MONTANA
STATE UNIVERSITY

Riding time and school size as factors in the achievement of bus transported pupils
by Alan George Zetler

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
DOCTOR OF EDUCATION
Montana State University
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Abstract:
The purpose of this study was to define possible limits to high school consolidation and bus transportation in sparsely populated rural areas—-limits determined by maximum bus riding time and optimum school size. Nine separate G.P.A. components and four standardized tests were used as criterion variables.

A sample of 812 bus pupils from 40 Montana high schools were classified into a 4 by 3 factorial post hoc experiment. Four levels of bus riding time were used: 0-30 minutes, 31-45 minutes, 46-60 minutes, and 60 or more minutes. School size levels were: small (0-99 pupils), medium (100-499), and large (500 or more).

No conclusive evidence of interaction between bus riding time and school size was found. Conclusion: Specific combinations of school size and bus riding time do not exist that could account for any given level of G.P.A. or standardized test achievement within the transported Montana high school rural population.

Bus riding time alone had no significant effects on transported pupils. Conclusion: Within any one of the three levels of Montana high schools, transported pupils riding the bus up to 90 minutes one-way will not experience differences in G.P.A. or standardized test achievement that can be attributed to the bus ride itself.

Significant difference among school size means were found for some components of G.P.A. Conclusion: G.P.A.°s earned by Montana bus pupils during the first three years of high school, or earned in required high, school courses, cannot be attributed to the size of school attended; senior and elective courses G.P.A. can be attributed to the size of school and favors the medium sized school.

Raw or standard scores of the ACT, ITED, NMSQT, and PSAT were recorded and normed on the bus population. Conclusion: Under the conditions of increasing discrimination of testees as schools become larger, PSAT verbal and NMSQT achievement significantly favors those bus pupils attending large high schools. Bus pupils from large high schools are more apt to possess those attributes required on standardized tests than are bus pupils from medium or small high schools.

RIDING TIME AND SCHOOL SIZE AS FACTORS IN THE

ACHIEVEMENT OF BUS TRANSPORTED PUPILS

by

ALAN GEORGE ZETLER

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree

of

DOCTOR OF EDUCATION

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VITA

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Alan George Zetler was born February 8, 1930 at Duke Center, Pennsylvania, the youngest son of George I. Zetler and Hazel Hutton Zetler. He married Dorothea Inez Perkins on August 18, 1956 at Denver, Colorado. They have four children: Tracie Lynn, Peggy Jo, Mark Alan, and Kimberly Dawn.

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A.G.Z.

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ABSTRACT

The purpose of this study was to define possible limits to high school consolidation and bus transportation in sparsely populated rural areas--limits determined by maximum bus riding time and optimum school size. Nine separate G.P.A. components and four standardized tests were used as criterion variables.

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CHAPTER I

INTRODUCTION

Many children can no longer secure an elementary and secondary education within walking distance of their homes. Advances in technology and attitudes toward travel have been incorporated into educational thinking to the extent that transporting pupils to school at public expense is no longer a question of acceptance but one of degree.

Evaluation of any educational practice must echo the premise on which it was based. Pupil transportation is no exception. Students board the bus for one purpose--to take advantage of an educational opportunity that does not exist in the immediate neighborhood. Busing pupils is an educational means and never an end in itself. The National Education Association's Department of Rural Education states: (51:33)

> It is also evident that the only justification of the pupil transportation effort, what it is and what it may become and in spite of its tremendous outlay for tangibles, will be in terms of an intangible--the *educational opportunity it contributes*.

This study is addressed to the question of whether or not that opportunity is being fulfilled.

Consideration of the pupil transportation movement must be accompanied by equal consideration of the school consolidation movement. These two elements are similar to the "chicken or the egg" argument and attempts to determine cause and effect are moot, for it is the parallel use of the two concepts that is important.

The philosophy behind school consolidation has aims allied with those of pupil transportation. Bringing together students from two or more previously separate schools will make available educational opportunities that heretofore were denied, at least for some of the students. If this were not so, what justification could be offered for the process? The increased opportunity may be academic, economic, or social, each with various degrees of overtness or subtlety. The school patrons and professional educators must arrive at some balance point where the advantages of consolidation can be realized within the limits of feasible transportation. Conversely, the transportation system must be designed or altered to realize the potential of the consolidation.

Roe (57:253) categorizes busing systems into two classes, one involved with populated urban and suburban centers while the other involves sparsely populated rural areas. The latter type was investigated in this study. Urban and suburban school transportation presents a different set of problems than does busing in the sparse rural regions. Sociological factors, such as racial integration, are becoming dominant in creating pressures for expanded city busing. The area from which students are drawn for a certain school building may depend on the capacity of the structure or the willingness of the local district to finance transportation. Distances traveled by the pupils are small and large numbers will board the bus at each pickup stop.

In contrast, sparsely populated regions, such as found in the high plains and mountain states, very often have open-ended maximum school enrollments. Upper limits are determined by how far the bus routes can reasonably extend into the surrounding countryside. Secondary education per pupil costs are generally higher than elementary per pupil expenditures. Coupled with a lack of students, this concentrates many rural educational problems at the high school level. Equipment, staff, and activities necessary for a comprehensive secondary school program demand an enrollment not easily satisfied in areas of low population density.

In the words of Aubertine: (4:592)

> The consolidation movement continues to reduce the number of small, rural schools, but in the plain and mountain regions of our nation, the combining of school districts is not always feasible.
>
> . . . Moreover, if schools were consolidated the more remotely located students would spend unduly long hours traveling.

A declining rural farm population within a predominantly urban society makes pupil transportation a necessity. With many small schools losing their clients, consolidation together with longer bus routes are inevitable to insure a competitive education for the remaining rural pupils.

But the problem of consolidation advantages weighed against transportation limitations must be met. The urban centers are growing larger and the small rural community is shrinking. Rural school patrons usually have a choice of accepting either limited consolidation with shorter bus routes and a smaller high school, or more extensive consolidation with longer bus routes and a larger school.

Questions may be raised. Should we consolidate and let the transportation vary accordingly? Should we consider the actual advantages possible from busing students and then consolidate accordingly? Is it possible the advantages and/or disadvantages of the resulting school size and those attributable to busing may not be independent? The results of this study provide partial empirical evidence to assist in solving this problem.

Statement of the Problem

In the state of Montana, pupils from the rural countryside are bused into various sized high schools operating in small rural communities or in larger towns and urban centers. Some bus pupils experience a considerably longer school day than other bus pupils, measured from morning loading time to evening unloading. The total length of school day as determined by bus riding time may have an effect on transported high school pupils as evidenced by realized achievement in school.

Montana high schools range along a size continuum from very small rural enrollments to large urban institutions. The degree to which the transported rural pupil is able to perform academically may be a singular function of the size of school attended. The social atmosphere and curricular offerings could be in agreement or conflict with what the bus pupil regards as important.

A blending of transportation effects with school size effects may create conditions under which academic performance can not be explained by the singular influence of transportation or size alone, but only by the unique outgrowth of the two forces acting in concert.

Statement of null hypotheses. Three statistical hypotheses of "no difference" will be tested by this study:

1. Bus riding time and school size are non-interacting variables as determined by the earned marks and standardized test scores achieved by transported high school rural students.

2. Bus riding time has no singular effect on the achievement of transported high school rural students as determined by earned marks and standardized test scores.

3. School size has no singular effect on the achievement of transported high school rural students as determined by earned marks and standardized test scores.

Three research or alternate hypotheses follow from the null statements. Each research hypothesis is measured by the same criteria of earned marks and standardized test scores:

1. Bus riding time and school size are interacting variables affecting the achievement of transported high school rural students.

2. In the absence of interaction, bus riding time affects the achievement of transported high school rural students.

3. In the absence of interaction, school size affects the achievement of transported high school rural pupils.

Significance and Need for the Study

Getting a child to school was originally an individual family responsibility, but the pattern by which formal education grew made public support for pupil transportation necessary. Featherston and Culp (28:2) credited three factors as primarily responsible for school transportation growth: (a) the passage of compulsory attendance laws, (b) the consolidation of rural attendance centers, and (c) the increased holding power of secondary schools, which is a recent development. State legislatures have stimulated the growth of transportation systems by providing financial support. Laws were passed that require a bus for those students living beyond certain specified distance limits. Recent trends in school statutes generally point toward more accessible transportation at public expense.

An assessment of pupil transportation and school consolidation was made at midcentury by Culp, who was quoted by the N.E.A. as saying: (51:31)

> School transportation was not designed merely as a convenience to children who live beyond a reasonable walking distance from school. In its basic philosophy and practical existence, school transportation is an indispensable and integral part of our system of consolidated schools, which were developed to serve the educational needs of our time.

Authors in the field of pupil transportation place the cost of school busing between 3.6 percent and 5.0 percent of current public education expenditures. (28:9; 34:10; 49:59) Over one third of the nation's elementary and secondary school students now ride buses to school. (34:9) With such an investment in money, time, and talent, it is not surprising that school transportation has been the subject of considerable research and evaluation.

But investigation has proceeded on an uneven front, covering only three of the four objectives, which Isenberg (51:169) claims are desired in any transportation program. The first objective is safety, or the elimination of avoidable hazards. Second is efficiency, the combining of all effort effectively to insure a competent busing operation. Third is economy which implies that the lowest possible cost is realized within desirable standards. The final objective is adequacy, or the degree to which the potentials of transportation contribute to the educational program. Defined in another way by Isenberg, adequacy asks "to what degree is the potential of the program achieved within justifiable practices?"

The adequacy objective has received much speculation but little concrete research effort. In the absence of systematic study, assumptions have been advanced around which transportation practices have been built. Repeated application of the practices has resulted in a generally accepted set of operating standards. However, continued use does not attest to the soundness of the underlying assumptions. The problem of transportation adequacy should therefore be explored, particularly with relationship to school consolidation because the two concepts are mutually supporting.

One of the assumptions in question is bus riding time; more specifically, the length of time students of high school age can be expected to ride the bus one way without adverse effects. Writers have loosely concurred for some time that one hour should be the maximum. (19:1197; 28:94; 48:473) Recommended riding times for elementary pupils are somewhat less, usually a fifteen minute reduction. Montana is one state that has enacted a law regulating bus riding time, but it is applicable only to elementary children. The statute reads: (47:243)

> No child attending public elementary school shall be required by any school board to ride a school bus, under average road conditions, more than one (1) hour per trip of said children in said school bus, without the consent of the child's parents or guardian.

<u>Consolidation-transportation relationship</u>. In the sparsely settled regions, the size of school often depends on how large a geographical area can be encompassed. In terms of the bus ride, the school size is dependent on how many minutes or hours the students are willing or allowed to ride the bus. One basis for consolidation decisions should be the effect of bus riding time as weighed against the educational benefits students may expect from increased school size. <u>Consolidation success must be measured by the achievement of those pupils whom the movement intended to serve</u>.

The enrollments of Montana high schools, given in Table 1, page 10, illustrates a sparsely settled state having a predominance of small high schools.

The model size of Montana high schools falls in the 50 to 99 enrollment range. Over half of the state's high schools enroll 149 students or less. The situation would appear to be ripe for extensive consolidation, except for the fact that Montana's large land area and sparse rural population exert a tempering influence to the movement.

Three alternatives are open to a district that decides to abandon its high school: (a) two or more small enrollment districts can form a centralized high school, (b) the abandoning district may send all its high school students intact to an adjacent district's larger high school, or (c) the abandoning district may be broken up, the pupils within each segment attending high school in the neigboring districts that annex each part. The choice of alternatives can result in various lengths of bus rides and different sizes of high school enrollment.

