A Study of the Relationship between High School Graduation Requirements and Student A.C.T. Assessment Scores in Public High Schools in the State of Michigan

William M. Pritchard

Western Michigan University

Follow this and additional works at: https://scholarworks.wmich.edu/dissertations

Part of the Educational Assessment, Evaluation, and Research Commons, and the Secondary Education and Teaching Commons

Recommended Citation


https://scholarworks.wmich.edu/dissertations/2340

This Dissertation-Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Dissertations by an authorized administrator of ScholarWorks at WMU. For more information, please contact maira.bundza@wmich.edu.
A STUDY OF THE RELATIONSHIP BETWEEN HIGH SCHOOL GRADUATION
REQUIREMENTS AND STUDENT A.C.T. ASSESSMENT SCORES IN
PUBLIC HIGH SCHOOLS IN THE STATE OF MICHIGAN

by

William M. Pritchard

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Education
Department of Educational Leadership

Western Michigan University
Kalamazoo, Michigan
August 1985
A STUDY OF THE RELATIONSHIP BETWEEN HIGH SCHOOL GRADUATION REQUIREMENTS AND STUDENT A.C.T. ASSESSMENT SCORES IN PUBLIC HIGH SCHOOLS IN THE STATE OF MICHIGAN

William M. Pritchard, Ed.D.
Western Michigan University, 1985

The literature has pointed toward changes in high school curriculum as a contributor to the decline of standardized test scores during the 1960's and 1970's. During the past few years, many schools have increased graduation requirements in various subject areas in an effort to increase learning on the part of students. The purpose of this study was to investigate the effect of the number of years of required study in various subject areas on student achievement.

The population that was studied included all public high schools in the State of Michigan. Two hundred thirty-eight schools were sampled from the population, and data were received from 209 of these schools.

The measures of student achievement that were utilized were the mean scores on the American College Testing (A.C.T.) Assessment subtests in the areas of mathematics, science, and social studies.

The results indicated that many high schools in the State of Michigan have increased the number of years of study required in mathematics, science, and social studies. Since 1981, over 51 percent of the reporting schools indicated that changes had been made
in mathematics requirements, 38 percent reported changes in science requirements, and 30 percent had made changes in social studies requirements. In addition, many schools indicated that future change is being considered.

Analysis of variance was performed for each of the subject areas of mathematics, science, and social studies, using the number of years of required study and the mean A.C.T. Assessment scores as the independent and dependent variables respectively. A positive relationship could not be established between the number of years of required study and student A.C.T. Assessment scores.

A lack of available data from small schools and a lack of data concerning the actual number of courses taken by students may have contributed to the inconclusive findings. Further research concerning the relationship between high school graduation requirements and student achievement is recommended.
INFORMATION TO USERS

This reproduction was made from a copy of a document sent to us for microfilming. While the most advanced technology has been used to photograph and reproduce this document, the quality of the reproduction is heavily dependent upon the quality of the material submitted.

The following explanation of techniques is provided to help clarify markings or notations which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting through an image and duplicating adjacent pages to assure complete continuity.

2. When an image on the film is obliterated with a round black mark, it is an indication of either blurred copy because of movement during exposure, duplicate copy, or copyrighted materials that should not have been filmed. For blurred pages, a good image of the page can be found in the adjacent frame. If copyrighted materials were deleted, a target note will appear listing the pages in the adjacent frame.

3. When a map, drawing or chart, etc., is part of the material being photographed, a definite method of "sectioning" the material has been followed. It is customary to begin filming at the upper left hand corner of a large sheet and to continue from left to right in equal sections with small overlaps. If necessary, sectioning is continued again—beginning below the first row and continuing on until complete.

4. For illustrations that cannot be satisfactorily reproduced by xerographic means, photographic prints can be purchased at additional cost and inserted into your xerographic copy. These prints are available upon request from the Dissertations Customer Services Department.

5. Some pages in any document may have indistinct print. In all cases the best available copy has been filmed.
Pritchard, William M.

A STUDY OF THE RELATIONSHIP BETWEEN HIGH SCHOOL GRADUATION REQUIREMENTS AND STUDENT A.C.T. ASSESSMENT SCORES IN PUBLIC HIGH SCHOOLS IN THE STATE OF MICHIGAN

Western Michigan University

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106

Ed.D. 1985

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
ACKNOWLEDGMENTS

The completion of this dissertation was made possible through the support and contributions of many individuals, and I wish to express my sincerest appreciation to them.

I wish to thank Dr. Uldis Smidchens, dissertation chairperson, who has provided invaluable guidance and encouragement that has led to the completion of this study. Dr. Smidchens gave freely of his time, was always available, and provided the necessary counsel and direction to keep the project on course.

I also wish to thank Dr. David Cowden and Dr. JoAnn Simon, the other members of my dissertation committee, for the help and support they provided. Dr. Cowden and Dr. Simon were generous in donating their time, and both demonstrated confidence in me and provided encouragement and suggestions that made this project successful.

I also wish to acknowledge Dan Jaksen and Jim Cambridge who offered opinions, criticisms, advice, and encouragement that was greatly appreciated.

A special and loving thanks is extended to my family. My sons Matt and Greg have contributed by their understanding and patience which have allowed me the time to complete this work. I also wish to thank my wife Betty for her constant help, advice, encouragement and love, which provided the incentive to achieve this goal.

William M. Pritchard

ii
TABLE OF CONTENTS

ACKNOWLEDGMENTS ................................................................. 11
LIST OF TABLES ........................................................................ vi

CHAPTER

I. INTRODUCTION ..................................................................... 1
   Background ....................................................................... 1
   Statement of the Problem ............................................. 2
   Significance of the Study ............................................. 3
   Research Questions ......................................................... 9
   Limitations of the Study ............................................. 10
   Overview of the Study ................................................. 11

II. LITERATURE REVIEW ................................................................. 12
   Introduction ..................................................................... 12
   Standardized Tests ......................................................... 13
      Scholastic Aptitude Test ......................................... 14
      American College Testing Assessment ................. 14
   Declining Scores Research ............................................. 15
   Educational Requirements ............................................. 19
      High School Requirements ........................................ 20
      Changing Requirements ......................................... 22
   Time and Student Achievement ..................................... 24
   Definitions ................................................................. 25
   Time and Achievement Studies ..................................... 26
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary</td>
<td>33</td>
</tr>
<tr>
<td>III. METHODOLOGY</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>36</td>
</tr>
<tr>
<td>Population</td>
<td>36</td>
</tr>
<tr>
<td>Sampling Procedure</td>
<td>36</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>38</td>
</tr>
<tr>
<td>Data Collection</td>
<td>39</td>
</tr>
<tr>
<td>Pilot Study</td>
<td>40</td>
</tr>
<tr>
<td>Data Processing</td>
<td>41</td>
</tr>
<tr>
<td>Statistical Analysis</td>
<td>41</td>
</tr>
<tr>
<td>IV. ANALYSIS AND INTERPRETATION OF DATA</td>
<td>45</td>
</tr>
<tr>
<td>Introduction</td>
<td>45</td>
</tr>
<tr>
<td>Responses</td>
<td>45</td>
</tr>
<tr>
<td>Graduation Requirements</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>47</td>
</tr>
<tr>
<td>Social Studies</td>
<td>49</td>
</tr>
<tr>
<td>Science</td>
<td>51</td>
</tr>
<tr>
<td>Increased Requirements</td>
<td>53</td>
</tr>
<tr>
<td>Achievement</td>
<td>56</td>
</tr>
<tr>
<td>Mathematics</td>
<td>58</td>
</tr>
<tr>
<td>Social Studies</td>
<td>60</td>
</tr>
<tr>
<td>Science</td>
<td>62</td>
</tr>
<tr>
<td>Summary</td>
<td>64</td>
</tr>
</tbody>
</table>
### Table of Contents--Continued

#### CHAPTER

V. CONCLUSIONS AND RECOMMENDATIONS .................................. 66

- Conclusions ............................................................... 66
- Further Research ....................................................... 69
- Summary of Study .................................................... 71

#### APPENDICES ................................................................. 73

- A. Data Collection Instrument ........................................ 74
- B. Cover Letter .......................................................... 77
- C. Follow-up Letter .................................................... 79
- D. Pilot Study Data Collection Instrument ....................... 81

#### BIBLIOGRAPHY ............................................................. 83

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
LIST OF TABLES

1. Response to Survey ................................................................. 46
2. Distribution of Current Mathematics Requirements ............... 47
3. Distribution of Mathematics Requirements of Schools Reporting Data of Students Completing the A.C.T. Assessment During the 1983-1984 School Year ......................................................... 49
4. Distribution of Current Social Studies Requirements ................ 50
5. Distribution of Social Studies Requirements of Schools Reporting Data of Students Completing the A.C.T. Assessment During the 1983-1984 School Year ......................................................... 51
6. Distribution of Current Science Requirements ............................. 52
7. Distribution of Science Requirements of Schools Reporting Data of Students Completing the A.C.T. Assessment During the 1983-1984 School Year ......................................................... 53
8. Mean Graduation Requirements .................................................... 54
9. Schools Reporting Changes in Graduation Requirements Since 1981 ......................................................... 55
10. Schools Considering Change or Further Change in Graduation Requirements ......................................................... 56
11. Mean A.C.T. Assessment Scores ................................................ 58
12. Groups Analyzed in Analysis of Variance - Mathematics ............ 59
13. Analysis of Variance - Mathematics ............................................ 60
14. Groups Analyzed in Analysis of Variance - Social Studies ............ 61
15. Analysis of Variance - Social Studies ............................................ 62
16. Groups Analyzed in Analysis of Variance - Science ....................... 63
17. Analysis of Variance - Science .................................................... 64

vi

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
CHAPTER I

INTRODUCTION

Background

There are many problems in public education today, but the over­riding concern is that of decreased levels of learning among our nation's youngsters. The National Commission on Excellence in Education (1983) drew increased public attention to educational problems when it released a report entitled, A Nation at Risk: The Imperative for Educational Reform, in April of 1983. The report cited the following as some of the indicators of problems reflecting on the nation's educational system that have been amply documented: (a) average achievement on most standardized tests by high school students is now lower than it was 26 years ago, (b) the scores achieved on the College Board Scholastic Aptitude Tests have steadily declined since 1963, (c) remedial mathematical courses in public four-year colleges increased by 72 per cent between 1975 and 1980, (d) approximately 13 per cent of the United States can be considered functionally illiterate, and (e) the average tested achievement of students graduating from college is declining.

Other reports have also been critical of current educational practices. Among them are Academic Preparation for College: What Students Need to Know and Be Able to Do (College Entrance Examination Board, 1983), Action for Excellence: A Comprehensive Plan to Improve

Taken together, the commission and task force reports and research studies that appeared during 1983 and 1984 constitute a staggering indictment of U.S. secondary education. They portray U.S. high schools as confused about their mission and irresolute about their program and standards - as flattening the hopes of the best teachers, sapping the energies of nearly everyone involved, and stifling public good will. According to the reports, U.S. high schools neither inspire students nor educate them well. (p. 472)

The amount of concern and criticism directed toward the nation's schools indicates that there is, at the least, the perception of a problem concerning the ability of schools to function effectively.

Statement of the Problem

Currently there are many actions being taken by educators and legislators alike in an attempt to improve the education of students in schools in the United States (Ranbom, 1983a).

