 1987a) Furthermore, most students achieve equally well whether grouped by ability or mixed heterogeneously (Slavin, 1988). Slavin (1987b) has also reviewed literature pertaining to mastery learning as a heterogeneous instructional mode, and found that mastery learning tends to produce no significant gain in student achievement when compared with other instructional methods. Johnson & Johnson (1984) found that the best academic results are obtained in heterogeneous settings where cooperative learning strategies are used. Their research shows that lower and middle ability students undergo significant academic gains in this setting. They do note that

the gains made by upper ability students tend to be only slightly higher than those made by similar students who were exposed to other heterogeneous instructional methods.

Effects of Accelerated Programs on Accelerates

Also important in this study are the effects of grouping strategies on both accelerates and nonaccelerates. More literature seems to be available on the effects on accelerates. Slavin (1988) concluded that no strong evidence exists in favor of special instructional programs for gifted students, but only that accelerated programs may increase the achievement of gifted students. This conclusion was based on what was previously referred to as Slavin's "best-evidence synthesis".

Two significant studies contradict this finding. One was done by Kulik and Kulik (1984A, 1984B), who did a second "meta-analysis" of the literature in an attempt to quantify effects of accelerated programs on the accelerates. Their review of the literature only considered studies which had data that was quantified and collected objectively. It was their hope to eliminate any studies which made conclusions based on subjective measures, or where results had been interpreted based on the bias of the researcher. As a result, their findings may represent a method for looking for trends in accelerated instruction. The second contradicting study was done by Brody and Benbow (1987), and will be referred to later.

Kulik and Kulik (1984a, 1984b) examined 13 studies where accelerates were compared to a control group consisting of nonaccelerates one year older in chronological and mental age. In each study, the accelerates and older nonaccelerates were matched by IQ score. In four of these studies, the younger accelerates outperformed their older counterparts, and in the other nine studies, they matched performance. They also examined 13 studies, each of which compared accelerates to a same age, bright, nonaccelerate control group. The average effect was that the accelerates showed a gain of 0.88 grade levels over the nonaccelerates. This data indicates that a positive effect occurs when accelerates are exposed to accelerated instructional programs.

A looming question remains, namely, whether or not this positive effect is caused by the homogeneous grouping or instead by the exposure to the more rigorous accelerated instruction. Regardless, it is worthwhile to note that a purely quantitative analysis of the literature indicates a strong positive case for accelerated instructional programs.

Other less tangible questions remain, such as:

1. Are there social/emotional impacts on accelerates?

2. Does the performance of nonaccelerates decrease or increase when accelerates are not in the class?

3. Does accelerated instruction promote an attitude of elitism among accelerates, or inferiority complexes among nonaccelerates?

Some of these questions were addressed by Brody and Benbow (1987) when they conducted a follow-up study of students who participated in the "Study of Mathematically Precocious Youth" at Johns Hopkins University under

the direction of J. Stanley. Stanley's study divided participants into four groups as follows.

Group 1 - Students who were accelerated to the point of skipping at least one grade.

Group 2 - Students who took several accelerated or AP courses.

Group 3 - Students who were at least exposed to accelerated or enriched curriculum.

Group 4 - Students who had no exposure to accelerated/enriched/AP courses.

Brody and Benbow (1987) were interested in examining four variables related to Stanley's study: academic achievement, extracurricular involvement, goals and aspirations, and social/emotional development. Their findings showed that some of the traditional concerns about accelerated programs may be unfounded. Their major conclusions were as follows.

1. Group 1 students earned more State/National Academic Awards than any other group, despite having at least one less year in high school than other groups.

2. Group 1 students were more likely to be accepted at selective colleges and universities.

3. Groups 2 students excelled more than any other group in extracurriculars. It was surmised by Brody and Benbow that Group 1 students may have been as capable, but were more inhibited because they were displaced from their normal peer group by grade skipping.