If it were known that long bus rides did or did not affect the academic performance of the transported pupils, the decision would be simplified. On the other hand, research has substantiated the wisdom of practicing attendance consolidation and district reorganization. According to Isenberg, (35:68) "the conclusions of dozens of studies point out that reorganized districts and consolidated schools have advantages over unreorganized and nonconsolidated schools . . ." Since transportation and school consolidation are complementary concepts, the

TABLE 1. ENROLLMENTS OF MONTANA PUBLIC HIGH SCHOOLS IN 1969-1970 BY INTERVALS OF FIFTY

Enrollment of School	Number of Schools
0 - 49	19
50 - 99	48
100 - 149	32
150 - 199	16
200 - 249	16
250 - 299	4
300 - 349	4
350 - 399	2
400 - 449	4
450 - 499	4
500 - 549	3
550 - 599	1
600 - 649	1
650 - 699	3
700 - 749	1
750 - 799	0
800 - 849	0
850 - 899	1
900 - 949	2
950 - 999	0
1,000 - up	10
Total	171

Source: Montana Educational Directory (46:11,117) question of transportation adequacy should be investigated in relation to its effect on consolidation. Research does exist on busing systems, but it has been aimed at securing safe, efficient and smoothly operating programs, with adequacy being only a secondary consideration. (20:1544)

Transportation is classified as an auxiliary service and does not directly add to the educational offering. (18:1167) Nevertheless, the costs consume district and state funds. The price tag for pupil transportation rose from 93 million to over seven times that amount during the period from 1944 to 1964. (23:11) Montana daily expenditures for school busing amounted to $18,658 during the 1968-1969 school year. (45:3) Mounting financial outlay and millions of involved children make it critical that the system be evaluated to determine the optimum educational benefit possible per transportation dollar.

To the writer's knowledge, no investigation has used bus riding time as a systematic variable with school size in considering the achievement of transported high school rural students. A statement by Moehlman (44:408) supported the effort:

> The problem of public school transportation needs careful research and study before it gets out of hand and determines the school program instead of depending on it.

Procedures

Investigation of the problem and testing of the null hypotheses required the following procedures:

1. Literature was reviewed on pupil transportation, school size, and achievement to lend direction and guidance to the subsequent analysis.

2. Bus riding time was divided into four levels of one-way time and high schools were divided into three size levels. Any member of the eventual sample was able to be classified into any one of twelve time-size combinations. Those students riding the bus for 30 or less minutes were subdivided according to whether they attended small (99 or less), medium (100 to 499), or large (500 and over) enrollment high schools. The same three school size subdivisions were made for bus pupils whose one-way riding times were 31-45 minutes, 46-60 minutes, and 61 or more minutes.

3. All bus routes in Montana were ranked from longest to shortest on the basis of the maximum mileage experienced by any high school pupil riding the route. Routes covering 40 or more one-way miles, plus selected shorter routes, became the basis for selecting transportees and schools used in the sample. Selection continued until a minimum of 50 students were placed in each of the twelve time-size combinations.

4. Dependent variable data consisting of earned school marks and standardized test scores were gathered in the field by the investigator.

5. The data was statistically interpreted using factorial experiment techniques. This process permits an analysis of two or more

independent variables acting simultaneously, as well as permitting an examination of the singular effects for each variable alone.

6. The results of the study were reviewed in relation to the increased educational opportunity potential that both pupil transportation and school consolidation claim as benefits.

Limitations of the Study

The study was confined to public high school pupils in the state of Montana. Only students from high school districts having at least one long bus route, as determined by Montana State Department of Public Instruction records, were subjected to investigation. Bus routes were those satisfying both of the following criteria: (a) The route was eligible for state financial reimbursement as determined by the State of Montana T-1 Form entitled, School District Application for Registration of School Bus and State Reimbursement. The form had to be on file in the State Department for the 1967-1968 school year. (b) At least one of the high school pupils riding the route lived near the end of the bus run so that his total miles traveled per day was near maximum for the route. At least one of the high school students riding the route had to live at less than maximum distance, the purpose being to guard against bias within any one riding time category for any one bus route.

Students on whom data was gathered were listed as eligible transportees (living three or more miles from the school) on the T-1 Form applicable to the selected bus route(s). The student members of the sample were riders on vehicles that actually delivered the students to the high school building. Feeder bus minutes were part of the total one-way riding time only if the investigator was able to interview the feeder bus operator to secure the correct number of additional minutes.

Riding time minutes were those figures reported by the bus driver or manager, minutes actually timed by the investigator, or totals obtained from school office personnel. Travel time was confined to the number of minutes spent on the vehicle from loading to unloading. Time spent en route from home to bus pick-up point or minutes spent waiting for bus arrival were not included in riding time.

Students investigated were members of: (a) the 1969-1970 junior high school class, (b) the 1969-1970 senior high school class, or (c) alumni of the school with either the 1968 or 1969 graduating classes.

Criterion variable data was confined to earned marks and standardized test scores that appeared on the pupil's permanent high school record or personal guidance file. Scores on all standardized tests were recorded but only those which satisfied the following three requisites were analyzed: (a) the test was administered in an arbitrarily selected minimum of 11 or more sampled high schools, (b) the number of schools administering the test were stratified proportionally to the total numbers of schools occurring in the size categories, and (c) the test was administered to individual bus students with frequencies proportional to the total number of pupils found in the four riding time categories.

Definition of Terms

Certain concepts referred to in the study are subject to different meanings and interpretations. The following terms are therefore defined along with comments about common usage:

Consolidation. . . . a process whereby students who previously attended separate schools are brought together in a single building. (35:67)

"Attendance consolidation" or "attendance center consolidation" are terms having the same meaning. It is not necessary that the original legal school districts be joined--only the students.

Reorganization . . . the formal combination of previously separate and legally constituted school districts into one school district. (35:67)

Reorganizing districts does not imply a necessary combining of attendance centers, although this is often the case. One board of school trustees now functions where before there had been two or more boards carrying out duplicate duties.

Riding time. . . . . the number of minutes a student spends in transit one way on a school bus, measured between loading and unloading.

Rural population . .	those persons living in towns of under 2,500 inhabitants or living in open country where the density of population is sparse enough so that the area cannot be classed as urban fringe. Most of the townsfolk living in small communities are rural even though they have no connection with farming. Consequently, they are called "rural non-farm people" as opposed to the rancher or farmer who lives on 10 acres or more or who receives a cash crop income of $250 or more. (7:4)
High school rural student. . .	any high school child whose parents or guardian are part of the rural population.
Rural high school. .	a high school building located in a town of less than 2,500 inhabitants. The enrollment or curriculum offered by the school has nothing to do with the classification.
School size.	the total number of students registered in a high school building. High school size refers to the total enrollment in grades 9-12 or grades 10-12, inclusive, depending on the adopted organization pattern.
Urban.	incorporated and unincorporated places having 2,500 or more inhabitants. (65:xv) A town may be closely tied with agriculture but still be urban by definition.
Urban high school. .	a high school building located in a town of 2,500 or more inhabitants.

CHAPTER II

REVIEW OF LITERATURE

A literature search concentrated on three topics relevant to the stated problem. The points reviewed were: (a) development, conceptual design, and scope of pupil transportation; (b) consolidation-transportation relationships; and (c) achievement as it relates to the rural student, school size, and bus riding time.

Development, Conceptual Design, and Scope of Transportation

Parents used to accept the responsibility of getting their children to school as long as there was a school building within reasonable reach of each settlement. By foot, horseback, or drawn wagon, a pupil could get to school if he was willing, even though the journey may have worked a hardship.

But a growing nation dictated that the common good depended on compulsory education. Demands entailed responsibilities, so in 1869 the state of Massachusetts passed the first law authorizing public funds for transportation. Other states were slow to follow. By 1900, only one-third of them had enacted similar legislation. The remaining states gradually established public support for school transportation during the next 19 years.

School buses were originally an adaptation of the farm wagon, and the name "transportation wagon" was therefore applied. Distance by horse-drawn vehicle was of course limited. Brown's assessment of transportation in his Tennessee district during 1917 illustrates the mileage boundaries then existing. He wrote, "Twenty-two transportation wagons are in use, hauling from twenty to thirty children, each a distance of from two to six miles." (8:2)

To supplement his arguments directed to those who were against hauling children to school, Calhoun (12:7) in 1917 quoted a colleague writing in the North Dakota Bulletin:

> Let him who has a lively imagination tell us what mothers would say whose children had always been transported warm and dry, when it should be seriously proposed that hereafter the little ones should wade while horses spoiling for exercise stand in barns and kick the boards off for sheer amusement or lack of exercise.

The wise use of horse energy may have had popular appeal in those days; but, of course, the basic thesis was the welfare of the child.

The rapid expansion of school busing could not have been possible without the breakthrough caused by the invention and acceptance of motorized vehicles. With them came demands for better roadways. The rapid growth of publicly supported transportation together with the increase in paved rural roadways is summarized in Table 2, page 19.

TABLE 2. SURFACED RURAL ROADS AND PUPILS TRANSPORTED FOR SELECTED YEARS

Years	Miles of surfaced rural roads	Transportees at public expense
1921-1922	387,000	594,000
1929-1930	662,000	1,902,826
1939-1940	1,318,000	4,144,161
1949-1950	1,865,000	6,980,689
1959-1960	2,557,000	12,700,989

Source: Featherston and Culp (28:4)

The 40 year span preceding 1960 saw transportation increase 21 times, while paved rural roads grew by seven times. Only seven states still grant compensation to school districts for adverse road conditions but the practice is generally thought unnecessary. (30:400)

The expansion of paved roads and school busing was not parallel and therefore suggests other factors may have contributed to the growth of pupil transportation. Crenson (23:10), the N.E.A. Department of Rural Education (51:116), Featherston and Culp (28:2), and Wilson (68:675) each list a variety of reasons for the spread of pupil transportation. The one factor on which all agree is school consolidation and district reorganization. Even though school busing was an auxiliary service, Crenson said that consolidation "raised the status of the bus to an absolute essential." (23:10)

A second factor isolated by authorities was the twentieth century pattern of population growth found in the United States. Partial evacuation of rural areas was accompanied by the concomitant rise in suburban and inner-city school problems. Sheer numbers of people, many of them migrants from rural regions, created a sociological phenomena peculiar to our time. Disclosures such as those of the Coleman Report (16:295) have turned much thought toward the possibility of solving urban educational inequities by means of busing. In addition, the distance created by suburban sprawl has accounted for bus services unknown prior to World War II.

Among other factors responsible for the expansion of pupil transportation were the better holding power of secondary schools, leadership of state departments in inspection and standards, the availability of administrative talent, and an increase in the application of the child benefit theory. This last reason has been the stimulation for greater parochial school busing and racial integration attempts.

<u>Legal responsibility for transportation</u>. States are responsible for education. The equalization of opportunity within political boundaries can partially be accomplished by passage of transportation statutes. State government legislative action reflects the school trans-

portation needs and, conversely, the development of the busing system can be regarded as a response to legislative stimulus.

The fifty states have generated fifty unique transportation systems. Uniformity exists, particularly in traffic laws and school bus standards. (28:7) School bus standards refers to mechanical equipment. Safety features on buses have gained general acceptance and much research has been directed toward this end. Other aspects of bus programs usually covered by state regulations are the training of bus drivers, fleet inspection of vehicles, and a host of detailed activities subsumed under the heading of operational regulations. With each function, record keeping and accounting are inherent.

But the visible operations are manisfestations of a deeper ideal. It is the conceptual design of a state's transportation system that is responsible for determining who shall be bused and for what purpose. Since the population under investigation in this study are Montana students, reference to Montana law illustrates the legal design on which a state supported program is based.

Section 75-4301 of the Revised Codes of Montana establishes the legal authority for operating a school busing system at the local level. It states: (47:238)

> Boards of trustees to furnish transportation. The board of trustees of any school district or county high school within the state of Montana may furnish transportation to and from school for all pupils residing within their district, who are enrolled in the public schools of their district, or who have been granted permis-

sion to attend a school in another district, and who reside three (3) or more miles distant, over the nearest practical route, from a public elementary or secondary school. Provided that, school boards may in lieu of transportation furnish supervised correspondence study: supervised home study: room rent, or board, or individual transportation payments, but any sum expended in lieu of transportation shall not exceed the per pupil cost set up by schedule in section 75-3407; provided, further, that the board of trustees must furnish transportation or services in lieu thereof when directed so to do by the county transportation committee and such direction has been upheld by the state superintendent of public instruction.

This statute is specific in stating what is to be done but flexible in its application. Local bus systems are theoretically allowed to develop in a manner best suited to district conditions while at the same time insuring the educational rights of each child.

Financial incentives for transportation. Forty-four states were allocating funds to support busing systems during 1965. (28:8) Allocation schemes varied, but the thesis of each was similar--equalization of educational opportunity. Programs of finance generally try to compensate for differences in distance and pupil density that are ultimately the cause of differences in busing costs.