Many states are launched on initiatives based on the impetus provided by reports and studies. Their governors have been particularly instrumental in bringing on these actions, but so have legislatures, state education departments and groups of business leaders. These initiatives tend to stress accountability for the teaching profession, differential pay systems, and strengthened graduation requirements for high schools. (Howe, 1984, p. 3)

Specifically, the recommendation of a core curriculum for
high school students is receiving much attention. The National Commission on Excellence in Education (1983) recommended that high schools require: (a) four years of English, (b) three years of science, (c) three years of mathematics, (d) three years of social studies, and (e) one-half year of computer science for graduation. The National Science Board Commission on Precollege Education in Mathematics (1983) and the Carnegie Foundation report, High School: A Report on Secondary Education in America (Boyer, 1982) called for somewhat similar requirements. These recommendations raise questions, however, as to their implications. Is there a relationship between the courses required for graduation and measurable achievement on the part of students? Will students who attend schools which require graduation standards as recommended by such reports demonstrate higher achievement as measured by the A.C.T. Assessment when compared to students who attend schools with lesser requirements?

The purpose of this study was to investigate the relationship between high school graduation requirements and student achievement.

Significance of the Study

It would logically appear that additional or more stringent requirements for high school graduation would result in higher student achievement scores. This is an assumption that appears to be accepted by many educators and governing bodies. Ranbom (1983a) reported on a survey conducted by the National Center for Educational Statistics for the National Commission on Excellence in Education.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
About half of the 571 school districts surveyed have established new requirements for core subjects since 1979-1980. Some local school districts have been increasing the requirements necessary for graduation. Several states have mandated that graduation requirements be upgraded.

In April of 1983, the Tennessee State Board of Education voted to increase the amount of instruction required for students in mathematics and science in an attempt to improve the students' skills and knowledge in those areas ("Tennessee to Increase Courses," 1983).

In May, 1983, the Washington State Board of Education approved a plan to upgrade graduation requirements. The board raised the minimum number of credits required for graduation from 45 to 48. They also tripled the number of credits required in science, doubled the number required in mathematics, and added an additional year of English (Ranbon, 1983b).

In 1982, the Department of Education in New York began a comprehensive review of programs and objectives throughout grades kindergarten to twelve (Ranbon, 1983b). The results, which will take effect with the graduating class of 1989, include several increases in requirements. Students will be required to obtain two credits in each mathematics and science, compared to one credit currently required. Social studies requirements will rise from two to three credits, and total requirements required for graduation will increase from 16 to 18.5 in 1989. To obtain a Regents' diploma, students will be required to earn two credits in mathematics and science, four credits in social studies and English, and three credits in foreign

The state legislature in Arkansas established a panel of citizens, teachers, administrators and college officials to investigate the Arkansas public school system and make recommendations for improvements (Ranbom, 1983b). As a result, new standards for Arkansas public schools were adopted March 1, 1984. Beginning in 1987, the school day will increase to a minimum of 5.5 hours, the school year will lengthen by three days, and students will be required to meet additional high school requirements for graduation (U.S. Department of Education, 1984).

In 1983 the Florida legislature set graduation requirements for the first time - something that local school boards had done in the past. Among the requirements are a specified number of credits needed for graduation. Twenty credits are required in 1984 and will gradually rise to twenty-four credits by 1987. Four courses in English, and three each in math and science, as well as other courses, will be necessary for graduation ("Florida Students Get Shock," 1983).


It appears that a trend toward additional graduation requirements is in progress and that many people are in favor of such. Not
all, however, support this direction or the conclusions reached by the various commissions in their reports. Tanner (1984), in referring to A Nation at Risk, stated "In short, this thin report of 36 pages, completed at a cost of almost half a million dollars over a period of almost two years, is a great disappointment... the commission resorted to superficial analysis, distortions of data, and reckless accusations" (p. 7). While Tanner was not opposed to graduation requirements, he offered the opinion that the specific graduation requirements recommended in the report are not what is needed for the nation's schools.

Cole (1984), in discussing high school reform, stated "Our nation cannot risk the impact increased requirements may have on a sizable number of teenagers who reject the content and approaches they currently encounter in school" (p. 38). He went on to say "I question the premise that everyone must possess a universal body of knowledge to the extent implied by requirements that are recommended in several reports" (p. 38). Lewis (1984), speaking on the same topic, indicated that legislators and educators have misinterpreted feedback from industry and the result has been a back-to-basics backlash which has resulted in improper or unnecessary requirements.

Raywid (1984), in discussing the ethical dimensions of various reports, referred to them as "... education's latest fad" (p. 22). She stated that the past sixteen months had spawned approximately twenty major reports, with twenty sets of recommendations. One of her criticisms dealt with the way that excellence was operationalized.

Virtually all of the reports operationalize its pursuit
as a matter of specified courses and of achievement expectations. The route to excellence is seen, then, as standardization and standards. The reports assume that excellence is cultivated via uniformity; the best way to try to stimulate its emergence is to expose all youngsters to the same thing. (p.23)

She went on to add, "I believe schools, and particularly high schools, need a great many changes. But I'm not very hopeful that what is needed can ensue from the reports" (p.24).

Howe (1984) stated that he was in disagreement with most of the reports, particularly when they presented the "sad state of American education" (p.4). Howe emphasized that American education has been successful during the past thirty years in bringing a larger proportion of our diverse society into the schools and succeeding with them to some degree. His main concern centered on students who were not high achievers. Howe stated that some of the recommendations contained in many of the reports are likely to increase the number of dropouts. He expressed concern that increased emphasis on standardized test scores may lead some schools to discourage students with learning problems not to take the tests. His opinion was that adoption of recommendations for more homework, longer school hours, and more stringent and required courses would likely increase the dropout rate and deprive individuals of educational opportunities.

Clark (1985) also stated his opposition to the uniformity that would result by requiring all students to meet the same requirements. He believes that excellence is not currently the primary mission of the high schools, but ranked it third behind equity and social integration. His solution for increasing excellence involves redefining
the mission of schools, with schools becoming competitive through the selection of students, creating a hierarchy of high schools with different goals.

Offermann (1984) also disagreed with the necessity for incorporating the graduation requirements in *A Nation at Risk*. He described the program in Oak Park, Illinois in which requirements in English, math, history, fine and practical arts were reduced. He contended that the Oak Park schools offered a high quality educational program and suggested that requiring courses to be taken from designated clusters was superior to the recommendations offered by the National Commission on Excellence in Education.

Paul Peterson (1983) summed up the feelings of many who are in opposition to the recommendations contained in many reports when he stated:

> It seems clear that the outpouring of commission and task force reports has had a profound effect on the national education debate. However, the reports themselves, upon close examination, prove to be disappointing. If we judge them by the standards ordinarily used to evaluate a policy analysis - focused statement of the problem to be analyzed, methodical evaluation of existing research, reasoned considerations of options, and presentation of supporting evidence and argumentation for well-specified proposals - they simply do not measure up. (p. 3)

The controversy concerning the acceptance or rejection of conflicting recommendations contained in various reports suggests a need for study to determine which factors contribute to increased learning among the students of this country. This study sought to determine if a relationship existed among varying high school graduation requirements and the achievement of students attending those schools.
Research Questions

The recommendations contained in *A Nation at Risk* (and other reports) have raised questions among educators as to their appropriateness and effectiveness. The recommendations also lend themselves to investigation. The following are questions concerning certain recommendations that were addressed in this study:

1. Is there a difference among the A.C.T. mathematics scores of students who attend high schools which require a differing number of years of mathematics instruction?

2. Is there a difference among the A.C.T. science scores of students who attend high schools which require a differing number of years of science instruction?

3. Is there a difference among the A.C.T. social studies scores of students who attend high schools which require a differing number of years of social studies instruction?

For the purposes of this study, high school shall be defined as those institutions serving students in either grades nine through twelve, or grades ten through twelve. The term secondary school may be used synonymously with high school.

Years of required instruction shall be defined as school years mandated by local boards of education or school administrations governing the high schools investigated.

A.C.T. mathematics scores, science scores, and social studies scores shall be defined as the mathematics scores, natural science scores, and social studies scores reported in *The High School Profile*.
Report for each school high school surveyed.

Limitations of the Study

In attempting to examine the relationship between graduation requirements and student achievement, some problems are encountered. Measurement of student achievement by the use of standardized tests imposes limitations. The A.C.T. Assessment is normally administered to students at or near the end of their eleventh grade year. This is prior to any effect that might result from a four year high school requirement. For this reason, comparison of student achievement with some measures of the A.C.T. Assessment were not be made. While the Commission on Excellence in Education recommended four years of instruction in English, and the A.C.T. Assessment provides an English score, all students will not have completed the requirement and most will have received the same amount of English instruction at the time of testing.

Another limitation involves the students that will provide the scores for the study. The A.C.T. Assessment is an elective test, and it is normally taken by the students who aspire to continue their education after graduation from high school. In essence, this population is a group of volunteers. Results of the study can only be projected to members of this population, as the assumption can not be made that findings apply to all students who attend high school and complete the requirements that will be studied.
Overview of the Study

Chapter II follows with a review of related literature. The literature cited provides for the logical development of the research hypotheses which are included in the chapter. Chapter III provides the reader a detailed description of the research methodology employed in the study. A description of the population studied, data gathering procedures, and statistical tests are included in Chapter III. Chapter IV presents the results obtained from the collection of the data and its analysis. Chapter V provides interpretations of the data and states the conclusions drawn from the data.
CHAPTER II

LITERATURE REVIEW

Introduction

Chapter II provides a review of relevant literature. The following are the topics that are discussed. (a) A background involving the decline in standardized test scores is presented. The decline that occurred in test score performance is a contributing factor to the recent call for reform in education. (b) A review of research pointing to the evolution of diversified curricula as a primary factor in test score decline follows. (c) Literature describing the current situation in American schools is discussed. It depicts an era of change, with many schools increasing or modifying graduation requirements in an apparent attempt to improve student achievement. (d) Literature describing research to determine the effects of various amounts and categorizations of time on student achievement is also presented. (e) Hypotheses suggested by the review of literature are stated.

The literature reviewed in this chapter was obtained from a variety of sources. Lists of data sources were secured by contracting with the Macomb Intermediate School District for computer searches. Three searches were generated through Dialog Information Services, Inc., using the ERIC Database. Two other searches were conducted through Dialog Information Services, Inc., using the
Dissertation Abstracts Online Database. Listings generated by the computer searches were used as guides in researching information at the University of Michigan, Wayne State University, Oakland University and Macomb Intermediate School District libraries. Research reports were also obtained through the Michigan Department of Education and U.S. Department of Education.

Standardized Tests

The majority of high school students who plan on attending college take either the S.A.T. (Scholastic Aptitude Test) or A.C.T. (American College Testing Assessment). The underlying reason for much of the concern that has led to the many reports urging reform in education, and a movement back to "basics", is the decline that has been witnessed in student achievement scores on these tests during the 1960's and 1970's. The National Commission on Excellence in Education (1983) brought this to the attention of the nation when they stated:

The College Board's Scholastic Aptitude Tests (SAT) demonstrate a virtually unbroken decline from 1963 to 1980. Average verbal scores fell over 50 points and average mathematics scores dropped nearly 40 points. College Board achievement tests also revealed consistent declines in recent years in such subjects as physics and English. Both the number and proportion of students demonstrating superior achievement on the SATs (i.e., those with scores of 650 or higher) have also dramatically declined. (pp. 8-9)

National public opinion of the nation's schools has also declined with standardized test scores. Gallup polls, which asked the public to assign a grade to schools in their effort to achieve goals that society expects, have documented a steady decline from

**Scholastic Aptitude Test**

The most widely administered college admissions examination in the United States is the S.A.T. (Weinman, 1976). Approximately one million students took the test during the 1982-1983 school year (Russell, 1983). The purpose of the test is to aid in assessing the competence of the student in pursuing future college work (Weinman, 1976).