4. Group 1 and 2 students earned more Ph.D.'s in law and medicine.

5. Group 1 and 2 students showed no differences in social/emotional development as compared to Group 3 and 4 students.

Summarizing this research, optimal academic and emotional/social development seems to occur for those students who were accelerated in several curriculum areas, but not across the entire curriculum. This concurs with findings of Slavin (1987A).

Effects of Accelerated Programs on Nonaccelerates

Very limited research exists on the effect that removing accelerates from the classroom has on nonaccelerates. One widely held view is that removing accelerates has a detrimental effect on nonaccelerates because of the absence of high-achieving peer models.

Schunk (1987) reviewed five studies that compared students who had "coping models" as peers in the classroom with students who had "mastery models" as peers. A "coping model" is a student who initially struggles with new learning but eventually masters it. A "mastery model" is a high-aptitude student who models the learning perfectly from the outset. In three studies, students showed better achievement when they had coping models, and in the other two, no significant difference appeared.

Schunk (1987) suggests that a loose interpretation of these results might be that students are more likely to feel motivated and self-confident if they have peer models of similar ability who are successful at the learning. This would

seem to give some support for grouping accelerates and nonaccelerates separately for instruction. This does contradict the findings of Johnson and Johnson (1984) who claim that the largest gains are made by average and below average students when they are grouped heterogeneously with above average students. However, their results are only valid for cooperative learning teaching strategies.

Summary

In conclusion, this chapter outlines the research to date on the effects of accelerated programs on students. Most research seems to indicate that best achievement for accelerates occurs when they are grouped homogeneously for two or less classes per day. The limited research on the effects on nonaccelerates is not conclusive at this time.

Chapter III

PROJECT DESIGN

This chapter will describe the design of the study, data collection instrument, sample selection, and collection and analysis of data. This study is designed to test for the effect of an accelerated program on nonaccelerates and accelerates who take Regents science exams. The project is designed to test the following hypotheses.

1. There shall exist no statistically significant difference between the Regents Chemistry exam scores of nonaccelerates taught in homogeneous classes and those of nonaccelerates taught in heterogeneous classes.

2. There shall exist no statistically significant difference between the Regents Biology exam scores of accelerates taught in homogeneous classes and those of accelerates taught in heterogeneous classes.

Research Design

A true experimental research design was implemented for this study. The independent variable manipulated was the type of grouping used for instruction, and the dependent variable measured was the level of achievement on a Regents science exam. True randomization of students in groups was limited by the design of the study and by scheduling limitations imposed by the school district where the study was conducted.

Sampling Methods

The sample sizes were beyond the control of the experiment due to scheduling limitations. Group A represents 12 nonaccelerates taught in a homogeneous nonaccelerated chemistry class during the 1990-1991 school year. Group A was the control group for the phase of the study which examined the effect of the accelerated program on the nonaccelerates. The experimental group (Group B) for this phase was composed of 24 nonaccelerates who took chemistry in heterogeneous classes during the 1989-1990 school year.

All students selected for this phase of the study met the following criteria:

1. Took biology as tenth graders
2. Received instruction from the same biology teacher
3. Sat for the New York State Regents exam in biology
4. Took chemistry as eleventh graders
5. Received instruction from the same chemistry teacher

The effect of the accelerated program on accelerates was examined using Groups C and D. The control group (Group C) represents 11 accelerates taught in a homogeneous accelerated biology class during the 1988-1989 school year. The experimental group (Group D) represents 7 accelerates taught in heterogeneous biology classes during the 1989-1990 school year. All students selected for this phase of the study met the following criteria:

1. Took earth science as eighth graders
2. Received instruction from the same earth science teacher

3. Sat for the New York State Regents exam in earth science
4. Took biology as ninth graders
5. Received instruction from the same biology teacher

Setting

This study was conducted in a small, rural school district in Western New York. The study involved students from three separate graduating classes, ranging from 1991 to 1993. All nonaccelerates received chemistry instruction in the same classroom, from the same chemistry teacher, sometime between 8:45 A.M. and 11:45 A.M. As well, all accelerates received biology instruction in the same classroom, from the same biology teacher, sometime between 11:45 A.M. and 2:45 P.M. All Regents exams were administered during the third week in June, on the date mandated by the Board of Regents. All exams were administered in the high school gymnasium.