Montana transportation budgets are financed in the amounts of: (a) one-third from state appropriation, (b) one-third from a county levy, and (c) the balance from district funds. State allocations are paid on the basis of a per bus mile schedule. (47:241)

Prior to the recent emphasis on urban and suburban busing, Cooper, Dawson, and Isenberg (18:1167) commented that rural schools are financially handicapped because transportation costs are peculiarly their problem and the condition does not add directly to the quality of the school program.

Scope of pupil transportation. The extent of pupil transportation can be expressed in both relative and absolute terms. The mid sixties offer a good basis for discussion because several authorities published transportation statistics for that period.

Hutchins and Barr (34:9) reported that during 1965-1966, buses carried 15.5 million students. The operating cost amounted to $784,400,000 annually, a figure which was 3.7 percent of the total educational expenditure for public elementary and secondary schools. Burrup and Anderson (30:397) substantiated those amounts, adding that 200,000 vehicles were then in use. Higher cost totals were given by Murray and Featherston (49:59) who claimed transportation consumed four to five percent of public school expenditures. An extremely high figure for isolated local districts was advanced by Campbell, Corbally, and Ramseyer for the early 1960's when they contended "the rural transportation function has become so extensive as to require in some places as much as 25 percent of the school budget." (13:117)

On a per pupil basis, the cost of transportation during 1965-1966 averaged $51 nationwide, ranging from Alaska's $129 to North Carolina's $20. Montana per pupil expenditure for the same period was $115, or 6.4 percent of public education outlay. (34:62) A 1968 research report by Lee (39:57) revealed that the three highest states in per pupil costs were Alaska, Wyoming, and Montana, ranked in that order.

Cost rose rapidly in the late sixties to where the 1968-1969 national transportation expenditure amounted to 1.2 billion dollars out of a 32 billion dollar total budget for education. (59:61) The actual count of pupils transported in Montana during the same year showed 28,483 elementary and 16,948 high school students being carried on 1,221 regular bus routes. (45:3) The cost was over five million dollars to local districts.

Trends in transportation. Refinements in school bus safety, efficiency, and economy continue to receive extensive coverage in the literature. The trend in the conceptual design of transportation that is gaining in published importance is the expansion of bus services to previously denied groups of students. The bulk of further development may well occur in urban areas if the rationale behind inter-city and suburban mixing is sound and the practice is continued. Disadvantaged youth could be the largest stimulus for increased transportation in the near future. (69:3433A)

School bus litigation tends to require increased services, certainly not cutbacks. Stapley (64:2149A) examined the pattern of court decisions and concluded:

> Where as a consequence of refusal to provide transportation for pupils, a child is denied the opportunity to attend school, earlier courts tended to rule that a school district need not provide transportation and later courts have tended to require the school district to provide the transportation.

Foreseeable trends as viewed by Murray and Featherston (49:60) are: (a) state departments of education are coming to provide greater degrees of direction and leadership, and (b) growing demands for extending school transportation for non-public school children will result in further expansion.

Consolidation and School Size

No one technique for equalizing educational opportunity for rural youth is probably more effective than the expansion of high school programs by attendance consolidation. (18:1173) The necessity of operating large scale commercial farms together with the flow of rural migrants to the cities has left a pattern of rural settlement that is ripe for consolidation and much of it has taken place by natural process. In fact, social circumstances have kept ahead of legal enactment in the pressure toward consolidation. (35:67) State legislatures can make drastic reductions in the numbers of school districts. Wilkow (67:50) reported that a 1957 Colorado law reduced the number of local districts from 929 down to 184.

The problem of high school consolidation in the sparsely settled plains and mountain states is especially pressing and difficult.

Montana is a classic example. During 1947-1948, the Council of State Governments (22:57) calculated that Montana had only 7.1 percent of its high schools enrolling as many as 300 students. Of the 214 high schools then existing, 76 of them, or 41.3 percent, had less than fifty pupils. Enrollment figures for 1969-1970 showed 21.1 percent of the state's high schools enrolling 300 or more students, 11.1 percent enrolling less than 50 pupils, and high schools of 1,000 or more numbered 5.8 percent. Changes have been made but the extremes have been accentuated. For example, the largest high school during 1969-1970 registered 2,163 students while the smallest had but 13 students. (46:15,114)

The disadvantages associated with small high schools have been pointed out in numerous studies concentrating on specific problems. Among the investigations were: Carlson (14:2878A) on general weaknesses, Aubertine (4:594) on teaching quality, Van Woert (66:36) on staff qualifications, Harris (31:3) and Oviatt (52:1229A) on optimum size and cost efficiency, and Currie (24:23) on number of subject offerings. The concern over small schools was succinctly stated by Isenberg, "The specific problem of education in rural areas could be itemized as a minimal level of nearly everything that makes up an educational program." (35:66)

Assessment of existing research on adequate and inadequate educational programs increasingly shows that educational objectives advanced by reorganization and consolidation are coming close to being achieved. (35:69) Comparisons among districts reveals that it is the smaller districts that are guilty of disadvantaging youth in more cases than are large districts. (9:104) Authorities tend to feel that increasing per pupil expenditure will not in itself insure program adequacy.

Transportation limits to consolidation. Expanded transportation usually results from a school consolidation action. Some authorities see disadvantages arising from extensive school busing which could act as limits to consolidation and reorganization.

One sociological consequence is seen by Faunce (27:510) who contends that the school bus often creates a class structure in rural secondary schools by separating the student body into a resident group and a transported group. The former controls extra-curricular activities because of easier accessibility. Transported children can be deprived of "extras." This concern stimulated officials of the Gunnison Watershed School District in Colorado to outfit an "audiobus" on an experimental basis so that students could hear tapes of evening performances held at the school--performances they were unable to attend. Radio and other educational materials were also available through the headphones. In discussing the project, Hoffman (33:15) contended that the long bus ride discouraged the bus students from participating in programs of activities occurring outside normal school hours.

Population sparsity is an impedence to school consolidation because of the long mileage between homes. Even with far-reaching routes, only small schools are sometimes possible. Such schools are often referred to as necessary small schools. (35:69) A Montana high school is classified as "isolated" if it has an enrollment of 24 pupils or less. (47:254) The status of isolation must be approved by the state department; this enables the school to share in foundation monies.

The cost of busing pupils can affect decisions on consolidation. Educators polled in 1947-1948 by the Council of State Governments (22: 199) answered that sufficient aid for pupil transportation would encourage reorganization more than any other factor. Per pupil busing expenditures are subject to an array of variables and district costs vary considerably. This investigator encountered an extreme case where a Montana district was busing 11 pupils at a cost of $7,500 annually, or $681.82 per child. A decision whether or not to annex such a district with that amount of transportation liability could be influenced by the dollar economics involved. As a district grows larger in student population and wealth, per pupil transportation expenditures will go up in proportion to the increased wealth and will not decrease to become a smaller percentage of total district expenditures. (26:1583A)

That factor most directly affecting pupils is the amount of time they will have to spend riding the bus to a consolidated school building.

The school day between opening and dismissal is usually the same for all pupils whether transported or not. A pupil riding the bus one hour each way will experience about forty-two hours of riding time per month or the equivalent of seven extra school days. (33:15) The N.E.A. Department of Rural Education (51:138), Pickel (54:989), and Scheiber (60:147) have all noted the extra time required of bused students. The average school day for the non-transported pupil is 6.4 hours nationwide, and he attends school an average of 179.9 days per year. (16:83) Bus time is added to these amounts.

The extent of geographical area from which a consolidated school draws its students is based on a consideration of two factors: (a) the desired school enrollment, and (b) travel time for bus pupils between home and school. (19:1197) What do educators feel is the maximum riding time? The American Association of School Administrators (2:191) gave one of the first recommendations in 1952. They felt that 30 minutes for elementary and 60 minutes for secondary were maximum riding times. Miller (43:366) later agreed with the one-hour limit as did Featherston and Culp. (28:94)

Another of the very first recommendations was that of the Michigan Public Education Study Commission. Moehlman (44:406) reported the group as suggesting maximum riding time limits of 45 minutes for high school students and 30 for elementary. The recommendations were definite in stating that school districts should be organized around these limits. It is not known if the commission's figures have since been revised. Riding times prescribed by Morphett, Reller, and Johns (48:473) are consistent with the one-hour limit used by the majority of authorities.

More subjective time limits have been advocated but still pivot around the one-hour stand. According to Miller: (43:366)

> They might be stated briefly as not picking up the first child until he has had breakfast at the traditional American hour, getting the last child home before dark, and requiring no youngster to ride more than one hour on any trip.

These standards could be open to different interpretations, especially in northern rural homes where meals do not always come at a "traditional" hour and daylight changes quite drastically with the seasons. However, the reasonableness implied in the statement is apparent.

Some consideration has been given in the literature to total home-to-school time. Walking and waiting time are part of the total. A figure of one and one-quarter hours has been suggested (28:59) with little written to either support or refute the amount. The 30th Yearbook of the American Association of School Administrators (2:189) reported that rural superintendents were in favor of having parents, teachers and school boards cooperatively develop standards for home-to-school travel time but that actual efforts to do this were not being made.

As of 1970, authorities seem to concur on a general maximum riding time of one hour, but there is a lack of research on the subject.

The most obvious result of transportation planning on the local level is the pattern of bus routes. Routing procedures can either complement or inhibit the potential of transportation and consolidation. Pupil riding time could be held to a minimum _if_ the number of buses, routes traveled, road conditions, and other factors were all optimum. Davis (25:5) states the problem:

> The term optimum may take on many different meanings. We may be interested in optimizing the number of buses in use, the number of miles traveled by the buses, the amount of time spent in transit by each student, or the total time spent by students in transit. Some of the alternatives may be achieved at the expense of the others . . . We must therefore build a model which optimizes one criterion while allowing the other criteria to vary within certain predetermined ranges.

Davis developed an algorithm for building bus route schedules by computer which could be altered to allow for a predetermined maximum travel time or distance. Earlier scheduling studies by Boyer, Cunningham, and Newton as reported by Davis (25:5, 15) were not based on the use of a maximum bus riding time. As an example of proper bus routing benefits, Davis referred to a significant side effect resulting from an application of the Boyer technique to a Mississippi school. Rides of 95 minutes were reduced to a maximum of 69 minutes and the number of students riding over 60 minutes was reduced from 13 percent to two percent. The essence in bus routing is a balance between what is desired and what is available.

Achievement of Rural Students

School achievement is highly complicated and multifaceted. Numerous studies attest to its complexity. Rural students' academic achievements can not be explained by reference to a single factor so it becomes necessary to isolate those which seem most relevant to the population under study.

Educational attainment. Children tend to be like their parents in educational aspirations and attainment. Nam and Powers (50:114) have done extensive work on the schooling of rural people. Using the 1960 census, they found the median years of school completed by all persons 25 years or older in the United States was 11.1 years for urban dwellers as compared to 9.5 years for rural non-farm adults and 8.8 years for rural farm adults. The differences may be partially accounted for by the selective migration which takes educated rural people to the cities and suburbs.

The west showed the highest degree of educational attainment for all census regions; about 25 percent of persons 25 years or older had some college experience as compared to about 16 percent for other regions. (50:116) However, the rural-urban differences still persisted. Rural youth go on to college in lower proportions than do urban graduates even though both groups continue through high school at about the same rate. Burchinal (10:150) contends "rural life seems to be associated with limited educational perspectives."

Educational achievement. A Wisconsin non-metropolitan study by Beals (6:5119) found little difference in the achievement of high school seniors coming from farm and non-farm backgrounds. Burchinal (10:159) in another Wisconsin investigation stated that, even though the ultimate aspirations of rural and urban pupils differ, only slight differences exist between rural and urban seniors in the proportion who graduated in the top half of their classes. The small differences favored the rural group.

Some components of achievement do show rural-urban differences. The work of Nam and Powers (50:118) showed rural students more likely to be scholastically retarded than urban pupils. Scholastic retardation is defined as a child behind one or more grades usually expected for his age; so called "age-grade progression." Regional variations are found, white farm boys in the north and west being less behind than white farm boys from other census regions. The two components of the rural population exhibit scholastic retardation at unequal rates; white children from rural farms showing rates higher than urban whites but lower than rural non-farm rates. A large proportion of scholastically retarded children drop out of school after reaching the minimum compulsory attendance age, usually 16 or 17 years. (60:119)

Concerning intelligence, Copp (21:36) has studied rural-urban differences and concluded:

> Studies of comparative intelligence typically find that country children have lower I.Q.'s than urban children.
>
> . . . Admittedly intelligence tests are culture-bound, but they are biased toward the culture in which the rural child will have to compete in adult life.