The S.A.T. is designed and scored by the Educational Testing Service for the College Entrance Examination Board. It is a two and one-half hour test, composed of separate verbal and mathematical sections. Each section is scored on a scale from 200 to 800. The verbal section of the S.A.T. tests reading comprehension, antonyms, and analogies. The mathematics section tests the use of basic arithmetic operations, as well as concepts in algebra, geometry, and the properties of integers (Weinman, 1976).

**American College Testing Assessment**

The A.C.T. Assessment measures student abilities in four subject areas; English, mathematics, social studies, and natural science. The English portion tests the students' understanding and use of basic elements of correct and effective writing. The mathematics section tests mathematical reasoning and problem solving ability.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
The social studies test is a reading test that examines problem-solving skills needed in social studies. The natural science test is also a reading test that examines problem-solving skills required in the natural sciences.

Scores of the tests are provided to students, their high schools, and participating postsecondary institutions. There were 1,097 participating postsecondary institutions in 1982. These institutions are primarily located in the Midwest, the Rocky Mountains, the Great Plains, and the South. Scores are provided for the purposes of evaluation and planning by educational institutions, and as a tool to provide information for individual counseling and guidance. Over 800,000 students took the A.C.T. Assessment during the 1982-1983 school year (American College Testing Program, 1983).

Declining Scores Research

Weinman (1976) reported that the Massachusetts State Department of Education undertook a study to determine the cause of declining standardized test scores. She reported that a continual decline in student performance on the Scholastic Aptitude Test (S.A.T), the American College Test (A.C.T.), and Preliminary Scholastic Aptitude Test (P.S.A.T.) had been observed nation-wide since the mid 1960's. Score declines were observed in public, private, and parochial schools in suburban, urban and rural communities. Massachusetts research centered on the S.A.T and confirmed that little of the test score decline could be attributed to changes in scaling of the tests or changes in content of the tests. The study also pointed out that

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
high school enrollment patterns indicated a decline in traditional courses with a simultaneous increase in specialized electives. It was also shown that a shift in emphasis from basic communication skills to fostering creativity and interpersonal relations had taken place. It was concluded that both of these trends were creating a growing discrepancy between what students were learning and what standardized tests were measuring. Weinman speculated that changes in student motivation, course enrollment, and school curriculum were major contributors to the decline in standardized test scores.

Munday (as cited in Rawnsley, 1977) undertook a study to investigate the causes of declining student achievement test scores. Although primarily concerned with investigating hypotheses to explain the decline in S.A.T. and A.C.T. test scores, he also reviewed data from other testing programs. He concluded that the best explanations for the declines were changes in the population taking the test and changes in high school curricula.

Ebel (1978) expanded on these concepts when he theorized that social and cultural phenomena such as television, increased drug use, the deterioration of the nuclear family, and the Vietnam war were reflected in changes in schools, and these changes resulted in lower student achievement scores. Ebel cited the teaching of the "whole child", with an emphasis on personal development rather than academic development, as a basis for declining student achievement scores.

In 1978, The National Academy of Education investigated issues relating to achievement testing (Ogden, 1979). They identified four
school-related factors as contributing to the decline in student achievement test scores. They were: (a) the proliferation of courses in the schools, (b) confusion about the appropriate role of teachers, (c) a slackening of "on-task" attention, and (d) a dismantling of opportunities for intensive study in selected academic environments at the high school level. Ogden hypothesized that there had been a decline in achievement on standardized tests due to a lowering of academic standards. She cited the proliferation of courses in schools as well as the slackening of "on-task" attention as factors contributing to decline in achievement scores. She compared exit test scores of students who graduated without being required to meet minimum competency requirements, i.e. minimum test scores, with students who were required to meet minimum competency standards. The data showed that requiring students to meet minimum competency standards resulted in higher test scores for low-achieving students.

In a nation-wide study prepared by the National Center for Education Statistics (Marrs, 1984), it was disclosed that there were more students who graduated in 1982 who had concentrated their study in art than students who concentrated their study in math or science. More than thirteen percent of the graduates had more than three credits in art, while 8.5 and 9.4 percent of the graduates had more than three credits in mathematics and science respectively. Figures released by the U.S. Department of Education (1985) indicated that 1982 graduates overall averaged 2.5 credits in mathematics, 1.9 credits in science, and 1.4 credits in visual and performing arts.
Eaton (1984), of the Institute for Research on Teaching at Michigan State University, stated that most high schools now avoid rigorous academics in order to achieve comfortable social relations with students, a practice which has shaped current high school standards. Her conclusion is based on the work of researchers at the institute who conducted an extensive review of the literature on high schools published during the past 20 years. Eaton also concluded that the worlds of work and higher education have taught students to pursue the credentials that schools offer, rather than the knowledge they signify. Student employment was cited as the central concern of many high school students, rather than academics, and that many schools have made accommodations to working students. She viewed this as having had an impact on academic standards.

Hertling (1984) reported that the National Center for Education Statistics recently completed a study that indicated that the decline in standardized test scores between 1972 and 1980 was caused by a decrease in academic rigor in the high school curriculum and a drop in the amount of time students spent on homework. The national study compared data from the 1972 National Longitudinal Study and ongoing longitudinal study High School and Beyond. It revealed that between 1972 and 1980, average test scores in mathematics, reading, and vocabulary all declined for male and female students, and for both white students and racial minorities. Hertling also indicated that the test score decline during the 1960's resulted from an increase in the number of students taking standardized tests, a conclusion that
had been previously reached by Munday. Hertling found that the test-taking population had leveled off by the early 1970's.

The studies that have been described thus far have attempted to find a cause for declining test scores. They point toward curricular changes and relaxed or modified standards as a possible cause. Is there a relationship between what students are required to study and their achievement scores? The studies that have been reviewed suggest that there is.

Recently, data have indicated that standardized test scores have stopped declining. S.A.T. scores, which experienced a nine percent drop between 1963 and 1980, have leveled off and increased slightly, up approximately one percent between 1980 and 1984. A.C.T. scores, which dropped five percent between 1971 and 1975, have remained at an almost constant level since 1975 (U.S. Department of Education, 1985). Beginning in the late 1970's and continuing through the present, educational requirements have also increased. Is there a relationship between the increase in emphasis on certain subjects in the nation's high schools and the stabilization of or the end to the decline of standardized test scores?

Recently, a few investigators and organizations have focused their attention toward educational requirements.

Educational Requirements

The publicity schools received due to declining student achievement test scores resulted in actions and reactions by educators. Changes were initiated in curriculum. Educators and commissions
reviewed and researched educational practices, offering possible solutions for the maladies of the schools. Some of these studies pointed to great discrepancies among school curricula. Boyer (1984), after looking at the education laws of all 50 states, pointed out that great diversities exist among the schools of this nation. Many states have thousands of pages of laws, filling many volumes. Local districts often have various requirements that are not congruent with other districts within the state. Some states mandate requirements, others do not.

The State of Michigan does not mandate requirements and as a result great diversity exists among the schools in the state. "Michigan graduation requirements are set locally, and as a result, there is a wide variation of practice" (Michigan Association of Secondary School Principals & Michigan Department of Education, 1983, p. 3). Boyer's report, as well as others, has attempted to focus educational endeavors toward a more common core of activities.

High School Requirements

A study of high schools in the State of Michigan ("Here's What Study Turns Up," 1983) gathered data from approximately 400 of the schools. It revealed that there was a wide range of requirements among schools. It was found that 43% of the schools required one year of mathematics for graduation and 41% required two years. In science, 57% of the schools required one year of study and 32% required two years. Social science requirements varied widely, with
eleven percent of the schools requiring less than two years, 31 percent requiring two years, fourteen percent requiring two and one-half years, 43 percent requiring three years, and ten percent requiring more than three years. Most schools were found to require three years of English for graduation (60 percent), with only four percent requiring less. For the State of Michigan, the following average requirements for graduation from high school were reported: (a) English, 3.2 credits; (b) science, 1.3 credits; and (c) mathematics, 1.5 credits. The average number of credits required for graduation from Michigan high schools was found to be 20.7, somewhat higher than the national average of 19.8.

Ranbom (1983a) reported results of a national survey of 571 school districts conducted by the National Center for Education Statistics for the National Commission on Excellence in Education. The purpose of the survey, conducted during the 1982-1983 school year, was to provide information on high school academic requirements and the efforts of school districts to boost academic achievement.

The results of the survey revealed that school districts varied widely in their requirements of students for graduation and also the amount of time a student is required to attend classes during the school day. Nationally, high school students average about five credit classes a day.

The amount of time spent in those classes ranges from a high of 350 minutes or more daily for 10 percent of the districts to a low of 240 minutes or less for another 10 percent. On the average, districts require a total of 19.8 credits for graduation, or about five credits per year for the typical four-year program. However, 5 percent of the school districts surveyed require as many as 24 credits,
although another 5 percent require as few as 16.5 credits. That is a difference of about one and half years of required credit, according to the study. (p. 5)

The study found that schools nationally averaged the following requirements for graduation: (a) 3.6 credits in English or language arts, (b) 2.6 credits in social studies/history, (c) 1.7 credits in mathematics, and, (d) 1.6 credits in science.

Analysis of the data collected in the survey produced conflicting results regarding the relationship between student achievement and the amount of time students spent in class. "In districts where students spent more class hours in credit courses, they scored significantly higher on the S.A.T. But in districts where the A.C.T. was the more widely administered test, students spending more hours in credit courses did not score significantly higher on the examination" (p. 16). Data reported by The National Center for Education Statistics (1983) showed that schools with students averaging 270 minutes or less of instruction in credit courses had a mean combined S.A.T. score of 884, while schools which required 330 minutes or more of instruction had a mean score of 907, a difference of 2.6 percent.

Changing Requirements

The past few years have witnessed changes in curriculum requirements in many schools. Ranbom (1983a) reported that approximately 50 percent of the school districts surveyed nation-wide had established new requirements for core subjects since 1979-1980. About one-half of the school administrators surveyed indicated that they thought increasing the number of required core courses and study-skill
courses would result in greater achievement.

Hall, Hord, Rutherford, and Huling (1984) also reported that American high schools are undergoing change. The changes included adding or subtracting course offerings. "Each school described a great number of changes, both small and large, that had been made or were in the process of being planned or implemented" (pp. 59-60).

The rate at which change is occurring appears to be rapid. This was confirmed when the Michigan Commission on High Schools released a report detailing curricular changes that had occurred in the state during the past year (Russell, 1985). Comparing data from surveys that they conducted in 1983 and 1984, the Commission reported that:

(a) 32 percent of the school districts in the state require four years of English for graduation, up from 25 percent the previous year.
(b) 65 percent of the districts require two or more years of mathematics, compared to 41 percent the previous year.
(c) 53 percent of the districts require two or more years of science, compared to 32 percent the previous year, and
(d) 53 percent of the districts require at least three years of social studies, up from 31 percent the previous year.