Instructional Format

Accelerates received instruction in biology based on a lecture format. Students took daily notes from the lecture, and had daily assignments out of a review book. This format was the same for Groups C and D.

Nonaccelerates received chemistry instruction based on a lecture and teamwork format. Students received a daily lecture/demonstration and then had problem sets to work on in small group settings. Assignments were given on

a weekly basis. This format was the same for Groups A and B.

Data Collection Instrument

The three criterion - referenced devices used in this study were the New York State Regents exams in earth science, biology and chemistry. All exams were produced by the New York State Board of Regents between the years of 1988 and 1991. Copies of these exams may be obtained by requesting New York State review books for each area of study from Prentice Hall School Division, 1-800-848-9500. The Regents exams in science use an interval/ratio scale. Questions are multiple choice, with the score being proportional to the number of correct responses. Scores may range from zero to 100, with scores varying continuously between these values. All scores are integers.

The earth science and biology exams were used for the phase of the study which involved the accelerates. The scores on the earth science exam were used to evaluate the equivalence of Groups C and D prior to biology instruction. The measurement tool itself was the biology exam.

The biology and chemistry exams were used in the phase of the study which involved the nonaccelerates in Groups A and B. Equivalence of the two groups was evaluated using the biology exam scores, and the measurement tool was the chemistry exam.

Data Collection Procedure

The Regents exams in science are given on a day during the third or fourth week of June, as mandated by the Board of Regents. The duration of the exam is three hours. An individual is eligible to sit for the exam if he has met the state-mandated laboratory requirement of 30 hours. Each student has an answer sheet on which to record answers. The answers must be recorded in strict accordance with exam rules, which require that each answer be circled and marked over with an "X". Any question with more than one mark is automatically invalidated. This is to prevent tampering by scorers. Answer sheets for each student were checked against an answer key provided by the Board of Regents. The exam in a particular curriculum area was corrected by one scorer, usually the teacher of that curriculum area.

Exam scores of groups are part of the public record as required by New York State law and must be produced upon demand. As a result, strict confidentiality was not deemed necessary for this study.

Data Analysis Procedure

The level of significance for statistical analysis was predetermined at the 0.01 level for the effect on nonaccelerates, and at the 0.05 level for the effect on accelerates. The more conventional value of 0.05 was not chosen for the effect on nonaccelerates since a significant body of research already indicates that grouping nonaccelerates with accelerates improves the performance of

nonaccelerates. (Slavin, 1988; Johnson & Johnson, 1984). Choosing an alpha level of 0.01 will increase the significance of any observed differences between Groups A and B.

Demographic factors such as gender and race were beyond the control of the experiment. Age was controlled, as described earlier, in an attempt to minimize differences between control and experimental groups.

Statistical analysis for the effect on nonaccelerates was performed between the experimental group (Group B) and control group (Group A) scores on the Regents exam in biology to determine if any significant difference in science ability existed between the groups before chemistry insruction began. Mean scores on this exam were determined for Group A and Group B. The group means were compared with an independent t - test to measure any significant difference in science ability prior to chemistry instruction.

Post-treatment analysis was performed between Group A and Group B scores on the Regents exam in chemistry to determine if any significant difference in chemistry aptitude existed between the groups due to instructional grouping. Mean group scores were compared with an independent t - test.

Statistical analysis for the effect on accelerates was performed between the experimental group (Group D) and the control group (Group C) scores on the Regents exam in earth science to determine if any significant difference in science ability existed between the groups prior to biology instruction. Mean scores were determined and compared with an independent t - test.