Evidence indicates that the rural student is not hampered by an innate inability to achieve but rather by his experience and academic aspirational deficiencies. The situation was expressed by Knebel: (37:82)

> The physician, the psychologist, and the sociologist would contend rural youth possess generally the same physical, psychological, and social characteristics as do urban youth. The pertinent point is that rural youth do not experience equal opportunities educationally and vocationally.

<u>School size and achievement</u>. An extensive study of school dropouts was undertaken in Iowa during the early 1959's by Van Dyke and Hoyt. The results were reported by Scheiber in <u>Rural Youth in Crisis</u>. (60:135) One conclusion of the work concerned school size and indicated that, as measured by the Iowa Test of Educational Development (ITED), there was no evidence that pupils attending small schools average any less in intelligence or achievement than do students from larger schools. Scheiber specified that school size, by itself, can not be used as an indicator of instructional quality that may exist

within a building. Another dropout study, again as related by Scheiber (60:140), showed that in the state of Washington dropout rates had no correlation to the size of school attended.

Separate investigations by McDaniel (41:1658) and Oviatt (52: 1230A) concentrated on "persisters" or pupils that stay on in school until graduation. Their conclusions state that school size, in itself, is not related to student achievement. A South Dakota study by Poling (55:1611) using two year gains on the Iowa Test of Educational Development administered to ninth and eleventh graders showed that gains favored those students whose high schools enrolled at least 150 pupils. However, two-thirds of the gains were not statistically significant in Poling's analysis.

The consequences of attending different sized high schools appear not to cause achievement differences when graduates go on to college. Pabst (53:332-A) concluded that increasing the high school enrollment will not, in and of itself, increase the probability of subsequent college success. Selected students from various sized high schools were studied at the University of Alabama by Sears. (61:1407-A) His conclusions, based on grade point average, or G.P.A., and standardized test scores earned in college, were that G.P.A. and scores at yearly intervals showed no significant differences regardless of the size of high school from which the students graduated.

An early study done by Nelson almost forty years ago was reported by Cooper, Dawson, and Isenberg. (18:1174) The result of that investigation was one that has been echoed many times since; the investigator was able to find few differences in achievement between students from large and small schools.

The foregoing research conclusions were based on school size _per se_. They do not shield the fact that achievement differences _do_ exist among school sizes when larger enrollments are accompanied by increased facilities, expanded curricula, and specialized teaching.

These increased offerings affect specific components of achievement or affect those pupils who are able to capitalize on the specialization. For example, students from reorganized or consolidated districts, implying greater enrollments, are more likely to have higher scores on standardized tests. (35:68) The Coleman Report on _Equality of Educational Opportunity_ revealed that variations in achievement are related to school size, given a knowledge of student background and per pupil expenditure, but that if curricular differences are controlled, the apparent achievement effect vanishes. (16:313) If a list of desired facilities is used as a basis for evaluation, larger schools normally receive higher ratings. But, if facilities are controlled and student achievement becomes the evaluative criteria, larger schools do not always receive highest rankings. (18:1174)

A more detailed analysis brought out by the Coleman Report has importance to sparsely settled rural states. Although most true for Negroes, Coleman (16:314) claims:

> Quite apart from facilities and curriculum, the smallest and most rural schools have lower achievement than larger and more urban schools, but the largest and most urban do not have higher achievement than those of middle size . . .

Similar findings were revealed in New York state during a dropout study conducted between 1954 and 1960. Smaller rural schools had less holding power through graduation than did suburban schools but about the same holding percentage as large city schools. (60:141) The results of the New York investigation appear to be consistent with one prime conclusion of the Coleman Report; suburban schools possess a climate which exerts pressure toward higher achievement and the desire to stay in school. The phenomena is probably due to the aspirations and middle-class orientation of the peer group. Coleman credits this factor more than any other as responsible for boosting the achievement of integrated minority children. (16:302)

Bus riding time and achievement. Studies of achievement related to school size have used samples randomized from the general pupil population or from defined subpopulations. Investigations into rural pupils' achievements have utilized samples drawn from the general rural school population or from specific subgroups such as ethnic, economic, or socially stratified. However, none of the studies have systematically taken into account differences in the bus riding time experienced by the students.

There is a definite lack of research in the literature that specifically measures the effects of bus riding time on the academic achievement of transported students, either general populations or defined subgroups.

Care must be taken to differentiate between "effects of busing" and "effects of bus riding time." The former is a nominal classification used to describe a pupil who is a bus rider but measured on some other variable than riding time itself. The latter uses time spent in transit as a classification variable. It is this category that has not been researched.

Separation of non-empirical publications from empirical research findings was attempted during the review of literature. Recommendations, assumptions, and opinions were found but no concrete studies on the effects of school bus riding time.

CHAPTER III

DESIGN OF THE STUDY

Chapter one raised the question whether transported students riding school buses for varying lengths of time experienced different levels of achievement within the different sized high schools they attended. The problem of the study was stated as three null hypotheses:

1. Bus riding time and school size are non-interacting variables as determined by the earned marks and standardized test scores achieved by transported high school rural students.

2. Bus riding time has no singular effect on the achievement of transported high school rural students as determined by earned marks and standardized test scores.

3. School size has no singular effect on the achievement of transported high school rural students as determined by earned marks and standardized test scores.

This chapter explains the design and detailed procedures by which the hypotheses were tested and the problem was investigated. The study was intended to be exploratory in nature because of: (a) the assumption that the background "rurality" of students has a constant influence across all the selected levels of bus riding time and school size, (b) the independent variables of riding time and school size were applied over a wide range of school bus and school size conditions, and (c) the lack of previous research in bus riding time that could serve as a delimiting guide for suggested study and research.

Experimental Design

The study was planned as an a posteriori factorial experiment to examine the effects of two simultaneously acting variables on selected dependent achievement criteria.

Independent variables. School bus riding time and high school size comprised the independent factors in the design. Riding time was divided into four levels: 0 to 30 minutes, 31 to 45 minutes, 46 to 60 minutes, and 61 or greater minutes. A level of 0 to 15 minutes was not used because relatively few students living outside the statutory three mile bus limit were anticipated as riding less than 15 minutes one way. The highest level, 61 or greater minutes, was selected because of the 60 minute maximum riding time limit so often found in transportation literature.

The second factor of school size was divided into three levels of enrollment: 0 to 99, 100 to 499, and 500 and over. These levels are referred to as small, medium, and large high schools, respectively. Former studies in other states involving high school size by McDaniel (41:1658), and Van Dyke and Hoyt (60:134) use approximately the same boundaries.

Chosen levels for the two independent factors created a four by three factorial configuration with 12 factor-level combinations, or cells, which are illustrated in Figure 1, page 41.

School size	Riding time in minutes: 0 - 30	31 - 45	46 - 60	61 - up
0 - 99 Small				
100 - 499 Medium				
600 - up Large				

Figure 1. Riding Time and School Size Factor-level Combinations

All transportees selected for the sample were assigned to a cell on the basis of minutes and enrollment.

Dependent variables. Two types of criterion, or dependent variables were used. The first was earned marks, usually assigned by teachers. Kieckbusch (36:21) showed in 1962 that 94 percent of sampled Montana high schools used letter symbols as the primary marking device. Letter marks were thus chosen as the basic recording unit for each semester of each subject taken in grades nine through twelve, except driver's training, physical education, and elective music. These three are usually not offered or scheduled for credits which are equal to the remainder of curricular subjects. Deviations from letter marks were recorded *per se* but were later transposed to the common symbol units.

The second dependent variable was standardized test scores. Only composite scores or major sub-tests of verbal and numerical performance were utilized. Composite scores are averages or addition totals of sub tests. (11:8) Verbal and numerical achievements are regarded by the College Entrance Examination Board as the only cognitive traits contributing to academic success. (11:487) Since scores were normed only on the defined bus population, raw scores or standard scores were used as raw data. Except for first semester freshman tests, all standardized tests taken during high school were recorded. Early ninth grade tests would not reflect high school influence but rather recent elementary experience. Arrestad's (1:29) study during 1964 revealed the Iowa Tests of Educational Development to be the most commonly administered Montana high school achievement battery. However, with 1969-1970 practices unknown, all tests except first semester ninth were recorded.

Three criteria of sufficiency had to be satisfied before a standardized test became part of the study analysis: (a) the test had to be administered in eleven or more different schools, (b) the number of schools administering the test had to be stratified proportionally to the total number of schools appearing within the three size levels, and (c) the number of students taking the test in each riding time level had to be proportional to the total number of pupils appearing within each level. Chi square tests for proportionality (29:200) as applied to observed frequency percentages was the statistical tool used to test the last two requirements for sufficiency. Standardized tests are diverse in purpose and populations they intend to measure, so no comparisons were possible among the various instruments. Each was examined in its own light.

Two classes of criterion variables were chosen because studies have shown that school marks and standardized tests measure different attributes. (17:10; 56:6453) Correlating the two types of criteria was therefore not attempted.

Experimental limitations. The factor variables of riding time and school size were not manipulated treatments in the strict experimental sense. They were, instead, classification variables. Ferguson says that "subjects are classified according to a characteristic which was present prior to the conduct of the experiment and did not result from the manipulations of the investigator." (29:279)

True statistical randomization did not exist in this study because it was impossible to determine the mathematical probability of a subject being chosen for a factor-level combination. Randomizing from a finite population is not possible under some conditions and this study seemed to be one of those conditions. It was necessary to sacrifice statistical randomization in order to apply a sample selection procedure that would secure sufficient numbers of students in selected factor levels. Alternatives to strict control grouping do exist, and this study made use of one such acceptable alternative in the selection of the two independent variables. (5:69)

Selection of the Sample

Bus routes, schools, and individual students in the sample were selected according to the following process:

1. The Montana State Department of Public Instruction has a record of each reimbursable public school bus route operating in the state. Each route is registered on a standard "T-1" form titled School District Application for Registration of School Bus and State Reimbursement (Appendix A, page 128). The form lists, among other things, the location of the school district, the names of each pupil riding the bus route according to elementary or high school attendance, and the total two-way mileage per day each pupil rides. T-1 forms from both current and recent years are kept on departmental file.

2. Total mileage was used as the basis for a priority system with which to locate the probable long bus routes in the state on the assumption that there would be at least moderate positive correlation between miles traveled and consequent riding time. Each 1967-1968 route T-1 form on inactive file was examined and the highest individual two-way mileage of any high school student was noted. This maximum mileage determined the priority rating for the route. The priority ratings and the total two-way mileage they represent are shown in Table 3, page 45.

TABLE 3. A PRIORITY RATING SYSTEM USING T-1 FORMS TO DETERMINE PROBABLE LONG BUS RIDING TIMES IN MONTANA

Maximum two-way mileage for the route	Priority rating for the bus route
100 miles or more	First priority
90 to 99 miles	Second priority
80 to 89 miles	Third priority
70 to 79 miles	Fourth priority
60 to 69 miles	Fifth priority
50 to 59 miles	Sixth priority

3. Routes together with their district locations were listed according to the priority scheme. However, two restrictions had to be met in order for a bus route to be listed: (a) the route had to have a priority number of six or higher, and (b) the route's T-1 form had to show evidence that at least one high school student was boarding the bus at some distance shorter than maximum for the route. Thus, a full bus load picked up at one stop and transported to school without intermediate pickups was not included in the study. The purpose in imposing this second restriction arose because of two factors. The first was to secure enough pupils to fill the four riding time factor-levels. The second reason was to reduce the possibility that some unknown charac-

teristic of any one bus route might introduce bias into any one riding time level.

4. All districts having bus routes of first, second, or third priority were chosen as definite stops on the investigator's travel itinerary. Fourth, fifth, and sixth priority districts were selected as stops if they would alleviate one or more of the following sample deficiencies arising from the first three priorities: (a) gaps in a desired state-wide geographical distribution, (b) disproportionately low number of <u>schools</u> in any school size level, (c) insufficient number of <u>students</u> predicted for any riding time or school size level, and (d) <u>post hoc</u> enumeration of sample frequency showed less than 50 students tabulated for each factor level combination.