Nationally, there have also been recent increases in graduation requirements. In 1984 the mean number of credits required in English was 3.8, up from 3.6 in 1983. The mean number of social studies credits also increased from 2.1 to 2.4 during this time. The mean requirements rose from 1.9 to 2.1 for mathematics, and 1.7 to 1.9 for science between 1983 and 1984 (U.S. Department of Education, 1985).

The intent of most school districts in raising graduation
requirements has been to ensure that students spend at least a minimum amount of time in the study of certain disciplines. Is there a relationship between the time that they spend and the results that are achieved?

**Time and Student Achievement**

Recent changes in requirements for students attending the nation's schools have often been made in an effort to increase skills and knowledge on the part of the students. The underlying motivation for such actions can perhaps be best described by the following statement. "It has been commonly accepted that there is a relationship between the amount of time an individual spends on a task on how well the task is accomplished. Research is showing evidence which substantially supports the common sense relationship between time and quality" (Michigan Association of Secondary School Principals & Michigan Department of Education, 1983, p. 7).

During the past few years standardized test scores have leveled off and begun improving. There is reason to believe that additional time in school may be a factor in the improvement. Biemiller (1984) reported on an increase in S.A.T. scores for students who took the test during the 1983-1984 school year when compared to scores of students who took the test the year before. Increases of one point in verbal and three points in mathematics scores were reported. A questionnaire accompanying the test gathered information indicating that students had taken more courses than the students the previous year, a trend that has been in effect for the past seven years, and
one that parallels a gradual increase in S.A.T. test scores. Over
one-half of those taking the S.A.T test during the 1983-1984 school
year had taken one more course than students taking the test during
the 1976-1977 school year.

Hertling (1984) reported that a study prepared by Educational
Testing Service for the National Center for Education Statistics
recommended that schools require more basic courses in an effort to
improve standardized test scores. It stated that more emphasis
should be given to English, mathematics, science, and social studies
courses in the high schools.

The recommendation made by the Educational Testing Service im­
plies that additional time spent in classes of various disciplines
will result in greater achievement in those disciplines. While this
may possibly be true, factors concerning the use of time should be
considered. As the Institute for Educational Leadership (1983)
pointed out, "Schools and classrooms around the Nation vary
evermously in the amount of time devoted to instruction. The amount
of time a pupil actually engages in learning activity each day can
vary from 50 to 90 percent of the total time" (p. 10).

Definitions

During the past 20 years, considerable research has been under­
taken for the purpose of establishing the relationship of time to
student achievement. As research has progressed, time has been
deined in different ways. Strother (1984) reviewed the more common­
ly investigated aspects of time and offered definitions.
Allocated Time

Allocated time was defined as the amount of time that a teacher plans to devote to a particular subject area. Allocated time may be determined at the secondary level through administrative decisions which determine the length and number of specific class periods. Allocated time may include nonacademic activities such as listening to announcements or collecting lunch money.

Engaged Time

Engaged time refers to the actual amount of time that a student spends trying to learn. This can include such things as listening and participating in class, working under teacher supervision in class, or doing homework without direct supervision.

Time-on-Task

Time-on-task is a general term that describes time periods when students are doing what their teachers have asked them to do. It can differ from engaged time in that students may be involved in nonacademic activities such as cleaning up their desks or putting away laboratory equipment.

Academic Learning Time

Academic learning time (ALT) refers to the amount of time that students engage in learning activities which result in fairly high levels of success.
Time and Achievement Studies

Deady (1970) undertook an experimental study to determine if a relationship existed between the amount of time allocated for science instruction and science achievement among fourth grade students. Three hundred and twenty-four students were randomly assigned to 16 classrooms. Half of the classes provided 35 minutes of science instruction each day, and half provided 20 minutes of science instruction. Both groups of students demonstrated gains in science achievement during the school year, but there was not a significant difference in student achievement between the two groups. Later studies, however, have reached different conclusions (Fisher, Filby, & Marliave, 1977; Holsinger, 1982; Marliave, 1978).

"The most extensive empirical study to focus directly on active learning has been the Beginning Teacher Evaluation Study, begun in 1972 by the California Commission for Teacher Preparation and licensing" (Stroher, 1984, p. 715). The original intent of the study was to identify desirable competences for new teachers, but the focus shifted to identifying factors related to student achievement. The research centered on second and fifth grade classes staffed by experienced teachers. As part of the study, Fisher et al. (1977) investigated the relationships of allocated time and engaged time with student achievement in reading and mathematics. Quantities of both allocated time and engaged time were related to student achievement in a series of regression analyses. Both were found to be positively related, but substantial amounts of time were necessary before the
relationships could be detected. In a follow-up study, Marliave (1978) investigated data of 139 second grade students and 122 fifth grade students for the purpose of studying the relationship of student achievement to academic learning time. Using regression analysis techniques, the data indicated that there was a positive relationship between achievement and time in both reading and mathematics. Approximately 11% of the variance in achievement was attributed to academic learning time.

CEMREL (1979), a research and development organization, was sponsored by the National Institute of Education to review data collected during a six year period in the Beginning Teacher Evaluation Study. They stated, "Teachers who allocate more time to a particular content area of the curriculum have students who achieve higher levels than teachers who allocate less time to that content area" (p. 1). They also reported that engaged time had a greater effect on achievement. "Teachers who increase the amount of time students actually spend engaged in a learning activity will see the difference reflected in increased achievement. Allocating time for reading, in other words, isn't sufficient" (p. 1).

Lomax and Cooley (1979) reviewed the research literature for the purpose of examining the relationship of student achievement with instructional time. They restricted their review to the domain of mathematics and reading in elementary schools. In their conclusion they stated, "We have found in reviewing the research that the relationship between instructional time and student achievement has not been as strongly and consistently substantiated in the literature
as most educational researchers have believed" p. (15). They did believe, however, that there was a relationship between time and student achievement. "Allocated time was found to be essentially unrelated to posttest achievement, while engaged time (or attention) was found to be moderately related (raw correlations about 0.4)" (p. 16).

Anderson (1980) did not reach the same conclusion expressed by Lomax and Cooley. Anderson investigated model learning projects in school systems throughout the United States, and reviewed literature not limited to the elementary level. He concluded that research has indicated that both allocated time and engaged time are positively related to student achievement.

Sanford and Evertson (1983) reported their findings involving a study of student achievement in 52 mathematics classes and 50 English classes in junior high schools. One of their research questions involved the relationship of class time use to student achievement. Class time use was divided into on-task, off-task, unsanctioned, and disruptive behavior. On-task behavior was found to correlate positively with student achievement in mathematics, but not in English. Their data led them to conclude that the difference resulted from the way that teachers used their class time. "Compared to English classes, there is less variation in curriculum materials and greater consensus on curriculum goals and appropriate instructional techniques in mathematics" (p. 146)

Holsinger (1982) reported on findings of the International Association for the Evaluation of Educational Achievement (IEA)
studies. The studies spanned many years and 22 nations, including
the United States, and focused on student achievement. Five thousand
schools and 133,000 students were sampled for representativeness.
The purpose of the study was to relate achievement to educational,
social, and economic variables. Data describing the amount of time,
both in minutes per week and number of years, were collected for
students taking various subjects and correlated with achievement
scores. While many variables were associated with student achieve­
ment, time available for learning was found to be an important
factor. Holsinger stated that, "Achievement is dependent on the
emphasis given in school through the curriculum, which in turn is
contingent upon the time available or allocated to a subject area"
(p. 17). He concluded that:

From the IEA data alone we would conclude that if national
educational planners and policy makers wished to do one
thing which would have a high probability of improving
national averages in a certain subject, they should give
that subject strong emphasis in the curriculum and encourage
teachers to devote as much time as possible to it in the
classroom. If they would do that they could reasonably
expect to observe measurable improvements in test scores.
(p. 29)

Ferratier and Helmich (1983) undertook a study involving gradu­
ation requirements in the state of Illinois. The purpose of the
study was to analyze the requirements within the state, compare them
to graduation requirements nationally, and report information regard­
ing requirements to the Illinois State Board of Education. Infor­
mation was obtained from 702 principals of high schools and junior
high schools in the state and compared with available national data.
Over 55 percent of the Illinois high school graduates each year

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
between 1968 and 1982 had taken the A.C.T. Assessment, and relationships between Illinois requirements and A.C.T. scores were sought. Comparisons of mean A.C.T. subscores between the United States and the state of Illinois in English, mathematics, social studies, and natural science showed declines for both between 1968 and 1982, but the percentage of decline for the state of Illinois was greater in all four categories than the national average. Their data also showed that 45.2 percent of the states exceeded Illinois graduation requirements in English, 66.7 percent exceeded them in mathematics requirements, 70.6 percent had greater science requirements, and 66.7 percent had greater social studies requirements. Their comparison of data led them to state, however, "The ACT scores show no discernible relationship between course requirements and academic achievement for Illinois" (p. 24).

The National Center for Education Statistics (1983) reported on a survey conducted for the National Commission on Excellence in Education in which data were collected from 571 school districts from a national population of 11,370. The study focused on the credits required for graduation, district policies regarding homework and testing, measures of academic achievement, and activities implemented or planned to improve academic achievement. They failed to find a consistent positive relationship between high school requirements and achievement. In districts which had the S.A.T. as the predominant measure of achievement, students having greater requirements scored higher on the test than students from schools with lesser requirements. In districts where the A.C.T. was the predominant measure of
achievement, however, no substantial difference was found. It was speculated that failing to find such a relationship could be the result of several different factors: (a) there may be a tendency for school districts with lower achieving students to raise requirements in an attempt to improve achievement, while districts with higher scores do not use such measures, (b) some districts may have raised their requirements recently and the effects of the changes may not yet be apparent, (c) effects on individual students may be difficult to detect when school district averages are used, and (d) district averages may be subject to great variability when the districts are relatively small and the values are based on few students.

Schmidt (1981) described an extensive study that he had taken part in to determine the effects of high school curriculum. The data that were analyzed were collected by the National Center for Education Statistics as part of the National Longitudinal Study of the High School Class of 1972. Data were obtained on 16,683 twelfth grade students in 990 high schools throughout the United States in 1972. Data were weighted and stratified to obtain a national probability sample. Analyses of data were performed to investigate the relationship of student achievement with quantity of schooling. Quantity of schooling was determined by obtaining the complete curricular history of each student, the number of weeks in a semester for the school, the number of periods per week that each course met, and the average number of minutes in a period. The information was used to compute the total number of hours of schooling each student received in each discipline. Achievement was measured by a battery.
of tests developed for the National Longitudinal Study of the High School Class of 1972. Students were given three test; vocabulary, reading, and mathematics. Analysis of data led Schmidt to state, "Mathematics is almost solely learned in school. Vocabulary and reading achievement are certainly learned and influenced by schooling, but research suggests that achievement in these areas is greatly influenced by the home environment" (p. 63). He went on to say, "The regression analysis suggests that, in general, for an additional 100 hours of instruction in mathematics, a four-percentile increase in mathematics achievement can be predicted" (p. 64). Schmidt also found that the quantity of schooling in science positively influenced the achievement scores in mathematics. He concluded that each additional semester course in science contributed to a 2.5 percentile increase in mathematics achievement.