Post-treatment analysis was performed between Group C and Group D scores on the Regents exam in biology to determine if a significant difference in

biology aptitude existed between the groups due to instructional grouping. Mean scores were compared with an independent t - test.

The effect of instructional grouping on accelerates was measured after instruction in biology rather than after chemistry instruction because all chemistry classes were heterogeneous, due to scheduling.

Summary

This chapter on project design has summarized the design of the study, sample selection and size, setting of the study, and the instructional format. The data collection instrument, data collection procedure and data analysis were also described. The analysis involved the use of independent t - tests.

Chapter IV

PRESENTATION AND ANALYSIS OF DATA

This research study was designed to determine if a relationship existed between type of instructional grouping and performance on a Regents exam in science. Each student that participated in the study sat for two exams, where each exam represented a criterion-referenced evaluation tool for measuring performance in a subject area. Specifically, the goals of this study will be evaluated by using the following null hypotheses.

1. There shall exist no statistically significant difference between the Regents Chemistry exam scores of nonaccelerates taught in homogeneous classes and those of nonaccelerates taught in heterogeneous classes.

2. There shall exist no statistically significant difference between the Regents Biology exam scores of accelerates taught in homogeneous classes and those of accelerates taught in heterogeneous classes.

Student Profile

Thirty-six students participated in the phase of the study which examined the effect of an accelerated program on nonaccelerates. These

students were divided into two groups, according to the instructional setting in which they took chemistry. Due to the uncontrolled dimension of scheduling, it also happened that students in the two groups took chemistry during different calendar years. However, all students included in this phase of the study were juniors by academic standing and received instruction from the same teacher.

The control group consisted of 12 students who were taught in a homogeneous nonaccelerated class during the 1990-1991 school year. All students were Caucasians; nine were males and three were females.

The experimental group consisted of 24 students who were all taught in heterogeneous chemistry classes during the 1989-1990 school year. Twenty-three were Caucasian and one was African-American; 12 were males and 12 were females.

All students who met the following criteria were included in this phase of the study:

1. Had not been accelerated in the science curriculum
2. Had not been eligible to be accelerated
3. Were juniors by academic standing
4. Had taken biology as tenth graders the previous year
5. Received chemistry instruction from the same teacher

Eighteen students participated in the phase of the study that examined the effect of the accelerated program on the accelerates. The control group consisted of 11 accelerates who received biology instruction during the 1988-1989 school year in a homogeneous accelerated class. All students in this group were Caucasians; six were males and five were females.

The experimental group consisted of seven accelerates who were enrolled in biology during the 1989-1990 school year, and who were taught in heterogeneous classes. All students in this group were Caucasian; five were females and two were males.

Statistical Analysis

Statistical analysis for the effect of an accelerated science program on nonaccelerates was performed between experimental and control groups (Group A and Group B). Significant difference in science ability between the two groups prior to chemistry instruction was assessed by using the Regents exam in biology. The mean Regents biology exam score for the experimental group was 75.75 with a standard deviation of 4.36. The mean Regents biology exam score for the control group was 75.33 with a standard deviation of 7.68. The independent t - test produced a calculated t score of -0.210, with a required t of 2.732. Therefore, it was concluded that science ability between experimental and control groups was not significantly different as measured by the Regents exam in biology. The results of this t - test are summarized in Table 1.

TABLE I

Means on the Regents Exam in Biology

Group	N	Mean	Standard Deviation	t
Experimental	24	75.75	4.36	-0.210
Control	12	75.33	7.68	

$p>0.01$

In order to assess significant differences in chemistry achievement based on instructional grouping, statistical analysis was performed between the experimental and control groups on the Regents exam in chemistry. The mean Regents chemistry exam score for the experimental group was 70.92 with a standard deviation of 8.85. The mean Regents chemistry exam score for the control group was 71.00 with a standard deviation of 7.15. The independent t - test produced a calculated t score of +0.03, with a required t value of 2.732. The null hypothesis was retained with a p greater than 0.01. Therefore, it was concluded that the chemistry achievement between experimental and control groups was not significantly different as measured by the Regents exam in chemistry. The results of this t - test are summarized in Table 2.