5. All state reimbursement eligible transportees on selected bus routes were potential study subjects. It was anticipated that the actual number of pupils whose high school records were available for inspection would be less, however. Moving from the district or dropping out of school prior to graduation would result in a student's permanent record not being in the active or graduated alumni file. Those students who had moved into the district after the 1967-1968 T-1 route forms had been submitted to the state department were not potential study subjects because their names were not listed. Since the investigation was conducted during the 1969-1970 school year, high school pupils listed on the 1967-1968 T-1 forms were therefore juniors,

seniors, or graduates of either 1968 or 1969, providing they had remained in school until commencement.

It was possible that some bus routes and pupils with high riding times were not recognized and investigated because their T-1 record showed low mileage, when in fact it took considerable time to cover those few miles. However, the use of sampling statistics rendered that problem inconsequential.

Sample selection procedures were aimed primarily at securing a sufficient number of subjects in the 61 or greater riding time level, allowing other students on the routes to fill the remaining three levels. The study proceeded on the premise that the sample obtained in the described manner was representative of the transported public high school rural student populations in the selected riding time and school size classifications.

Field Procedures

After selection of the sample bus routes and districts, a list of high school pupils riding the routes during 1967-1968 was obtained from copies of T-1 forms supplied by the Montana State Department of Public Instruction, county superintendents, or local district officials.

The investigator traveled to each selected school and obtained permission to examine permanent school records or student guidance folders. Those students listed as 1967-1968 transportees and whose records were available in current or alumni files became members of the final sample. Data on each student was tabulated on individual record forms constructed by the investigator. (Appendix B, page 130) Any additional information on students which was anticipated to be collectively valuable in interpreting study results was recorded in comment fashion.

Riding time information for each student was obtained from bus drivers, transportation clerks or contractors, and school office personnel. If time was available and official permission was granted, the investigator rode the bus route to measure riding time and gain perspective on the local situation. Pertinent observations as related by bus drivers, school officials, contractors, or county superintendents were noted to acquaint the investigator with the variances or agreements existing among local transportation practices.

Statistical Analysis

Statements of the null and research hypotheses were concerned with riding time and school size interaction, riding time singularly, and school size singularly. The method by which all three null hypotheses were tested was through the analysis of variance (ANOVA) on a 4 X 3 factorial design. The technique is sometimes called a two-way analysis of variance when two independent variables are simultaneously studied.

Cochran and Cox (15:152) relate three instances when factorial experiments may be suitable:

> 1. In exploratory work where the object is to determine quickly the effects of each of a number of factors over a specified range . . .
>
> 2. In investigations of the interactions among the effects of several factors . . .
>
> 3. In experiments designed to lead to recommendations that must apply over a wide range of conditions.

These instances appear to coincide reasonably with the conditions of this study.

Two independent variable factors, one-way riding time and high school size, appeared respectively as a four fixed-level factor and a three fixed-level factor. Techniques applicable for fixed ANOVA models were therefore appropriate. (29:309) Separate analyses were made on components of earned school marks and on each standardized test. The tested components of earned marks were: (a) ninth grade G.P.A., or "grade point average," (b) tenth grade G.P.A., (c) eleventh grade G.P.A., (d) twelfth grade G.P.A., (e) combined ninth and tenth grade G.P.A., (f) combined eleventh and twelfth grade G.P.A., (g) total G.P.A., (h) English G.P.A., and (i) elective subjects G.P.A.

A legitimate question exists concerning the use of letter marks for interval data. Ferguson claims "many variables are in fact ordinal, although for statistical purposes they are, quite justifiably, commonly treated as if they were interval or ratio variables."(29:15)

Assumptions in the analysis. Extraneous variables are common in educational and behavioral studies. Their effects can in some cases be strictly controlled and cannot in others. The technique used in this study to minimize extraneous bias of any one factor level was to equalize uncontrolled variables. Kolstoe (38:259) attests to the acceptability of this procedure. Sample size was purposely large to help insure the existence of counterbalancing elements. Equalization of extraneous variables was assumed by using large sample sizes within cells, a large sample in statistics being defined as one containing 30 members or more. (58:156)

Total sample size was preset at 600 students or greater. Cell frequencies were therefore 50 or more, not by simple arithmetic averaging over the total sample, but by locating at least 50 pupils for each factor-level combination. Population representation was assumed within a cell if its frequency reached 50 members. Extraneous variable bias was also assumed to be equalized within a cell if the figure of 50 was attained.

Analysis of variance procedures rest on three assumptions: (29:294; 42:288)

1. Variances are equal in the populations from which the samples are drawn.

2. Variables in the population are normally and independently distributed.

3. Total variation can be separated into component additive parts.

According to Ferguson, an advantage to the analysis of variance technique is that "reasonable departures from the assumptions of normality and homogeneity may occur without seriously affecting the validity of the inferences drawn from the data." (29:295)

The .05 significance level was selected because of its common acceptance for behavioral and educational testing. (5:81; 29:164) The more rigorous .01 level of significance, if reached, was noted because severe violations of the ANOVA assumptions tend to result in .05 significance having actual levels of .06 to .07, giving too many significant differences. (42:288)

Sequence of analyses. For any given component of achievement, tests for interaction were conducted first. If significance was reached, further tests on the component ceased and the interaction was interpreted. If interaction effects were not significant, tests were made on the singular main effects of bus riding time and school size. Authorities do not agree on the feasibility of testing main effects after evidence of significant interaction. (32:405; 62:382) The reccommendations of Snedecor were followed. He states, "If interaction appears, there is usually no point in pursuing the analysis. Main effects would have little or no meaning." (62:382)

Significant riding time and school size effects were analyzed further by Scheffé tests. (29:296) The purpose of Scheffé a posteriori testing is to show significant differences between the means of the several factor levels when they are compared two at a time. Thus, it was possible to isolate differences between the three sizes of high schools and between the four levels of bus riding time.

Preparation of Data and Computation

Earned marks for each school subject were recorded as actually appearing on permanent files regardless of the marking technique used by individual schools. All departures from the A through F letter symbol system were first converted to letter marks by means of the conversion scale shown in Table 4.

TABLE 4. CONVERSION SCALE FOR COMMON MARKING SYSTEMS

Letter symbols	Percentages	S and U equivalents	Numerical equivalants
A	100-95	-	4
B	94-87	-	3
C	86-77	S	2
D	76-70	-	1
F	Below 70	U	0

All satisfactory (S) grades were translated to a "C" mark under the premise that S marks would tend to be "average" over the long run. Marks of unsatisfactory (U) were regarded as failing and were equivalent to letter "F." After being transposed to the basic letter symbol unit, all marks were key punched as numerical equivalents according to the conversion scale. Letter symbols which appeared with a "plus" or "minus" designation were punched only as the root symbol. For example, both B+ and B- were equivalent to 3, the same as for a straight B.

Numerical equivalents permitted the letter symbols to be treated as interval data, a condition necessary for the calculation of grade point averages.

Any G.P.A.'s appearing on school records were disregarded because of the unknown method by which they were computed by the various schools. As used in this study, G.P.A.'s were calculated by finding the arithmetic mean of semester mark equivalents.

Scores of standardized tests were key punched as raw scores or standard scores, read directly from the field data sheets. Coded identification data for each student was also punched to allow for subsequent separation into appropriate factor-level classifications.

The analysis of variance was accomplished on the Sigma 7 computer at Montana State University using a free-access program titled Multifactor Analysis of Variance Program written by Lund. (40:1) A feature of the program was that it accommodated unequal cell frequencies, a necessary condition since assignment of students to the twelve factor-level combinations was dependent on natural occurence.

CHAPTER IV

RESULTS OF THE STUDY

Chapters one through three outlined the problem to be investigated, reviewed literature pertinent to the variables, and explained the procedure by which the study was conducted. This chapter reports the results of the study in three sections: (a) the sample selection process as it related to the selection of bus routes, schools, students, and standardized tests; (b) the analysis of earned marks; and (c) the analysis of standardized test scores. Examples and comments observed during the field work were added to illustrate the practices that are taking place in the high schools and transportation systems of Montana.

Sample Selection Results

Bus routes and schools. Approximately 1,150 State of Montana T-1 forms were examined in the offices of the State Superintendent of Public Instruction. Bus routes satisfying the criteria of sixth or higher priority and the existence of interim distance riders were recorded by priority number, school district and route number. Of the selected routes, a total of 59 were used in the final sample. Forty different high schools were associated with the 59 routes. Table 5, page 56, summarizes the number of routes and schools used in the study.

In the first three priorities, all of the routes and all of the associated high schools were part of the sample. In the fourth, fifth,

TABLE 5. NUMBER OF BUS ROUTES AND ASSOCIATED HIGH SCHOOLS IN SAMPLE BY PRIORITY CLASS AND SCHOOL SIZE

Priority class	School Size						Total routes in priority class
	Small		Medium		Large		
	Routes	Schools	Routes	Schools	Routes	Schools	
First	-	-	2	2	1	1	3
Second	1	1	5	5	2	2	8
Third	6	4	5	5	-	-	11
Fourth	6	5	4	3	5	5	15
Fifth	6	5	5	4	7	4	18
Sixth	2	1	1	1	1	1	4
Total routes by size	21		22		16		59
Number of different high schools by size		15		16		9	40

and sixth priorities, 37 routes were selected. This represented 79 percent of all available routes in the fourth priority, 48 percent of all routes existing in priority five, and only a small fraction of those in the sixth priority. The use of this last class was largely unnecessary and only four routes were taken from it.

A simple sum of the schools associated with bus routes is misleading since schools were apt to have bus routes in more than one priority class. The ratio of routes to different high schools was about 3 to 2, or an average of one and one-half routes per studied school. The ratio of bus runs to large schools was almost 2 to 1, indicating that it was more difficult to find long riding students in the large high schools. The situation results from large cities usually being ringed by several smaller communities with small high schools. It is the smaller districts that receive the long bus riding pupils under these conditions.

Only two different large schools were found in the first three priority classes, while the same classes yielded eleven medium schools and five small schools. Of the total number of bus routes existing in Montana, the sample of 59 runs represented five percent of the state total.

Montana had 171 operating high schools during 1969-1970 and so the 40 sampled schools amounted to 23.4 percent of the total. A breakdown by school size shows that: (a) 15 of the state's 67 small high schools were sampled, or 22.4 percent; (b) 16 of the state's 82 medium sized high schools were sampled, or 19.5 percent; and (c) nine of the state's 22 large high schools, or 41.8 percent, were sampled.

Forty-four high schools were actually visited. Four bus routes associated with the schools were found not to satisfy the criteria of route length or interim riders, or else the route was changed from 1967-1968 to where it was impossible to connect students to a single riding time.

Although a geographical distribution of schools was accomplished, a majority of the long bus routes and very small schools were found east of the mountains.

Student sample. A total of 812 pupils composed the final sample. They were riders on the selected bus routes and their records were available at the time the investigator visited the high school. The number of students per factor-level combination cell was set at a minimum of 50. The least number found for any cell was 53 pupils, this for small schools in the 46-60 riding time category. The maximum count was 93, occurring in the 0-30 time level for medium schools. It was not unusual to find only five or six high school age pupils riding on some routes serving small high schools.

Student records were not always available or complete for several reasons: (a) the record was not up to date by reason of the previous year's marks not yet having been copied onto permanent record forms,

(b) the student's matriculation through high school was irregular and caused a gap in the records, and (c) the record keeping system was such that no single record file contained all the necessary information and the investigator was unable to take the time to search all the necessary sources. The presence of a trained guidance person on the school staff was found to be a good indicator that the permanent school records would be complete and well kept. The large majority of records were kept in vaults and could be assumed safe from fire damage. There were a few notable exceptions in poorly equipped small high schools. The total student sample on whom records were available and whose bus riding times subsequently became known are summarized in Table 6.

TABLE 6. STUDENT SAMPLE BY FREQUENCIES IN FACTOR-LEVEL COMBINATIONS, RIDING TIME AND SCHOOL SIZE TOTALS

School size levels	Riding time levels 0-30	31-45	46-60	61-over	Size level totals
Small	78	55	53	68	254
Medium	93	78	55	65	291
Large	68	63	76	61	267
Riding time totals	239	296	184	193	812

It should be noted that the sample of 812 is that portion of the bus population on which _most_ of a normal permanent high school record was available. The frequencies with which each component of high school earned marks actually occurred are in all cases less than the maximum of 812. Incomplete records account for the discrepancies, the word "incomplete" not being used as a criticism of the school but used to indicate a lack of the specific kinds of information desired for this study.