Schmidt wished to further examine and replicate his findings, and used the four subtests of the A.C.T. Assessment as measures of student achievement. Since not all students in the original study had taken the A.C.T. Assessment, analysis was made on an available sample of 1,421 students. Results using the A.C.T. tended to confirm the original findings. It was found that the quantity of mathematics schooling was most strongly related to mathematics achievement. Also, "For both science and English achievement, the quantity of schooling in the corresponding curricular area was the single largest predictor of achievement" (p. 71). Very little relationship was found, however, between the quantity of social studies schooling and social studies achievement.
Summary

The decline in standardized test scores during the past two decades has caused great concern on the part of individuals and organizations which make educational decisions. Research points toward changes in curriculum at the high school level as a cause for the decline. Requirements have been and are still being increased in an effort to improve student achievement.

Reviewing the literature as it relates to student achievement and time has produced conflicting and inconsistent evidence regarding a relationship. It should be noted, however, that time has been defined in many different ways by different researchers. The majority of the studies point to a positive relationship between time and student achievement. It appears that the degree of the relationship is dependent upon the discipline involved and the definition of time applied to the study of the discipline. Relatively small differences in time between control groups and experimental groups may either result in no difference in student achievement or in such a small difference that it can not be detected. The literature also points to differences between disciplines as a variable in student achievement. Sanford and Evertson (1983) failed to find a significant relationship between time and English achievement. Schmidt (1981) did not find a significant positive relationship between time and social studies achievement. Most studies, however, indicated that a positive relationship exists between time and mathematics achievement. It is possible that subject areas such as mathematics
and science may be more structured in content or hierarchical in approach than social studies and English, thus making it possible to more easily detect differences in achievement when there is a variance in time.

The adoption of specific graduation requirements is a method of providing allocated student time. While the relationship between allocated time and student achievement does not appear to be as great as other measures of time, it does appear to be a positive relationship. With this in mind, the following hypotheses are proposed:

1. Students who are required to complete more years of study in mathematics will demonstrate higher mathematics achievement scores than students who are required to complete less years of study in mathematics.

2. Students who are required to complete more years of study in science will demonstrate higher science achievement scores than students who are required to complete less years of study in science.

3. Students who are required to complete more years of study in social studies will demonstrate higher social studies achievement scores than students who are required to complete less years of study in social studies.

Chapter III follows with a detailed description of the methodology that was used to investigate the hypotheses.
CHAPTER III

METHODOLOGY

Introduction

This chapter provides the reader with an understanding of the investigative procedures that were used in this study. It presents: (a) the population that was studied, (b) sampling procedures, (c) the instrumentation, (d) data collection procedures, (e) pilot study results, (f) data processing procedures, and (g) the procedures used for statistical analysis of the data.

Population

The population that was studied was defined as all public high schools in the State of Michigan. There are six hundred twenty seven public high schools in the State of Michigan (Michigan Education Directory, 1985). (The terms high school and secondary school may be used synonymously. The terms refer to schools that serve students in grades nine through twelve or grades ten through twelve).

Sampling Procedure

Two hundred thirty eight schools (38%) from the population of 627 were selected for study. The sample size was determined by referring to a chart listed in Mapping Your Millage (Michigan State Board of Education, 1984b). It stated that 234 interviews were
needed from a population of 600 to achieve a \( \pm 5\% \) error rate at the 95\% level of confidence. A sample of 248 was listed as necessary to achieve the same results from a population of 700 members. As 627 schools comprised the population to be studied, 0.27 was multiplied by the difference between the sample sizes of the two populations (14) and added to the value given for sample size from the population of 600 members (234). The sample sizes listed in the chart in Mapping Your Millage were verified by consulting a table listed in an article entitled "Small Sample Techniques" (1960).

A copy of the 1985 Michigan Education Directory and Buyer's Guide was obtained as a resource for use in identifying all of the secondary schools in the state. The publication not only lists secondary schools, but other institutions as well, and contains data relating to the schools. In order to simplify the process of selecting a sample, a listing of principals' names and mailing addresses was purchased from the publisher of the 1985 Michigan Education Directory and Buyer's Guide. The list was arranged in alphabetical order of the school districts, with the names of the principal, high school, and school address imprinted on individual mailing labels. The labels were affixed to sheets of computer tractor-feed paper which were joined together to form one long, continuous list.

The labels were assigned the numbers 1 through 627 consecutively. Using a random number table presented by Borg and Gall (1983), numbers were identified in the table, and the corresponding mailing label was included in the sample.
Instrumentation

A report listing the individual A.C.T. Assessment scores of students attending each high school, as well as composite scores for each school, is supplied free of charge by the American College Testing Program to the administrations of the school districts who have a minimum of 50 students taking the A.C.T. Assessment. The report is available for purchase by those districts that have less than 50 students taking the tests during any year. An instrument was developed by the investigator to gather information from the school districts concerning both the composite scores of the district and the graduation requirements of the school. A copy of the instrument is included in Appendix A. The instruments that were mailed comprised a single page that was eight and one-half inches wide and fourteen inches long. The copy of the instrument in Appendix A has been printed on two pages of paper to conform to the paper size of this document.

The validity of the instrument was checked by submitting it to five high school administrators in St. Clair County, Michigan, for review of content. It was also evaluated for ease of use, clarity, and format.

Much of the information collected with the instrument is student data compiled by the American College Testing Program. According to the American College Testing Program (1983), the A.C.T. Assessment is a comprehensive evaluative measure of student abilities in subject areas traditionally identified with college and high school programs.
Four academic tests measure abilities in English, mathematics, social studies, and natural sciences.

A.C.T. test scores are reported on a standard scale that ranges from 1 to 36. On this scale, a student's true score is usually within two score points on either side of the score reported for each of the four tests. (p. 1)

The scores for the population that were studied were norm referenced with 84,956 scores, which represented a ten percent sample of all students taking the tests during the 1983-1984 school year (American College Testing Program, 1984a).

Hills (1980) described conditions of reliability and validity concerning the A.C.T. Assessment in The Eighth Mental Measurements Yearbook. Reliability was assessed at .90. "The content validity seems reasonable, i.e., the tests look as if they would measure that which the test descriptions indicate they are meant to measure" (p. 623).

Data Collection

The survey instrument was sent to the selected schools by first class mail. The envelope and a cover letter were personally addressed to the principal of each school. The name of the principal and address of the school were obtained from the mailing list purchased from the publishers of the 1985 Michigan Education Directory and Buyer's Guide. The cover letter explained the purpose of the study and provided instructions for completion and return of the instrument. A copy of the cover letter is included in Appendix B. A stamped, addressed envelope was included to provide for the return of
the survey instrument. Schools that did not respond within 21 days of the mailing were sent another instrument and a letter urging its return. A copy of the follow-up letter can be found in Appendix C. If the instrument was not received within ten days of the second mailing, an attempt to contact the principal of the school by telephone was made in order to secure the return of the completed survey form.

Pilot Study

In order to determine if an acceptable return rate could be achieved, and also to explore the possibility of unforeseen problems with the data collection instrument, a pilot study was performed. Systematic sampling was used to select 21 high schools from the mailing lists purchased from the publishers of the 1985 Michigan Education Directory and Buyer's Guide. Each identified school was mailed a cover letter and questionnaire. Seventeen of the schools returned the completed questionnaire. A copy of the instrument used in the pilot study is included in Appendix D. Of the seventeen returning the instrument, six indicated that they did not have the data requested concerning A.C.T. Assessment scores. This indicated that a substantial number of schools might be so small that less than 50 students per year were taking the A.C.T. Assessment, and thus they did not receive a free report and did not purchase one. In order to confirm this inference, a question asking the principal to indicate the number of students in the senior class was added to the questionnaire.
Another question was also added to the questionnaire after the pilot study. One principal wrote that his school housed grades ten through twelve. A question was then added to the instrument to determine what grades were housed in the school, so that requirements of three year high schools would not be analyzed with requirements of four year high schools.

The addition of the two questions to the original questionnaire increased its length so that it would not fit on a standard eight and one half by eleven inches page. The resulting questionnaire was further altered by inserting additional spaces between the questions to make it appear less crowded. The questionnaire was then printed on a single page that measured eight and one-half by fourteen inches. The revised questionnaire that was later used in the study is included in Appendix A.

Data Processing

Data from the survey instruments were coded and entered into an IBM 4341 computer by the investigator. The STATPAK computer program (Gordon, 1977) was used to sort the data into several lists that were appropriate for analyses. The lists were analyzed using the STATPAK program.

Statistical Analysis

The data that were collected yielded two groups of variables. One of these groups was the number of years of study required in a
discipline for graduation from the high school. Data were collected from the schools indicating the number of years of study in each of the disciplines of mathematics, natural science, and social studies.

The second variable group included the mean A.C.T. Assessment scores of the mathematics, natural science, and social studies disciplines. Data that contributed to the mean scores were collected and tabulated by the American College Testing Program and provided to school administrators. The data collected reflected the scores of all students at the school who took the tests during the 1983 - 1984 school year.

Reported values of the first variable group, the number of years of required study in a discipline, constitute the independent variables. The levels of the independent variables were reported as 0, .5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, and 4.0 years. These levels varied among the disciplines, and appropriate levels were chosen for each analysis.

The mean A.C.T. Assessment scores of the school districts for the mathematics, science, and social studies disciplines were designated as the dependent variables.

A one-way analysis of variance was performed using the number of years of required mathematics as the independent variables and the A.C.T. mathematics mean scores as the dependent variables. One-way analysis of variance was also conducted using science graduation requirements and A.C.T. natural science mean scores, and social studies requirements and A.C.T. social studies mean scores.

The hypothesis developed in Chapter II which stated, students
who are required to complete more years of study in mathematics will demonstrate higher mathematics achievement scores than students who are required to complete less years of study in mathematics, was restated in the following forms for investigation.

Null hypothesis: There is no difference between the mean A.C.T. mathematics scores of students who attend high schools requiring one year or less and two years or more of mathematics study.

Alternate hypothesis: The mean A.C.T. mathematics scores of students who attend high schools requiring two years or more of mathematics study are greater than the mean mathematics scores of students who attend high schools requiring fewer than two years of mathematics study.

The hypothesis developed in Chapter II which stated, students who are required to complete more years of study in science will demonstrate higher science achievement scores than students who are required to complete less years of science study, was restated in the following forms for the purposes of analysis.

Null hypothesis: There is no difference between the mean A.C.T. Assessment natural science scores of students attending high schools requiring one year or less and more than one year of science study.

Alternate hypothesis: The mean A.C.T. Assessment natural science scores of students attending high schools requiring more than one year of science study are greater than the mean A.C.T. Assessment natural science scores of students attending high schools which require one year or less of science study.
The hypothesis developed in Chapter II which stated, students who are required to complete more years of study in social studies will demonstrate higher social studies achievement scores than students who are required to complete less years of study in social studies, was restated for the purposes of investigation as follows.

Null hypothesis: There is no difference between the mean A.C.T. Assessment social studies scores of students attending high schools requiring two years or less and more than two years of social studies requirements.

Alternate hypothesis: The mean A.C.T. Assessment social studies scores of students attending high schools requiring more than two years of social studies are greater than the mean A.C.T. Assessment social studies scores of students attending high schools requiring two years or less of social studies.

The probability of committing a Type I error was set at .05 for testing the null hypotheses.
CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Introduction

In this chapter are presented data that were collected and analyzed from the high schools surveyed in the State of Michigan. The sections that follow provide: (a) an explanation of responses utilized in analyses, (b) a detailed description of data regarding graduation requirements, and (c) results of statistical procedures used to test the null hypotheses of this study.