Table 2

Means on the Regents Exam in Chemistry

Group	N	Mean	Standard Deviation	t
Experimental	24	70.92	8.85	+0.03
Control	12	71.00	7.15	

$p>0.01$

Statistical analysis for the effect of an accelerated program on accelerates was performed between experimental and control groups (Group C and Group D). Significant difference in science ability between the two groups prior to biology instruction was assessed by using the Regents exam in earth science. The mean Regents earth science exam score for the experimental group was 94.57 with a standard deviation of 3.36. The mean Regents earth science exam score for the control group was 91.00 with a standard deviation of 2.76. The independent t - test produced a t score of -2.46, with a required t value of 2.921 for a p greater than 0.05. Therefore, it was concluded that the science ability between the experimental and control groups was not significantly different as measured by the Regents exam in earth science. The results of this t - test are summarized in Table 3.

TABLE 3

Means on the Regents Exam in Earth Science

Group	N	Mean	Standard Deviation	t
Experimental	7	94.57	3.36	-2.46
Control	11	91.00	2.76	

$p>0.05$

In order to assess significant differences in biology achievement based on instructional grouping, statistical analysis was performed between experimental and control groups on the Regents exam in biology. The mean Regents biology exam score for the experimental group was 93.86 with a standard deviation of 3.98. The mean Regents biology exam score for the control group was 92.09 with a standard deviation of 3.88. The independent t - test produced a calculated t score of -0.93, with a required t value of 2.120. The null hypothesis was retained with a p greater than 0.05. Therefore, it was concluded that the biology achievement between experimental and control groups was not significantly different as measured by the Regents exam in biology. The results of this t - test are summarized in Table 4.

TABLE 4

Means on the Regents Exam in Biology

Group	N	Mean	Standard Diviation	t
Experimental	7	93.86	3.98	-0.93
Control	11	92.09	3.88	

$p>0.05$

Summary

This chapter has summarized the data analysis required for the two null hypotheses designed for this study. Statistical analysis included the application of four independent t - tests. It was concluded that no statistically significant difference existed between nonaccelerates taught in homogeneous nonaccelerated classes and those taught in heterogeneous classes. It was also concluded that no statistically significant difference existed between accelerates taught in homogeneous accelerated classes and those taught in heterogeneous classes.

Chapter V

CONCLUSION

Summary

This research study used a post-test only, control group design. This study was designed to determine the effect of an accelerated program on the science achievement of accelerates and nonaccelerates. The intent of the study was to determine if any significant difference could be detected in student achievement because of homogeneous or heterogeneous grouping for instruction. Analysis of post-test scores for nonaccelerates demonstrated no significant difference between experimental and control groups as measured by the Regents exam in chemistry. Likewise, the analysis of the post-test scores for accelerates demonstrated no significant difference between experimental and control groups as measured by the Regents exam in biology.

Two research hypotheses were established at the onset of this study. The first hypothesis stated: There shall exist no statistically significant difference between the Regents chemistry exam scores of nonacceleates taught in homogeneous classes and those of nonaccelerates taught in heterogeneous classes. Statistical analysis of the scores of experimental and control groups on the Regents exam in chemistry showed no statistically significant difference existed. Thus the hypothesis was retained.

The second hypothesis stated: There shall exist no statistically significant difference between the Regents Biology exam scores of accelerates taught in homogeneous classes and those of accelerates taught in heterogeneous classes. Statistical analysis of the post-test scores of experimental and control groups on the Regents bology exam showed that no statistically significant difference existed. Thus the null hypothesis was retained.