Five schools had a readily available list of riding times for their bus routes, not listed as riding times _per se_ but as the clock hour at which the bus normally was expected at each stopping point. Busing contractors or their clerical helpers were usually able to supply time information if asked. School bus drivers were the main source of riding time information and were able to tell within five minutes the riding time of their transportees. On two occasions, riding times were not available from any immediate source so the investigator sent letters to the bus drivers, in which was explained the purpose of the study and a request for the desired riding times of specific pupils on his route. Both drivers replied to the letters. It was not necessary for the investigator to time routes in the field, although he did so on two occasions while riding the route himself. Seven different bus routes were ridden by the investigator, a number less than desired. The main problem in this respect was the fact that long route vehicles are kept overnight at the driver's home and there was no way to return to the school after the evening run.

All schools visited were very cooperative in offering any information they could. Only one school on the travel itinerary was bypassed because of poor weather. A total of 6,500 miles was covered during portions of five months. Five of the sample schools had to be selected _post hoc_ from the fourth, fifth, and sixth priority classes to fill in gaps in specific factor-level combinations. The great majority of the student sample came from schools that were chosen _a priori_ as definite stops on the investigator's travel itinerary.

Bus riding times encountered. The range of riding time found was 83 minutes, shortest one-way time being seven minutes, and longest being 90 minutes. In the event the actual minutes en route could not be found, the period between school dismissal and arrival at home was used as riding time. Most buses started moving within five minutes after school dismissed.

All information on riding time was obtained during normal dry weather road conditions. Drivers stated that adverse weather was not generally a problem unless it became extreme. One driver did remark that wet roads of any sort boosted the riding time of his students from a few minutes up to one hour. Few drivers or contractors complained of poorly maintained roads and were quick to state that this factor would not appreciably affect any reported riding times.

School districts have a variety of road conditions and the general type of roadway did have effects on pupil riding times. One small district had no paved roads of any kind and several others had only four or five miles of pavement. Gravel and dirt roads were slower than blacktopped roads. However, if these non-surfaced roads were well maintained, they were not in themselves the chief determinant of longer bus riding times.

The one practice that seemed to add the most time to individual bus runs was the act of taking students down private farm lanes and dropping them off right at their doors. The decision to use farm lanes seemed to vary according to local district policy and was based primarily on the winter exposure conditions to which small elementary children might be subjected.

Several long riding times were encountered by virtue of the road pattern necessary to accommodate homes isolated on separate roads. An angry father reported to the investigator that his daughter boarded the school bus at 7:20 a.m. in order to begin classes at 8:35 a.m. when the school was only nine miles away by paved road. One circular route pattern encountered caused two first grade pupils to ride until 5:30 each evening, considerably longer than any high school student on the route.

There was a positive correlation between miles traveled and riding time. The relationship between these two variables can be best expressed as a linear regression equation in which riding time "Y" is a function of one-way miles "X". The relationship is given as $Y = bX + c$, where b and a are constants. (29:119) A subsample of 94 students was drawn from the 812 total by using a table of random numbers. (15:577) The one-way mileage and bus riding time of this subsample was used as data in the calculation of a regression equation for the transported Montana high school student. The specific equation in this case was $Y = 1.96X - 2.04$. Table 7 translates intervals of ten bus miles to the number of minutes those mileages may be expected to consume.

A one hour bus ride can be expected if the number of miles is between 30 and 35. Buses average about 32 miles per hour including stops.

TABLE 7. BUS MILES TRAVELED AND MINUTES CONSUMED BY MONTANA HIGH SCHOOL TRANSPORTEES BY INTERVALS OF TEN ONE-WAY MILES

Miles traveled	Minutes consumed
10	17.56
20	37.16
30	56.76
40	76.36
50	95.96
60	115.56

The regression equation can be used as a crude estimator of riding time but would be subject to modification by local conditions.

<u>School sizes encountered</u>. Of the 40 sample schools, 15 were small, 16 were medium, and the remaining nine were large. The small schools ranged in enrollment from 42 to 97, the mean being 62 students. Medium schools ranged in size from 112 to 420 with a mean enrollment of 227 pupils. Large high schools had from 522 to 1,729 students, the mean being 993. The mean enrollment for all sampled schools was 337 pupils.

The percentage of the student body who were bus students varied greatly among the 40 schools. One large building housed nearly 1,000 pupils but was served by only two small capacity buses. At the other extreme, a rural superintendent for a small school system reported that 90 percent of his students rode the bus.

The smallest high schools were found in the plains region of Montana, although some of these same schools encompassed entire counties. Large schools tend to be concentrated in the more populous western half of the state.

<u>Marking systems encountered</u>. The sampled schools were quite consistent in the use of A to F letter symbols as the basic marking unit. Only six of the schools, or 15 percent, did not use the system. All of these six used a percentage system employing 70 percent as the minimum passing mark.

No school used "S" and "U" marks as the exclusive means of reporting achievement in school courses. The two symbols were encountered in only two instances, being used only for special courses or for remedial pupils. The utilization of "S" and "U" at the high school level seemed to be very limited.

Standardized tests encountered. Eleven different standardized tests were found recorded on transported pupils' records. Table 8 gives the number of schools in which each test was administered.

TABLE 8. NUMBER OF SAMPLE HIGH SCHOOLS ADMINISTERING ELEVEN STANDARDIZED TESTS TO TRANSPORTED STUDENTS; BY SCHOOL SIZE AND BY TEST

Test title by initial	School size			Total schools administering test
	Small	Medium	Large	
ACT	12	11	8	31
CEEB	3	4	3	10
ITED	2	5	4	11
NEDT	11	5	0	16
NMSQT	7	8	6	21
PSAT	14	11	9	34
SAT	2	0	0	2
SCAT	1	0	1	2
SHSP	0	1	1	2
STEP	1	0	0	1
TAP	0	1	0	1

Standardized tests commonly used in schools are often referred to by initial rather than using the full title. The test initials used hereafter refer to the following titles: ACT - American College Testing Program Examination; CEEB - College Entrance Examination Board Scholastic Aptitude Test; ITED - Iowa Tests of Educational Development; NEDT - National Educational Development Test; NMSQT - National Merit Scholarship Qualifying Test; PSAT - Preliminary Scholastic Aptitude Test; SAT - Stanford Achievement Test, High School Battery; SCAT - School and College Aptitude Test; SHSP - Scholastic High School Placement Test; STEP - Sequential Tests of Educational Progress; TAP - Tests of Academic Progress.

The first sufficiency criterion of the study limitations stated that a test had to be administered in 11 or more high schools. After application of the criterion, five tests remained. They were the ACT, ITED, NEDT, NMSQT, and PSAT.

The second sufficiency criterion stated that a test had to be administered in different schools in numbers proportional to the total number of schools appearing in each size level. The observed frequencies from Table 8, page 65, were subjected to Chi square testing.

The specific Chi square test applied to the five remaining standardized tests determined whether or not the number of administering schools differed significantly from the proportions of 15 to 16 to 9 total high schools. The results of the Chi square application are given in Table 9, page 67.

TABLE 9. CHI SQUARE TESTS OF PROPORTIONALITY ON THE NUMBER OF HIGH SCHOOLS ADMINISTERING FIVE STANDARDIZED TESTS

Test	Chi square	Results
ACT	.3190	ACT accepted
ITED	2.1748	ITED accepted
NEDT	8.9062	NEDT rejected
NMSQT	.4622	NMSQT accepted
PSAT	.8577	PSAT accepted

Critical chi square at 2 df = 5.99

Chi square values less than 5.99 indicate that the number of schools administering the test was proportional to total schools in each size level. The NEDT did not satisfy the criterion. This was expected since the test was not administered in a single large high school.

The four surviving tests, the ACT, ITED, NMSQT, and PSAT, were subjected to the third sufficiency requirement. This stated that the test had to be administered to students in the four riding time levels with frequencies proportional to the total pupils appearing in those levels. Chi square tests of proportionality were again conducted. The results are given in Table 10, page 68.

TABLE 10. CHI SQUARE TESTS OF PROPORTIONALITY ON THE NUMBER OF RIDING TIME LEVEL STUDENTS TAKING FOUR STANDARDIZED TESTS

Test	Chi square	Results
ACT	.6638	ACT accepted
ITED	2.1098	ITED accepted
NMSQT	.2464	NMSQT accepted
PSAT	5.8254	PSAT accepted

Critical chi square at 3 df = 7.82

All of the four test frequencies were proportional to the total pupils used as samples within the time levels. The fact that a standardized test satisfied the criterion of proportional riding time frequencies indicates that no one riding time level affected pupils to the extent that they were denied taking the test. This point applies especially to tests that are administered more discriminately to special groups of students in the school. The ACT and the NMSQT are examples because they are aimed specifically at college bound students. The investigator found that discrimination of testees increased as school sizes became larger. Small schools were more apt to "blanket" their students with even the more selective tests. However, the indiscriminate use of standardized tests is by no means universal among small schools. The presence of a trained guidance specialist seems to exert a pressure toward the proper selection and use of standardized tests, regardless of the size school in which he is employed.

Analysis of Earned Marks

High school students in Montana receive a semester mark for their completed or half completed courses. Each semester mark became data in the computation of grade point averages, or G.P.A.'s. All courses taken under the broad field name of English, social studies, mathematics, or science were classified as "required" subjects. "Elective" subjects were those falling outside the required classification. Driver training, music, and physical education were not included in elective courses as they usually do not amount to either a half or full Carnegie unit of credit when taken over one semester or a full year.

Analysis of earned marks was accomplished by applying statistical analysis of variance, or ANOVA, procedures to nine different components of the marks. ANOVA was applied to the following earned mark G.P.A.'s: (a) ninth grade, (b) tenth grade, (c) eleventh grade, (d) twelfth grade, (e) combined ninth and tenth grade required subjects, (f) combined eleventh and twelfth grade required subjects, (g) total high school marks, (h) English only, and (i) elective subjects.

Two tables are used to show the major computations necessary for analyzing each component of achievement. The first is a table giving the frequencies and means for all factor-level, or riding time-school size combinations, plus the total frequencies and means for each level of both riding time and school size. Table frequencies represent that portion of the 812 sample total on which data was available for the particular achievement component under consideration.

The second table gives the ANOVA parts and shows whether or not significance was reached at the .05 significance testing level. Blank space in the ANOVA tables indicates that a particular part of the table has no bearing on ANOVA calculations or that the particular part was not printed on the computer program printout. All essential ANOVA table parts are shown, however, that are necessary in the determination of significance. The bottom of each ANOVA table contains two additional pieces of information. "Harmonic mean" is a constant used to account for the unequal cell frequencies. It is included in the ANOVA figures and therefore requires no separate attention. "Maximum ratio of counts" is a numeral indicating the multiplicative discrepancy between the highest and lowest cell frequencies. It does not affect the ANOVA testing but is used to partially judge the validity of the ANOVA results. Snedecor and Cochran (63:475) state that maximum ratio counts around 2.00 are acceptable. When the ratios get too high, the use of the results can be questioned, although a too high ratio is not defined.

Significant interactions were interpreted by referring to the means of the individual factor-level cells. Non-significant interactions resulted in both riding time and school size main effects being tested for differences among their level means. Significance for either main effect factor resulted in that factor's several levels being compared two at a time. The purpose of the comparisons was to see which sets of means differed significantly. The Scheffé testing process was used for all comparisons.

<u>Ninth grade G.P.A.</u> Examination of Table 11, page 72, shows that 743 ninth grade G.P.A.'s were machine calculated. The highest natural occurrence was in the medium sized schools at the 0-30 time level. Riding time means exhibit a drop in the 31-45 time level and then a gradual climb for longer riding pupils. Students attending medium sized high schools achieved the highest, as shown under "school size totals."

However, all differences among individual cell means and among level means were not statistically significant, as shown by ANOVA Table 12, page 73. There is no evidence to show that ninth grade G.P.A. for transported students is in any way affected by the interaction between riding time and school size.