Responses

Of the 627 high schools in the State of Michigan, 238 were selected by random sample. More than 71 percent of the schools surveyed responded to the first mailing of the questionnaire. The subsequent requests for data produced additional responses and 209 schools, nearly 88 percent of those surveyed, returned a data collection instrument. The total of 209 respondents represented exactly one-third of all the public high schools in the State of Michigan. Table 1 displays the data concerning response to the survey.
### Table 1

**Response to Survey**

<table>
<thead>
<tr>
<th>Population Sample</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools responding</td>
<td>209</td>
<td>87.8</td>
</tr>
<tr>
<td>Schools not responding</td>
<td>29</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Three of the questionnaires that were returned were not usable. In addition, 21 schools which housed grades ten through twelve were not included in much of the analyses. It was not apparent if the graduation requirements they reported pertained to grades ten through twelve or grades nine through twelve. Rather than make an assumption involving or interpretation concerning these questionnaires, much of the data reported on them were not used. Data concerning changes or future changes in graduation requirements were analyzed from these respondents, but other data were not. Data from other schools housing grades ten through twelve were used in all of the analyses, however, if it was indicated on the instruments which grade levels the requirements included. Elimination of the the 21 schools plus the three unusable returns reduced the schools used in analysis in most instances to no more than 77.7 percent of the total sample. Seventy-eight percent of those sampled provided data that were used in compiling current graduation requirements and possible future changes in requirements, while 50 percent provided usable A.C.T. Assessment data that were used to test the hypotheses previously

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
presented.

Graduation Requirements

Mathematics

Questions concerning the requirements for graduation from high school were posed to those surveyed. All schools which responded indicated that at least one year of mathematics was required for graduation. The majority of schools indicated that two years are required. The responses to the question concerning the mathematics requirements now in effect in the schools are presented in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Number of Years Required</th>
<th>Number of Schools</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>35</td>
<td>19.3%</td>
</tr>
<tr>
<td>1.5</td>
<td>10</td>
<td>5.5</td>
</tr>
<tr>
<td>2.0</td>
<td>126</td>
<td>69.6</td>
</tr>
<tr>
<td>2.5</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>3.0</td>
<td>8</td>
<td>4.4</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td>99.9%</td>
</tr>
</tbody>
</table>

Analysis of the data involving mathematics graduation requirements and student achievement was performed for students who took the A.C.T. Assessment during the 1983 - 1984 school year. These students
were not necessarily required to meet the current standards now in effect for graduation from high school. Many schools have changed requirements recently, and students who were already enrolled when changes in requirements were made only have to meet the standards that were in effect when they entered high school. A question asking which mathematics requirement the students had to meet was included on the questionnaire. It revealed that the students taking the A.C.T. Assessment during the 1983 - 1984 school year had to meet less stringent requirements than those currently in effect. While the majority of schools (69.6%) currently require the students to complete two years of mathematics study, the majority of schools which reported scores of students taking the A.C.T. Assessment during the 1983 - 1984 school year (52.9%) only required the students to complete one year of mathematics. Table 3 notes that five of the schools providing data reported that the students did not have to meet any or only one-half of a year requirement, options that were not available to current students depicted in Table 2. The data describing the mathematics requirements of those schools which reported mathematics scores of their students for the A.C.T. Assessment during the 1983 - 1984 school year are presented in Table 3.
Table 3

Distribution of Mathematics Requirements of Schools Reporting Data of Students Completing the A.C.T. Assessment During the 1983 - 1984 School Year

<table>
<thead>
<tr>
<th>Number of Years Required</th>
<th>Number of Schools</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>4</td>
<td>3.3%</td>
</tr>
<tr>
<td>0.5</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>1.0</td>
<td>64</td>
<td>52.9</td>
</tr>
<tr>
<td>1.5</td>
<td>7</td>
<td>5.8</td>
</tr>
<tr>
<td>2.0</td>
<td>42</td>
<td>34.7</td>
</tr>
<tr>
<td>2.5</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>3.0</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Social Studies

Great variation was found among schools regarding the requirements for social studies. Schools mandated as few as one and one-half years and as many as four years of study. Nearly one-half of the schools currently require three years of social studies credit for graduation. Another 30 percent of the schools require two years of study. Table 4 displays the number of years of social study requirements reported by the schools.
Table 4  
Distribution of Current Social Studies Requirements

<table>
<thead>
<tr>
<th>Number of Years Required</th>
<th>Number of Schools</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>6</td>
<td>3.3%</td>
</tr>
<tr>
<td>2.0</td>
<td>56</td>
<td>30.9</td>
</tr>
<tr>
<td>2.5</td>
<td>18</td>
<td>9.9</td>
</tr>
<tr>
<td>3.0</td>
<td>87</td>
<td>48.1</td>
</tr>
<tr>
<td>3.5</td>
<td>11</td>
<td>6.1</td>
</tr>
<tr>
<td>4.0</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>181</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Students for which the A.C.T. Assessment data were available during the 1983-1984 school year were generally required to complete fewer years of social studies requirements than are now in effect. Note that this conclusion is drawn from only 51 percent of the sample (121 schools), whereas the data presented in Table 4 were provided by 76 percent of the sample. Several schools did not provide data concerning A.C.T. Assessment scores for the 1983-1984 school year, and other schools provided data that were deemed unusable. Table 5 displays the social studies graduation requirements in effect for students completing the A.C.T. Assessment during the 1983-1984 school year.
Table 5

Distribution of Social Studies Requirements of Schools Reporting Data of Students Completing the A.C.T. Assessment During the 1983 - 1984 School Year

<table>
<thead>
<tr>
<th>Number of Years Required</th>
<th>Number of Schools</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>16</td>
<td>13.2%</td>
</tr>
<tr>
<td>2.0</td>
<td>42</td>
<td>34.7</td>
</tr>
<tr>
<td>2.5</td>
<td>14</td>
<td>11.6</td>
</tr>
<tr>
<td>3.0</td>
<td>40</td>
<td>33.1</td>
</tr>
<tr>
<td>3.5</td>
<td>7</td>
<td>5.8</td>
</tr>
<tr>
<td>4.0</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>121</td>
<td>100.1%</td>
</tr>
</tbody>
</table>

Science

Over 90 percent of the schools reported graduation requirements for science to be either one or two years, with 40 percent of the schools requiring one year and 51 percent requiring two years. Only one of the 180 schools reported no requirement in science. The data regarding current high school graduation requirements is displayed in Table 6.
Table 6

Distribution Current of Science Requirements

<table>
<thead>
<tr>
<th>Number of Years Required</th>
<th>Number of Schools</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>1</td>
<td>0.6%</td>
</tr>
<tr>
<td>1.0</td>
<td>72</td>
<td>40.0%</td>
</tr>
<tr>
<td>1.5</td>
<td>12</td>
<td>6.7%</td>
</tr>
<tr>
<td>2.0</td>
<td>92</td>
<td>51.1%</td>
</tr>
<tr>
<td>2.5</td>
<td>1</td>
<td>0.6%</td>
</tr>
<tr>
<td>3.0</td>
<td>2</td>
<td>1.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
<td><strong>100.1%</strong></td>
</tr>
</tbody>
</table>

Students completing the A.C.T. Assessment during the 1983 - 1984 school had to complete fewer years of science to graduate from high school than do students now entering high school. The majority of the schools (63.9%) required only one year for graduation, and nearly six percent required none. While over 50 percent of the schools in the study now require two years of science for graduation, only 21.8 percent of the schools required the students taking the A.C.T. Assessment during the 1983 - 1984 school year to meet this requirement. Again, note that fewer schools provided usable data concerning graduation requirements for students completing the A.C.T. Assessment during the 1983 - 1984 school year than were available for current requirements. The data presented in Table 7 represents 50 percent of those sampled. The science requirements for students taking the
students taking the A.C.T. Assessment during the 1983 - 1984 school year are reported in Table 7.

Table 7

Distribution of Science Requirements of Schools Reporting Data of Students Completing the A.C.T. Assessment During the 1983 - 1984 School Year

<table>
<thead>
<tr>
<th>Number of Years Required</th>
<th>Number of Schools</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>7</td>
<td>5.9%</td>
</tr>
<tr>
<td>0.5</td>
<td>2</td>
<td>1.7%</td>
</tr>
<tr>
<td>1.0</td>
<td>76</td>
<td>63.9%</td>
</tr>
<tr>
<td>1.5</td>
<td>7</td>
<td>5.9%</td>
</tr>
<tr>
<td>2.0</td>
<td>26</td>
<td>21.8%</td>
</tr>
<tr>
<td>2.5</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Increased Requirements

The data collected regarding graduation requirements reflect a recent increase in requirements. This was expected, as the literature had indicated that schools were increasing their requirements in core subject areas (Russell, 1985; U.S. Department of Education, 1985). Data describing such increase is of interest to this study, as an assumption has been made that schools have increased requirements in order to improve student achievement. Analysis of the reported requirements revealed that the number of years of mathematics study increased the most, followed by science. While social studies

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
requirements demonstrated the least increase in the number of years, these requirements are the greatest in amount overall. Mean values of current graduation requirements and requirements that were in effect for students completing the A.C.T. Assessment during the 1983 - 1984 school year were calculated, and are displayed in Table 8.

Table 8
Mean Graduation Requirements

<table>
<thead>
<tr>
<th>Subject</th>
<th>Schools Reporting 1983-1984 A.C.T. Data (Number of Years)</th>
<th>Currently Required (Number of Years)</th>
<th>Difference (in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>1.375</td>
<td>1.828</td>
<td>+0.453</td>
</tr>
<tr>
<td>Social Studies</td>
<td>2.446</td>
<td>2.642</td>
<td>+0.196</td>
</tr>
<tr>
<td>Science</td>
<td>1.186</td>
<td>1.567</td>
<td>+0.381</td>
</tr>
</tbody>
</table>

Schools were asked if they had changed their graduation requirements in the past four years. Over one-half of the 206 schools providing data for this question indicated that they had changed mathematics requirements. Over one-third of the schools indicated that changes had been made in science requirements, and 30 percent reported that social studies requirements had been revised. Analysis of the data generated by this question is displayed in Table 9.
Table 9

Schools Reporting Changes in Graduation Requirements Since 1981

<table>
<thead>
<tr>
<th>Subject</th>
<th>Schools Reporting Change</th>
<th>Percent of Schools Reporting Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>107</td>
<td>51.9</td>
</tr>
<tr>
<td>Social Studies</td>
<td>63</td>
<td>30.6</td>
</tr>
<tr>
<td>Science</td>
<td>80</td>
<td>38.8</td>
</tr>
</tbody>
</table>

Schools were also asked if they were currently considering actions to make changes in their graduation requirements. Even though many schools have already made recent changes, some indicated that further changes might be made, and many schools that have not made recent changes are contemplating such. Approximately one-third of the schools reported that they were considering changes in requirements for mathematics and social studies, and one-fourth of the schools indicated that they may change science requirements. The responses to questions regarding future changes in graduation requirements were provided by 204 high schools and are displayed in Table 10.
Table 10
Schools Considering Change or Further Change in Graduation Requirements

<table>
<thead>
<tr>
<th>Subject</th>
<th>Schools Considering Change</th>
<th>Percent of Schools Considering Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>67</td>
<td>32.8</td>
</tr>
<tr>
<td>Social Studies</td>
<td>77</td>
<td>37.7</td>
</tr>
<tr>
<td>Science</td>
<td>52</td>
<td>25.6</td>
</tr>
</tbody>
</table>

The review of literature had indicated that changes in graduation requirements had taken place, both throughout the country and in the State of Michigan. The data collected in this study verified that much change has occurred in Michigan, and that further change is still contemplated.