Discussion

As previously stated, the statistical analysis showed that the instructional grouping scheme had no significant effect on science achievement of either accelerates or nonaccelerates.

Data from this study showed that no significant difference in chemistry achievement existed between the scores of nonaccelerates taught in homogeneous classes and those taught in heterogeneous classes. Chemistry achievement was measured using the Regents exam in chemistry. It appears from the data obtained for this study that each research group of students achieved similarly on the Regents chemistry exam.

Data from this study showed that no significant difference in biology achievement existed between the scores of accelerates taught in homogeneous classes and those taught in heterogeneous classes. Biology achievement was measured using the Regents exam in biology. It appears from the data obtained for this study that each research group of students achieved similarly on the Regents biology exam.

Reasons for these findings are suggested below. Students in experimental groups took Regents exams in a different year from the students in control groups. Though Regents exams are generally considered to be reliable and valid measurement tools for science achievement, they are not exactly the same from year to year. Since experimental and control groups did not take exactly the same exam, group means may have been affected.

The presence of accelerates in the heterogeneous groups (the experimental groups) may not have had a significant effect on the achievement of nonaccelerates due to the instructional format. All students involved in this study were exposed to an instructional style that was more traditional and competitive than a cooperative learning style. In his synthesis of the research on instructional grouping, Slavin (1988) concluded that most students achieve equally well whether grouped homogeneously or heterogeneously. Johnson & Johnson (1984) found that the only significant gains in achievement seem to occur in heterogeneous settings when cooperative learning stategies are used. The data from this study seems to support both these researchers' findings.

This study did not control reactive factors such as time of day, proximity of class time to meal time, and class personality, all of which may have had an effect on the data.

Conclusions

The data from this study allowed the researcher to conclude that the grouping scheme used did not significantly affect the science achievement of nonaccelerates or accelerates. The conclusion is based on the assumption that all instruction occured within a traditional, competitive type of classroom setting. Conclusions for each hypothesis outlined in Chapter I are as follows.

1. There was no difference between the chemistry achievement of nonaccelerates taught in homogeneous or heterogeneous classes.

2. There was no difference between the biology achievement of accelerates taught in homogeneous or heterogeneous classes.

Recommendations

Based on the data analysis for this study, the following recommendations were proposed.

1. This study should be repeated using larger groups of students.

2. This study should be repeated using groups of students who would all take the same exact Regents exam.

3. This study should be repeated using groups of students taught in classrooms where cooperative learning is used.

4. This study should be repeated to more tightly control factors such as time of day for instruction and proximity of instructional time to meal time.

5. This study should be repeated in other subject areas.

APPENDICES

Appendix A

EQUIVALENCE OF GROUPS PRIOR TO CHEMISTRY INSTRUCTION

Experimental (Group B)		Control (Group A)	
Student	1989 Regents Biology Exam Score	Student	1990 Regents Biology Exam Score
1	69	1	65
2	70	2	65
3	70	3	68
4	70	4	69
5	70	5	71
6	70	6	74
7	72	7	79
8	73	8	79
9	75	9	81
10	75	10	81
11	76	11	85
12	76	12	87
13	76		
14	77		
15	78		
16	78		
17	79		
18	79		
19	79		
20	80		
21	80		
22	81		
23	81		
24	84		

Appendix B

EQUIVALENCE OF GROUPS PRIOR TO BIOLOGY INSTRUCTION

Experimental (Group D)		Control (Group C)	
Student	1989 Earth Science Regents Exam Score	Student	1988 Earth Science Regents Exam Score
1	90	1	87
2	92	2	88
3	92	3	88
4	95	4	90
5	96	5	90
6	98	6	91
7	99	7	92
		8	92
		9	93
		10	94
		11	96