There is no statistical evidence to indicate that the marks of ninth grade transported pupils are affected by the amount of time they spend riding the bus, up to one and one-half hours. Slight differences

TABLE 11. NINTH GRADE G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	58	2.3558	48	2.1216	46	2.3539	48	2.2562	200	2.2753
Medium	97	2.3420	79	2.3107	51	2.4052	64	2.2820	291	2.3314
Large	55	2.2458	63	2.2736	74	2.1277	60	2.3623	252	2.2458
Riding time totals	210	2.3206	190	2.2506	171	2.2747	172	2.2995	743	2.2841

TABLE 12. ANALYSIS OF VARIANCE FOR NINTH GRADE G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0143	.0071	.6350	Not significant
Riding time	3	.0098	.0032	.2903	Not significant
Inter-action	6	.0640	.0106	.9416	Not significant
Between cells	11	.0883	-	-	-
Within cells	734	-	.0113	-	-
Total	745	-	-	-	-

Harmonic mean of cell count 59.325

Maximum ratio of counts 2.130

in G.P.A. means favor the shortest 0-30 minute riders. The size of school attended by the ninth grade bused student has no effect on his earned marks. Non-significant differences favor those pupils attending medium high schools.

Tenth grade G.P.A. The frequencies of tenth grade records were almost identical with the ninth grade, which was to be expected. The highest achieving factor-level group was that attending medium schools and having 46-60 minute riding time. Table 13, page 75, shows that students riding up to 30 minutes had the highest marks of any bus group, while pupils in medium schools had the best achievement among school sizes. The range of marks for school size totals was less than the ninth grade, however.

The ANOVA results are given in Table 14, page 76,. No significance was found for interaction or main effects. There is no evidence to indicate that bus riding time and school size combine to have any effect on tenth grade achievement. Likewise, bus riding time and school size alone do not affect tenth grade earned marks.

Eleventh grade G.P.A. The grade point achievement for the total eleventh grade sample is considerably higher than that of either the ninth or tenth grades. An eleventh mean of 2.41 contrasts with 2.28 found in both previous years. Table 15, page 78, shows that the mean for every factor-level combination, riding time level, and school size level exceeds the achievement experienced by tenth grade pupils.

TABLE 13. TENTH GRADE G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	61	2.3573	48	2.1627	47	2.2821	48	2.2614	204	2.2716
Medium	96	2.3644	79	2.3445	50	2.4544	63	2.1593	288	2.3297
Large	55	2.2375	64	2.2957	73	2.1708	58	2.3512	250	2.2593
Riding time totals	212	2.3294	191	2.2825	170	2.2826	169	2.2564	742	2.2868

TABLE 14. ANALYSIS OF VARIANCE FOR TENTH GRADE G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0108	.0054	.4945	Not significant
Riding time	3	.0062	.0020	.1911	Not significant
Inter-action	6	.0780	.0130	1.1899	Not significant
Between cells	11	.0951	-	-	-
Within cells	733	-	.0109	-	-
Total	744	-	-	-	-

Harmonic mean of cell count	59.3450
Maximum ratio of counts	2.0640

Several reasons may account for this phenomenon. First, those bus pupils who were receiving poor marks early in high school may have dropped out of school before finishing the first semester of their junior year. Second, the motivation to achieve may be greater as a high school junior. Third, the eleventh grade G.P.A. reflects the existence of more elective courses in students' schedules.

ANOVA testing, as reported in Table 16, page 79, shows that none of the means for eleventh grade were significantly different. School marks given in the eleventh high school year are not affected by riding time-school size interaction. There is no evidence to indicate that interaction exists. The achievement of bus pupils shows no effects due either to bus riding time alone or to school size alone.

Although not significant among themselves, the eleventh grade G.P.A. gains over the ninth and tenth marks reveal a changing pattern. Large schools demonstrate higher achievement than small schools, a switch in second and third ranks. Medium schools were still in the top position. Longest riding bus pupils experienced the highest achievement of all transported students.

<u>Twelfth grade G.P.A.</u> Bus pupils remaining in high school until graduation experience a mean G.P.A. of 2.5791, the highest of any high school year. Table 17, page 81, points out that the 61-over category bus pupils are achieving higher than any other riding level, as was

TABLE 15. ELEVENTH GRADE G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	49	2.4485	38	2.2552	40	2.2037	36	2.444	163	2.3425
Medium	69	2.4540	53	2.4752	33	2.5151	38	2.4984	193	2.4790
Large	40	2.3762	50	2.3480	56	2.3682	48	2.5206	194	2.4023
Riding time totals	158	2.4326	141	2.3708	129	2.3548	122	2.4912	550	2.4079

TABLE 16. ANALYSIS OF VARIANCE FOR ELEVENTH GRADE G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0398	.0199	1.4536	Not significant
Riding time	3	.0326	.0108	.7935	Not significant
Inter-action	6	.0388	.0064	.4723	Not significant
Between cells	11	.1114	-	-	-
Within cells	539	-	.0137	-	-
Total	550	-	-	-	-

Harmonic mean of cell count	43.9620
Maximum ratio of counts	2.1210

the case in the eleventh grade. Those students attending medium sized schools are receiving marks that are considerably higher than those of either small or large high schools. Large schools ranked second in achievement as was also the case in eleventh grade.

ANOVA procedures applied to twelfth grade earned marks are reported in Table 18, page 82. There is no evidence of interaction between riding time and school size as it affects school marks in the twelfth grade. Significance was not found for the effects of riding time alone, indicating that time is inconsequential.

The difference between the means for school size totals do show significance at both the .05 and .01 significance levels. Critical values of 3.03 and 4.69 were exceeded by the F ratio of 5.0473. Comparisons between school size means were made two at a time using the Scheffé significance testing method. The results are summarized in Table 19, page 83.

Highly significant differences exist between both the small-medium and medium-large comparisons, in each case favoring the medium sized high school. Transported pupils in large schools attain twelfth grade marks significantly higher than the marks earned by seniors in small Montana high schools. The bused student will achieve best if he is attending a medium sized high school. Transportation does not affect the marks of seniors but the size of school accounts for differences in the academic success of transported pupils.

TABLE 17. TWELFTH GRADE G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	31	2.4996	21	2.3200	23	2.4969	24	2.4529	99	2.4495
Medium	36	2.7075	32	2.7103	16	2.6981	18	2.9183	102	2.7441
Large	25	2.3768	31	2.4277	38	2.6094	32	2.7093	126	2.5439
Riding time totals	92	2.5476	84	2.5084	77	2.5942	74	2.6770	327	2.5791

TABLE 18. ANALYSIS OF VARIANCE FOR TWELFTH GRADE G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.2128	.1064	5.0473	Significant
Riding time	3	.0745	.0248	1.1790	Not Significant
Inter-action	6	.0532	.0088	.4212	Not significant
Between cells	11	.3407	-	-	-
Within cells	315	-	.0210	-	-
Total	326				

Harmonic mean of cell count	25.4280
Maximum ratio of counts	2.3750

TABLE 19. SCHEFFÉ TESTS ON THE COMPARISONS BETWEEN MEANS OF SCHOOL SIZE LEVELS: TWELFTH GRADE G.P.A.

School size comparisons	Difference of means	F ratio	Results
Small-medium	.2946	206.88	Significant
Small-large	.0964	24.97	Significant
Medium-large	.2002	109.12	Significant

Critical F at .05 = 6.06

Combined ninth and tenth grade required subjects. The courses required in the ninth and tenth grade were combined for analysis because of two reasons. First, some students enter the high school building at the ninth grade and others not until the tenth. If any first year adjustment shock exists, the combined analysis might show that fact. Secondly, subjects taken in the ninth and tenth grades are predominantly required curricular offerings which might be achieved differently than are non-required courses.

Table 20, page 84, directs attention to the means for required school subjects. The overall mean of 2.22 is less than either of the separate ninth or tenth grade overall means of 2.28. Indications are that the pupils are performing quite well on the few elective subjects they are permitted to take in the first two years. The various means

TABLE 20. COMBINED NINTH AND TENTH GRADE REQUIRED SUBJECTS G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	61	2.2914	48	2.1333	48	2.2908	49	2.2175	206	2.2368
Medium	97	2.2930	79	2.2620	51	2.3431	64	2.1584	291	2.2638
Large	55	2.1558	64	2.2082	74	2.0663	60	2.2746	253	2.1711
Riding time totals	213	2.2571	191	2.2116	173	2.2113	173	2.2144	750	2.2239

TABLE 21. ANALYSIS OF VARIANCE FOR COMBINED NINTH AND TENTH GRADE REQUIRED SUBJECTS G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0158	.0079	.6991	Not significant
Riding time	3	.0025	.0008	.0751	Not significant
Inter-action	6	.0560	.0093	.8265	Not significant
Between cells	11	.0744	-	-	-
Within cells	741	-	.0113	-	-
Total	752	-	-	-	-

Harmonic mean of cell count	60.0450
Maximum ratio of counts	2.0420

within Table 20 were tested for significance by ANOVA, and the results are shown in Table 21, page 85.

Analysis of variance showed no evidence of interaction effects on combined ninth and tenth grade required subjects. Riding time alone had no effect on this aspect of achievement, although the shortest 0-30 minute riders were highest in attainment. Bus students in medium sized schools were higher in achievement than either small or large schools, but the differences were not significant.

Combined eleventh and twelfth grade required subjects G.P.A. Previous analyses have shown that overall G.P.A. rose from 2.2841 to 2.5791 from the ninth to the twelfth grade. Required courses in the freshman and sophomore years tend to lower the earned marks of bus students. Table 22, page 87, reveals that the required junior and senior subjects have a similar depressing influence on G.P.A.'s. This effect appears across all levels of both riding time and school size. The indication would be that riding time and school size do not therefore affect the required junior and senior courses. The analysis of variance, as given by Table 23, page 88, bears out this indication. There are no interaction effects, no main riding time effects, or no main school size effects.

An examination of the means shows that pupils having the longest bus rides were the highest achievers. Transported students enrolled in medium sized high schools earned higher marks than those attending either small or large high schools.

TABLE 22. COMBINED ELEVENTH AND TWELFTH GRADE REQUIRED SUBJECTS G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	48	2.4691	38	2.1613	40	2.1665	36	2.3233	162	2.2898
Medium	69	2.3159	53	2.3984	33	2.3733	37	2.3654	192	2.3581
Large	40	2.2112	50	2.1646	56	2.2800	48	2.3912	194	2.2636
Riding time totals	157	2.3361	141	2.2516	129	2.2686	121	2.3631	548	2.3038

TABLE 23. ANALYSIS OF VARIANCE FOR COMBINED ELEVENTH AND TWELFTH GRADE REQUIRED SUBJECTS G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0211	.0105	.7175	Not significant
Riding time	3	.0252	.0084	.5701	Not significant
Inter-action	6	.0741	.0123	.8377	Not significant
Between cells	11	.1205	-	-	-
Within cells	537	-	.0147	-	-
Total	548	-	-	-	-

Harmonic mean of cell count 43.7800

Maximum ratio of counts 2.1210

Total G.P.A. A combination of all course marks earned during high school constitutes total G.P.A. For juniors, this was composed of the marks earned thus far in high school, or a combination of all freshman and sophomore courses. Senior total G.P.A. was composed of the three previous year's marks and the total G.P.A. of graduates was based on all four high school years.

The overall mean of 2.3090, as given in Table 24, page 90, is not the simple arithmetic average among the separate four yearly means. All of the sample students had completed the freshman and sophomore years, but only portions of the sample had completed the junior and senior years. Therefore, the total G.P.A. mean is weighted toward the ninth and tenth grade means.

Non-significant differences in school size effects for the ninth, tenth, and eleventh grades overbalanced the school size significance found for the twelfth grade. The ANOVA results of Table 25, page 91, point out this fact statistically.

As it related to total G.P.A., there was no evidence of interaction effects, riding time effects, or school size effects. The mean differences that do exist slightly favor those students riding the bus for 61 or more minutes. Total earned mark achievements is greater in medium schools than in either small or large, with small schools being last.

English G.P.A. The one school subject taken by all students during all four years of high school is English or a related language

TABLE 24. TOTAL G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	65	2.3290	49	2.1514	52	2.2778	50	2.3172	216	2.2737
Medium	97	2.3730	79	2.3459	51	2.4729	64	2.2684	291	2.3602
Large	55	2.2527	64	2.2996	75	2.2189	60	2.4163	254	2.2932
Riding time totals	217	2.3294	192	2.2808	178	2.3090	174	2.3334	761	2.3090

TABLE 25. ANALYSIS OF VARIANCE FOR TOTAL G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0183	.0091	.9835	Not significant
Riding time	3	.0082	.0027	.2941	Not significant
Inter-action	6	.0570	.0095	1.0196	Not significant
Between cells	11	.0836	-	-	-
Within cells	752	-	.0093	-	-
Total	763	-	-	-	-

Harmonic mean of cell count	61.1550
Maximum ratio of counts	2.0000

arts course. A comparison of the means from Table 26, page 93, with all the previous analyses of means points out that English marks are almost consistently lower. The difference is especially noticed during the senior year. English marks are highest for that group of bus students riding 61 or more minutes. Highest school size achievement was found in the medium sized schools, although the differences were not as great as when considering total G.P.A.