Achievement

The assumption has been made that schools are increasing graduation requirements in an effort to improve achievement and knowledge in specific subject areas. This study utilized A.C.T. Assessment scores as a measure of student achievement to investigate the relationship between graduation requirements and achievement. Usable questionnaires provided A.C.T. Assessment scores for 121 schools in the disciplines of mathematics and social studies. Scores for 119 schools were also used in data analysis in the area of science. Some of the schools which were not included in the analyses provided.
A.C.T. data, but it was unclear as to the number of grade levels for which the graduation requirements applied. Other schools did not report A.C.T. Assessment scores which were necessary for analysis regarding student achievement. This was mainly due to the fact that schools with less than 50 students taking the A.C.T. Assessment in a given year do not receive a free report which details student distributions and mean scores. Most of the schools that did not include A.C.T. Assessment subscores were smaller schools, though some of the smaller schools provided data as they had either purchased the report or calculated the data from individual student scores.

Mean A.C.T. Assessment scores for the various disciplines were calculated from the reported data. They closely approximate the mean scores reported by the American College Testing Program (1984b) for the State of Michigan. Table 11 displays the data calculated from responding schools and also data provided by the American College Testing Program for the State of Michigan for students completing the A.C.T. Assessment during the 1983 - 1984 school year. The scores reported are on a standard scale that ranges from one to 36.
Table 11
Mean A.C.T. Assessment Scores

<table>
<thead>
<tr>
<th>Subject</th>
<th>Sample</th>
<th>State of Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>18.2</td>
<td>18.0</td>
</tr>
<tr>
<td>Social Studies</td>
<td>17.5</td>
<td>17.4</td>
</tr>
<tr>
<td>Science</td>
<td>21.6</td>
<td>21.4</td>
</tr>
</tbody>
</table>

Mathematics

The A.C.T. Assessment scores for mathematics were analyzed with respect to the graduation requirements reported by the schools. Previously in this report, Table 3 presented a distribution of the number of schools requiring various numbers of years of mathematics as a graduation requirement. It showed that over 87 percent of the reporting schools either required one year of mathematics (52.9%) or two years of mathematics (34.7%) for graduation. Schools requiring a different number of years for graduation ranged between 0.8 percent and 5.8 percent of those reporting.

The underlying assumptions of analysis of variance require that the groups are normally distributed and that the variances of the groups are equal (Hinkle, Wiersma, & Jurs, 1979). In order to maintain accuracy of the results where these assumptions are not met, the small groups were combined with the major groups. Specifically, the groups of 0.0 and 0.5 years as a requirement, which contained four
and one members respectively, were combined with the 1.0 year group, and the groups of 1.5, 2.5, and 3 years as a requirement, containing seven, two, and one members respectively, were combined with the 2.0 years group. This combination resulted in a group containing 69 cases which required one year of mathematics or less, and a group of 52 cases requiring more than one year of mathematics.

The two groups were analyzed using a one-way analysis of variance procedure. The analysis was performed to test the following hypothesis: There is no difference between the mean A.C.T. Assessment mathematics score of students who attend high schools requiring one year or less of mathematics and the mean score of students attending high schools requiring more than one year of mathematics study.

Table 12 describes characteristics of the two groups used in the analysis of variance procedure. Table 13 displays the results of the analysis and includes the F value calculated as the ratio of the mean squares, and the probability, p, that the results would occur by chance alone.

Table 12

Groups Analyzed in Analysis of Variance - Mathematics

<table>
<thead>
<tr>
<th>Group</th>
<th>Number in Group</th>
<th>Mean ACT Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year or less</td>
<td>69</td>
<td>18.0</td>
<td>2.5</td>
</tr>
<tr>
<td>more than 1 year</td>
<td>52</td>
<td>18.3</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Table 13
Analysis of Variance - Mathematics

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>1.559</td>
<td>0.29</td>
<td>0.41</td>
</tr>
<tr>
<td>Within</td>
<td>119</td>
<td>5.452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of the analysis of mathematics requirements and A.C.T. Assessment mathematics scores require that the null hypothesis not be rejected. The probability, p, of obtaining similar results if scores were selected into groups at random exceeded the .05 alpha level which had been established for this test. It can not be concluded from the data evaluated that there is a relationship between student A.C.T. Assessment mathematics scores and the number of years that the students are required to study mathematics.

Social Studies

A.C.T. Assessment scores for social studies were compared with the graduation requirements reported by the schools. Table 5 previously displayed the distribution of the schools which reported A.C.T. Assessment social studies scores, showing the number of schools requiring various amounts of study for graduation.

The groups of schools presented in Table 5 exhibited a consider-
able range in the number of cases, as they contained 16, 42, 14, 40, 7, and 2 schools. The underlying assumptions of analysis of variance require that the groups are normally distributed and that the variances of the groups are equal (Hinkle et al., 1979). In order to maintain accuracy of the results where these assumptions are not met, the groups were combined into two groups of nearly equal size for the purpose of analysis. The groupings of 1.5 and 2.0 years of required social studies were combined to create a group of two years or less of social studies requirements with 58 members. The remaining groups were combined to create a group of more than two years of social studies requirements. This group contained 63 members. Data concerning the characteristics of these two groups are presented in Table 14.

Table 14
Groups Analyzed in Analysis of Variance - Social Studies

<table>
<thead>
<tr>
<th>Group</th>
<th>Number in Group</th>
<th>Mean ACT Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years or less</td>
<td>58</td>
<td>17.3</td>
<td>1.5</td>
</tr>
<tr>
<td>more than 2 years</td>
<td>63</td>
<td>17.6</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Analysis of variance was performed to test the hypothesis: There is no difference between the mean A.C.T. Assessment social studies score of students attending high schools requiring two years or less of social studies and the mean score of students attending
high schools requiring more than two years of social studies.

Table 15 displays the results of the analysis and includes the calculated F value and the probability p.

Table 15
Analysis of Variance - Social Studies

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>3.890</td>
<td>1.30</td>
<td>0.74</td>
</tr>
<tr>
<td>Within</td>
<td>119</td>
<td>2.990</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The investigator failed to reject the null hypothesis based on the results of the analysis of the data. The probability, p, that similar results would be achieved if values were grouped at random exceeded the .05 alpha level which had been established for this test. It can not be concluded that there is a relationship between the number of years that students are required to enroll in social studies and the A.C.T. Assessment social studies scores of the students.

Science

The analysis of variance procedure was also performed using reported science requirements and A.C.T. Assessment science scores.
The distribution of schools reporting requirements and A.C.T. Assessment science scores was reported in Table 7. Again, some groups were small, containing only one, two and seven members. For the purpose of analysis, schools requiring 0.0 and 0.5 years of science study were combined with schools requiring 1.0 years of study. This produced a group with 85 members. Schools requiring 1.5 and 2.5 years of science study were combined with schools requiring 2.0 years, creating a group of 34 members. These two groups were analyzed through analysis of variance, but it should be noted that the disparity in group size, with one group nearly three times larger than the other, may violate the assumptions of analysis of variance regarding normal distribution within the groups and equal variance between the groups. Characteristics of the two groups are displayed in Table 16.

Table 16
Groups Analyzed in Analysis of Variance - Science

<table>
<thead>
<tr>
<th>Group</th>
<th>Number in Group</th>
<th>Mean ACT Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year or less</td>
<td>85</td>
<td>21.6</td>
<td>1.9</td>
</tr>
<tr>
<td>more than 1 year</td>
<td>34</td>
<td>21.4</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Analysis of variance was performed using the two groups to test the following hypothesis: There is no difference between the mean
A.C.T. Assessment natural science scores of students attending high schools requiring one year or less of science and the mean score of students attending high schools requiring more than one year of science study.

The results of the analysis of variance are presented in Table 17.

Table 17
Analysis of Variance - Science

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>1</td>
<td>0.342</td>
<td>0.09</td>
<td>0.23</td>
</tr>
<tr>
<td>Within</td>
<td>117</td>
<td>3.846</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis was not rejected. The probability, p, that similar results could be obtained if scores were selected at random exceeded the .05 alpha level which had been established for this test. It can not be concluded that there is a relationship between student A.C.T. Assessment science scores and the number of years that the students are required to study science.

Summary

The data that were collected revealed that many schools have changed their graduation requirements during the past four years.
Over one-half of the high schools reported that they have changed mathematics requirements, and over 30 percent have made changes in the areas of science and social studies. When requirements of students completing the A.C.T. Assessment during the 1983 - 1984 school year were compared to the requirements currently in effect, mean increases of nearly one-half year in mathematics, over one-third of a year of science, and one-fifth of a year of social studies requirements were found. Also, approximately one-third of the schools indicated that they are considering future changes in mathematics and social studies, and one-fourth may make changes in science requirements.

Analyses of A.C.T. Assessment scores and data concerning graduation requirements were performed in an attempt to find a relationship between the two. The analyses failed to establish a relationship between graduation requirements and scores in mathematics, social studies, or science.

Chapter V presents the conclusions that were drawn from this investigation.
CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to summarize the analyses of data previously stated, and to formulate the conclusions justified by these analyses. Furthermore, recommendations for future research are presented.

Conclusions

The underlying motivation for conducting this study was to investigate factors that contributed to student achievement. It appeared that a trend toward increasing high school graduation requirements was in progress. A logical question that arose from this observation concerned the effect of such increases on student achievement.

Student achievement has been studied by many investigators in the past, and several variables have been implicated as affecting achievement. Time on task has been studied extensively as a variable, and has frequently been positively linked to student achievement. The literature pointed to many ways of defining time, however, and the various definitions of time appear to relate to student achievement to differing degrees. Allocated time in particular appeared to demonstrate the lowest relationship to student achievement. Graduation requirements as defined in this study are a measure of
allocated time. The statistical tests performed at the .05 alpha level in this study failed to establish a positive relationship between this measure of allocated time and the measure of student achievement that was used. While these analyses do not disprove that such a relationship exists, they fail to confirm one.

It should also be pointed out that the results of this study do not apply to all students attending high school in the state of Michigan. The relationship between high school graduation requirements and student achievement was investigated regarding only students who completed the A.C.T. Assessment. These students are the ones who most likely will continue their education after the completion of high school. This group of students may very likely have characteristics that distinguish them from the population of students in general.

The literature that was reviewed revealed that many schools have been changing their graduation requirements in the past few years. This study supported that conclusion for the State of Michigan. The literature also suggested that increases in graduation requirements have come as a result of concern regarding declines in standardized test scores.

Schools may be changing requirements due to the influence of several national reports, perceived public opinion of schools, and publicity concerning the increases being made by schools throughout the nation. While the immediate reasons for change in particular school districts may vary, the assumption underlying these changes is that increased requirements will result in increased student
achievement.

As previously stated, the findings of this study do not support this assumption. It is possible that increasing graduation requirements does not affect student achievement. Explanations for this conclusion can be offered. For example, schools requiring one year of study in mathematics may have many students completing algebra as well as other mathematics courses. The students may have done so even if the requirement was not in place. Other students at these schools may elect to take a course in general mathematics, and either show no appreciable increase in achievement, or may have taken such a course anyway during their high school years.