Appendix C

POST-TEST CHEMISTRY EXAM SCORES

Experimental (Group B)		Control (Group A)	
Student	1990 Regents Chemistry Exam Score	Student	1991 Regents Chemistry Exam Score
1	42	1	59
2	61	2	64
3	62	3	64
4	64	4	67
5	65	5	67
6	65	6	71
7	65	7	72
8	68	8	74
9	70	9	74
10	70	10	76
11	72	11	81
12	72	12	83
13	73		
14	74		
15	74		
16	75		
17	75		
18	75		
19	76		
20	76		
21	80		
22	82		
23	83		
24	83		

Appendix D

POST-TEST BIOLOGY EXAM SCORES

Experimental (Group D)		Control (Group C)	
Student	1990 Regents Biology Exam Scores	Student	1989 Regents Biology Exam Scores
1	89	1	87
2	91	2	88
3	91	3	89
4	92	4	89
5	98	5	91
6	98	6	92
7	98	7	93
		8	93
		9	94
		10	98
		11	99

REFERENCES

Brody, L. E., & Benbow, C. P. (1987). Accelerative strategies: How effective are they for the gifted? Gifted Child Quarterly, 24, 105-109.

Campbell, J. R. (1985). The phantom class: A viable approach of providing for gifted and talented high school science students. Roeper Review, 7 (4), 228-231.

Daurio, S. P. (1979). "Educational enrichment vs. acceleration: An overview" in W. C. George, S. J. Cohen and J. Stanley (Eds.), Educating the Gifted: Acceleration and Enrichment. Baltimore: Johns Hopkins University Press.

Fox, L. (1981). Instruction for the gifted: Some promising practices. Journal For the Education of the Gifted, 4 (3), 246-254.

Fox, L. H. (1979). "Progress for the gifted and talented: An overview" in A. H. Passow (Ed.), The Gifted and Talented: Their Education and Development. Chicago: University of Chicago Press

Good, T. & Marshall, S. (1984). "Do students learn more in heterogeneous or homogeneous groups?" in P. Peterson and L. Cherry Wilkinson (Eds.), Student Diversity and the Organization, Process, and Use of Instructional Groups in the Classroom. New York: Academic Press.

Harthill, R. (1936). Homogeneous grouping as a policy in the elementary schools in New York City. Teachers College, Columbia Contributions to Education, #690. New York: Teachers College Press.

Holy, T. C., & Sutton, D. H. (1930). Ability grouping in the ninth grade. Educational Research Bulletin, 9, 419-422.

Kulik, C.-L., & Kulik, J. A. (1982), Effects of ability grouping on secondary school students: A meta-analysis of evaluation findings. Americar Educational Research Journal, 19, 415-428.

Kulik, J. A., & Kulik, C.-L. (1984a). Synthesis of research on effects of accelerated instruction. Educational Leadership, 42 (2), 84-89.

Kulik, J. A., & Kulik, C.-L. (1984b). Effects of accelerated instruction on students. Review of Educational Research, 54, 409-425.

Miller, W. S., & Otto, H. J. (1930). Analysis of experimental studies in homogeneous grouping. Journal of Educational Research, 21, 95-102.

Pfeiffer, K., & Olson, J. N. (1981). Basic Statistics For The Behavioral Science. New York: Holt, Rinehart and Winston.

Pizzini, E. L. (1985). Improving science instruction for gifted high school students. Roeper Review, 7 (4), 231-237.

Purdom, T. L. (1929). The Value of Homogeneous Grouping. Baltimore: Warwick and York.

Schunk, D. H. (1987). Peer models and children's behavioral change. Review of Educational Research, 57, 149-174.

Slavin, R. E. (1988). Synthesis of research on grouping in elementary and secondary schools. Educational Leadership, 46 (1), 67-77.

Slavin, R. E. (1987a). Mastery learning reconsidered. Review of Educational Research, 57, 175-213.

Slavin, R. E. (1987b). Ability grouping and student achievement in elementary schools: A best evidence synthesis. Review of Educational Research, 57, 213-236.