Another conclusion that can be drawn from this study is that it is possible that there may be an increase in achievement on the part of students who do not take the A.C.T. Assessment, while those who do take the tests do not demonstrate greater scores. If this were shown to be true, it would demonstrate a benefit of increasing graduation requirements. That may not, however, resolve the purpose that underlies the changes that have occurred in many school districts. The literature points toward standardized tests such as the A.C.T. and S.A.T. as measurement of the effectiveness of schools. Much research and public concern have been directed toward the decline in standardized test scores, and the literature points toward the trend of increasing requirements as a means of attempting to increase test score performance. Perhaps the use of standardized tests such as the A.C.T. and S.A.T are not adequate measures of the effectiveness of a
school system.

In view of the great number of schools that have been or are considering increasing graduation requirements, the failure of this study to establish a relationship between the number of years of graduation requirements and the A.C.T. measure of student achievement indicates that more investigation is necessary.

Further Research

This study attempted to establish a relationship between the number of years of study required of students and the students' A.C.T. Assessment scores. Future studies dealing with the same topic could be refined to control more of the extraneous variance that existed in this study. Some suggestions for accomplishing this follow.

One of the problems encountered in a study of this nature is that of obtaining the necessary data. Individual student records are confidential, and permission from appropriate school administrators is necessary for access to student files. School administrators can be requested to provide individual student data, but if the request involves considerable searching of files, it is not likely to receive a great response. Access to more detailed student histories, however, could eliminate some of the variance that was not controlled in this study.

A source of variance that may have effected the results of this study involves the situation in which students may have exceeded the minimum requirements for a subject area. For example, schools which
require one year of study in a subject area may have many students who complete more than one year of study in the discipline. In fact, it is very probable that many of the students who took the A.C.T. Assessment exceeded the minimum graduation requirements. The students taking the tests are generally those who are considering the continuation of their education at college, and it seems reasonable to conclude that some of these individuals would have taken additional courses in basic areas in order to improve their background in these areas before entering college. In this study, this would most likely affect scores of students who attend schools which have the least requirements. Schools which require one year of study in a discipline are more likely to have students exceed the requirement to a greater degree than schools which require two years of study. For example, while some schools may require one year of mathematics study for graduation and other schools may require two years, some of the students at both groups of schools may complete three years of study.

In the analyses of the data available for this study, there was no control or investigation concerning the actual amount of study that a student had undertaken in a given discipline. If an investigator could gain access to individual student files in several school districts, and determine the actual number of courses that a student had completed, a more accurate assessment of the relationship of student achievement to the number of classes completed could be made.

While the previous suggestion relates to student achievement and time spent in study, it does not directly relate to graduation re-
requirements. Another possibility for further research that directly relates to graduation requirements lies in an investigation that includes A.C.T. data from schools of the size that did not contribute to this study. Schools with less than 50 students completing the A.C.T. Assessment in any given year do not receive a free report from the American College Testing Program which details mean scores for the various subtests. As a result, relatively few of the smaller schools surveyed provided such data. Over 25 percent of the schools involved in this study fell into this category. Schools do receive individual scores of the students, however, and these can be used to calculate needed data. An investigation which includes the sizable number of smaller schools in the state would provided a more accurate picture of the relationship of student achievement and A.C.T. Assessment scores.

Summary of Study

The literature indicated that scores had declined on standardized tests during the 1960's and 1970's. Research to determine the cause of the decline pointed toward changes in high school curricula. It was suggested that students were allowed a greater choice of elective courses during this time, and this choice resulted in a decrease in the number of traditional courses studied by the students. The literature also indicated schools were currently requiring more courses in basic areas, in an attempt to increase student achievement scores.

This study investigated the relationship between high school
graduation requirements and mean A.C.T. Assessment scores of schools in the State of Michigan. Specifically, A.C.T. subscores for the areas of mathematics, social studies, and natural science were analyzed in order to establish a relationship with the number of years of graduation requirements that were mandated for each discipline.

The population that was studied included all high schools in the state of Michigan, and more than one third of the schools were sampled. A return rate of nearly 88 percent was achieved, although over 25 percent of the schools responding were unable to supply A.C.T. Assessment data.

The literature had revealed that a large number of schools, both nation-wide and in the State of Michigan, had increased graduation requirements during the past few years. The results of this study showed that many schools in the State of Michigan have made changes in requirements since 1981. The number of schools reporting changes ranged from 30 percent in the area of social studies, to over 50 percent in the area of mathematics. In addition, the number of schools that indicated that they were considering future changes in graduation requirements ranged from 25 percent in the area of science to 37 percent in social studies.

Analyses of A.C.T. Assessment data and graduation requirements did not support a relationship between graduation requirements and A.C.T. Assessment subscores. Future research is suggested to investigate the relationship of these two variables.
Appendix A

Data Collection Instrument
HIGH SCHOOL GRADUATION REQUIREMENTS

1. What grades are in your high school? _____ 9 - 12 _____ 10 - 12

2. How many seniors are in this year's class? ________

3. Please circle the number of years that are required for graduation from your high school in each of the following subjects:

   Mathematics: 0 1/2 1 1 1/2 2 2 1/2 3 3 1/2 4
   Social Studies: 0 1/2 1 1 1/2 2 2 1/2 3 3 1/2 4
   Science: 0 1/2 1 1 1/2 2 2 1/2 3 3 1/2 4

4. Has the graduation requirement for mathematics changed since the 1980-1981 school year? _____ yes _____ no (IF NO, GO TO ITEM 5)
   In what year was the change implemented? __________
   How many years were previously required? _____ years
   Do this year's seniors have to meet the new requirements? ____yes ____no

5. Has the graduation requirement for social studies changed since the 1980-1981 school year? _____ yes _____ no (IF NO, GO TO ITEM 6)
   In what year was the change implemented? __________
   How many years were previously required? _____ years
   Do this year's seniors have to meet the new requirements? ____yes ____no

6. Has the graduation requirement for science changed since the 1980-1981 school year? _____ yes _____ no (IF NO, GO TO ITEM 7)
   In what year was the change implemented? __________
   How many years were previously required? _____ years
   Do this year's seniors have to meet the new requirements? ____yes ____no
7. Is the school board or administration currently considering increasing the graduation requirements in . . .

mathematics _____ yes _____ no  science _____ yes _____ no
social studies _____ yes _____ no

The High School Profile Report is prepared for each school about their students who took the ACT Assessment. The report may be housed in the counseling office of your school. The following information is needed from page 2 of the report for your students (yellow cover) tested during the 1983-84 year (bottom of the page).

8. Number of students tested

9. Mean ACT Mathematics score

10. Mean ACT Social Studies score  ____  Do not have report

11. Mean ACT Natural Science score

THANK YOU FOR YOUR ASSISTANCE.

Note: Schools with less than 50 students taking the test do not receive a report, and must purchase one. Check here if your school does not have one.
Appendix B

Cover Letter
Mr. or Ms. First and Last Name
Principal
Name of High School
Street Address
City, State Zip Code

Dear Mr. or Ms. Last Name:

Much attention has been drawn to education since the National Commission on Excellence in Education released *A Nation at Risk*. As an outgrowth of that report, many questions were raised about the value of graduation requirements. Your high school is one of more than two hundred in the state of Michigan which has been randomly selected to provide data for a study involving such requirements. The data concerning graduation requirements and composite student A.C.T. scores requested on the enclosed survey instrument will take only a few minutes of your time, and is extremely vital to the study.

The purpose of this research is to study graduation requirements and their relationship to student achievement. Hopefully this work will add to knowledge concerning high school requirements as they relate to student achievement. The research is being conducted with the approval of the Educational Leadership Department at Western Michigan University, where I am a doctoral candidate.

I wish to emphasize that your school will not be identified in any way. The number that appears on the questionnaire is for follow-up purposes only, and once the questionnaire is received it will be removed, making it impossible to identify the school with the data received. The values reported will be combined with values from other schools having the same graduation requirements, and then statistically analyzed and reported.

It would be greatly appreciated if you will take a few minutes to complete the enclosed questionnaire and return it prior to March 15. A stamped, addressed envelope is enclosed for your convenience. If you would like a brief summary of the results of this study when it is completed, please indicate so.

Thank you for your assistance in this project.

Sincerely,

William M. Pritchard

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Mr. or Ms. first and last name
Principal
Name of High School
Street address
City, State and zip code

Dear Mr. or Ms. last name:

Your high school is one of more than two hundred in the state of Michigan which has been randomly selected to provide data for a study involving graduation requirements. I have previously mailed a questionnaire to you, but I have not received a response. As perhaps the questionnaire was not received, or it became misplaced, I am including another one. The data concerning graduation requirements and composite student A.C.T. scores requested on the enclosed survey instrument will take only a few minutes of your time, and is extremely vital to the study.

The purpose of this research is to study graduation requirements and their relationship to student achievement. Hopefully this work will add to knowledge concerning high school requirements as they relate to student achievement. The research is being conducted with the approval of the Educational Leadership Department at Western Michigan University, where I am a doctoral candidate.

I wish to emphasize that your school will not be identified in any way. The number that appears on the questionnaire is for follow-up purposes only, and once the questionnaire is received it will be removed, making it impossible to identify the school with the data received. The values reported will be combined with values from other schools having the same graduation requirements, and then statistically analyzed and reported.

It would be greatly appreciated if you will take a few minutes of your time to complete the enclosed questionnaire and return it prior to March 23. A stamped, addressed envelope is enclosed for your convenience. If you would like a brief summary of the results of this study when it is completed, please indicate so.

Thank you for your assistance in this project.

Sincerely,

William M. Pritchard
Appendix D

Pilot Study Data Collection Instrument
HIGH SCHOOL GRADUATION REQUIREMENTS

1. Please circle the number of years that are required for graduation from your high school in each of the following subjects:

   Mathematics  0  1  2  3  4
   Social Studies  0  1  2  3  4
   Science  0  1  2  3  4

2. Has the graduation requirement for mathematics changed since the 1980-1981 school year?  yes  no (IF NO, GO TO ITEM 5)
   In what year was the change implemented?  ________
   How many years were previously required?  ________ years
   Do this year's seniors have to meet the new requirements?  yes  no

3. Has the graduation requirement for social studies changed since the 1980-1981 school year?  yes  no (IF NO, GO TO ITEM 6)
   In what year was the change implemented?  ________
   How many years were previously required?  ________ years
   Do this year's seniors have to meet the new requirements?  yes  no

4. Has the graduation requirement for science changed since the 1980-1981 school year?  yes  no (IF NO, GO TO ITEM 7)
   In what year was the change implemented?  ________
   How many years were previously required?  ________ years
   Do this year's seniors have to meet the new requirements?  yes  no

5. Is the school board or administration currently considering increasing the graduation requirements in . . .
   mathematics  yes  no  science  yes  no  social studies  yes  no

The High School Profile Report is prepared for each school about their students who took the ACT Assessment. The report may be housed in the counseling office of your school. The following information is needed from page 2 of the report for your students (yellow cover) tested during the 1983-84 year (bottom of the page).

6. Number of students tested  ________

7. Mean ACT Mathematics score  ________

8. Mean ACT Social Studies score  ________  Do not have report

9. Mean ACT Natural Science score  ________

Note: Schools with less than 50 students taking the test do not receive a report, and must purchase one. Check here if your school does not have one.
BIBLIOGRAPHY


Fowler, C. (1977). As test scores have fallen, so has the time schools give to teaching. American School Board Journal, 164(9), 26,38.


Tennessee to increase courses required in math and science. (1983). *Education Week, 2*(35), 2.