ANOVA testing of the means showed no significance for interaction, riding time, or school size. The ANOVA results are summarized in Table 27, page 94. Transported students experience no difference in English earned mark achievement regardless of their bus riding time or the size of high school they attend.

Elective subjects G.P.A. Comparisons of yearly and total G.P.A.'s with required subject G.P.A.'s have indicated that transported students' marks are lower in their required courses. The implication was that elective courses were therefore higher. A pattern of increasingly higher grade point averages was noted as the pupils progressed through high school. Since the number of elective courses increases with the number of years in school, the higher G.P.A.'s would appear to result from the presence of elective courses.

Table 28, page 96, shows that the G.P.A. for elective subjects is about one-quarter of a grade point higher than required eleventh and twelfth grade subjects. When compared to total G.P.A., Table 24, page

TABLE 26. ENGLISH G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	65	2.3535	49	2.2065	52	2.2667	50	2.2652	216	2.2788
Medium	97	2.2500	78	2.2944	51	2.3472	63	2.2771	289	2.2850
Large	55	2.2040	64	2.2126	75	2.1646	60	2.3170	254	2.2216
Riding time totals	217	2.2693	191	2.2445	178	2.2482	173	2.2862	759	2.2618

TABLE 27. ANALYSIS OF VARIANCE FOR ENGLISH G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0104	.0052	.4680	Not significant
Riding time	3	.0035	.0011	.1060	Not significant
Inter-action	6	.0279	.0046	.4189	Not significant
Between cells	11	.0419	-	-	-
Within cells	750	-	.0111	-	-
Total	761	-	-	-	-

Harmonic mean of cell count 61.0270

Maximum ratio of counts 2.0000

90, elective subject means are almost consistently .25 grade points above all cells and factor level totals.

The ANOVA testing showed that there was no evidence of riding time-school size interaction as measured by the elective subject marks of transported pupils. Riding time alone did not affect elective performance. The effect of school size did have an influence on elective achievement, however, as is shown by the results in Table 29, page 97. The .05 critical level of 3.01 was reached, but the 4.64 critical value for .01 was not reached.

The significance among school size total means was further analyzed by the Scheffé method. All comparisons were tested to see which sets of means were significantly different. Table 30 gives the results of the three comparisons.

TABLE 30. SCHEFFÉ TESTS ON THE COMPARISONS BETWEEN MEANS OF SCHOOL SIZE LEVELS: ELECTIVE G.P.A.

School size comparisons	Difference of means	F ratio	Results
Small-medium	.1592	295.95	Significant
Small-large	.1304	187.86	Significant
Medium-large	.0288	10.87	Significant

Critical F at .05 = 6.02

TABLE 28. ELECTIVE SUBJECTS G.P.A.: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	58	2.5100	44	2.2306	48	2.4506	49	2.5412	199	2.4416
Medium	94	2.5800	76	2.5372	51	2.7350	62	2.5998	283	2.6008
Large	54	2.4914	61	2.6113	75	2.5021	59	2.6938	249	2.5720
Riding time totals	206	2.5370	181	2.4876	174	2.5541	170	2.6180	731	2.5381

TABLE 29. ANALYSIS OF VARIANCE FOR ELECTIVE SUBJECTS G.P.A.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	.0688	.0344	3.4374	Significant
Riding time	3	.0380	.0126	1.2674	Not significant
Inter-action	6	.0751	.0125	1.2511	Not significant
Between cells	11	.1820	-	-	-
Within cells	722	-	.0100	-	-
Total	733	-	-	-	-

Harmonic mean of cell count	58.5050
Maximum ratio of counts	2.1590

Differences in elective subject achievement was highly significant when comparing small to medium schools. Medium enrollments were highly favored. Also highly significant was the small to large comparison, in which the large schools were favored. Only slight differences existed between medium and large school elective means, but the difference significantly favored medium schools.

<u>Trends in earned mark achievement</u>. The lack of interaction in any of the nine conducted ANOVA tests indicates that school bus riding time and school size are independently acting variables and there is no tendency for one to influence the other's effects.

Differences in means among school size levels favored the medium schools in all cases. Second ranked achievement favored small schools during the first two years of high school but favored large schools during the last two years. Differences in means for school sizes tend to be not significant until the last year in high school.

Riding time by itself has no significant effects on the earned marks of bus pupils. The tendency exists for 31-45 minute riders to score lower than the short time 0-30 minute students. The means for the 46-60 time level are generally higher than the 31-45 level, and the 61-over level is usually the highest of all, surpassing the shortest time level about two-thirds of the time.

There was a tendency for the maximum ratio of cell counts to stay near 2.00. This indicates that all factor-level combinations of transported pupils tend to remain in, or drop out of school at the same rates.

Analysis of Standardized Tests

Four standardized tests met the requirements of sufficiency as defined in the study limitations. They were the ACT, or American College Testing Program Examination, the ITED, or Iowa Tests of Educational Development, the NMSQT, or National Merit Scholarship Qualifying Test, and the PSAT, or Preliminary Scholastic Aptitude Test. Each test was analyzed separately using ANOVA techniques. Each is reported as two tables, the first showing frequencies of occurrence and means, and the second table showing the chief components of the ANOVA computations.

ACT Test. The ACT is generally administered only to college bound students. In the words of the test constructors, "The tests are designed to measure the student's ability to perform the kinds of intellectual tasks typically performed by college students." (3:3) The principal function is to "transmit timely information that is particularly relevant to educational planning during the period of transition from high school to college." (3:2) A standard score of 16 is median for unselected national sample students and 20 is median for first semester college bound seniors.

Table 31, page 100, shows that the total administered frequency was 185, or 23 percent of the entire 812 sample. ANOVA results, as

TABLE 31. ACT TEST (AMERICAN COLLEGE TESTING PROGRAM): FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	18	21.2778	8	19.0000	12	19.2500	12	19.9167	50	20.1000
Medium	29	22.2758	24	22.2083	14	19.1429	15	23.0667	82	21.8658
Large	11	17.2727	14	23.5000	12	20.3333	16	20.1625	53	20.4528
Riding time totals	58	21.0172	46	22.0435	38	19.5526	43	21.0698	185	20.8062

TABLE 32. ANALYSIS OF VARIANCE FOR ACT TEST (AMERICAN COLLEGE TESTING PROGRAM)

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	7.1709	3.5854	2.2368	Not tested
Riding time	3	6.8013	2.2671	1.4143	Not tested
Inter-action	6	24.7793	4.1298	2.5764	Significant
Between cells	11	38.7516	-	-	-
Within cells	173	-	1.6029	-	-
Total	184	-	-	-	-

Harmonic mean of cell count	13.7990
Maximum ratio of counts	3.6250

reported in Table 32, page 101, indicate a significant interaction between the effects of bus riding time and the effects attributable to school size. A critical significance value of 2.15 was reached at the .05 level but the .01 critical value of 2.91 was not reached.

Lowest ACT scores were made by 0-30 riders in large high schools. However, the highest scores were made by 31-45 minute students in the same large schools. Low achievement was experienced by small school students who rode the bus for 31 minutes or longer. A generally high level of performance was found among medium school students except for the 46-60 riding time level pupils who scored about 2.5 points below the group mean.

ACT achievement among transported pupils does not fall into a decisive pattern but nevertheless indicates students attending small schools are apt to score lower if they ride the bus for 31 or more minutes. Pupils attending medium sized high schools are apt to score the highest regardless of the riding time. Riding time in large schools appears not to affect ACT achievement.

Sampling fluctuation could account for the lack of a definite interaction pattern. A repeated sample might eliminate evidence of interaction. ACT frequencies were small, ranging from 8 to 29 pupils within the twelve cells. The maximum ratio of counts for the cells was 3.6250, indicating a slight risk in drawing conclusions from the results. With interaction present, the means of school size totals and riding time totals have little real meaning because they are tied up within the interaction effect. Therefore, an examination of the cell means for trends constituted the analysis. The F ratio for school size main effect was 2.2368, this being close to 3.05 significance. Indications are that school size is the chief contributor to interaction.

ITED analysis. The ITED is an achievement battery administered to general school populations. This study disclosed that it is utilized chiefly by medium and large high schools. Administration of the instrument in small schools is infrequent. Reference to Table 33, page 104, shows that the few small school transportees who did take the ITED achieved between three and four score points higher than students in medium and large high schools. ITED means were analyzed by ANOVA and the results appear in Table 34, page 105.

ANOVA results indicate no significant interaction between bus riding time and school size as measured by the ITED. There is also no evidence of singular riding time effects or singular school size effects, although school size is approaching significance. The 9.33 ratio of cell counts is a caution signal that casts serious doubt on the validity of this particular ITED sample.

NMSQT analysis. The NMSQT is a test taken by college bound pupils for the purpose of competing for college scholarships. It is administered to second semester juniors and first semester seniors. Table 35, page 107, shows that the frequency of administration in large

TABLE 33. IOWA TEST OF EDUCATIONAL DEVELOPMENT: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	15	20.2667	7	17.4286	4	16.0000	3	21.0000	29	19.0690
Medium	26	14.9615	16	14.5000	12	17.0000	19	16.6316	73	15.6301
Large	6	14.3333	26	16.3077	28	14.6429	15	15.9333	75	15.4533
Riding time totals	47	16.5745	49	15.8776	44	15.4091	37	16.7027	177	16.7174

TABLE 34. ANALYSIS OF VARIANCE FOR IOWA TEST OF EDUCATIONAL DEVELOPMENT

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	26.6487	13.3244	2.9470	Not significant
Riding time	3	7.1068	2.3689	.5239	Not significant
Inter-action	6	16.8458	2.8076	.6209	Not significant
Between cells	11	50.6014	-	-	-
Within cells	165	-	4.5213	-	-
Total	176	-	-	-	-

Harmonic mean of cell count	8.9730
Maximum ratio of counts	9.3333

schools is proportionately low. This fact illustrates a practice which the investigator observed in the field. Large schools tend to become quite discriminating in the administration of standardized tests. The NMSQT is given only to the brightest students in large schools. This is less so in medium schools and much less so in small schools.

ANOVA procedures applied to the NMSQT are reported in Table 36, page 108. No significant interaction was found for NMSQT testees. Evidence of singular riding time effects were also not present.

School size effects were significant at the .05 level of significance but not at the .01 level. The applicable critical values were 3.05 and 4.73. The mean NMSQT score for large schools was higher than medium schools and much higher than the mean of small schools. Scheffé tests on the comparisons between the three means are summarized in Table 37, page 109.

The NMSQT achievement of transported pupils in both large and medium schools was significantly higher than that of small schools. There is some difference between the performance of medium and large schools. School size does exert an influence on the NMSQT scores under the conditions of greater or lesser administration discrimination as is practiced in Montana high schools. The maximum ratio of cell counts indicates some slight caution is necessary in using the results as a valid measure of achievement. The brightest pupil in a large school is apt to be higher in achievement than the brightest pupil from a smaller

TABLE 35. NATIONAL MERIT SCHOLARSHIP QUALIFYING TEST: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	23	88.1304	18	86.7222	21	92.5238	18	86.6111	80	88.6250
Medium	27	97.8148	18	105.5555	8	84.7500	14	98.2857	67	98.4328
Large	8	96.1250	8	107.5000	13	99.0769	15	103.6667	44	101.6364
Riding time totals	58	93.7414	44	98.2045	42	93.0714	47	95.5319	191	96.2314

TABLE 36. ANALYSIS OF VARIANCE FOR NATIONAL MERIT SCHOLARSHIP QUALIFYING TEST

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	346.5400	173.2700	4.6303	Significant
Riding time	3	106.5840	35.5281	.9494	Not significant
Inter-action	6	214.8730	35.8122	.9570	Not significant
Between cells	11	667.9980	-	-	-
Within cells	180	-	37.4203	-	-
Total	191	-	-	-	-

Harmonic mean of cell count	13.5820
Maximum ratio of counts	3.5000

school. Probability alone might account for the significant differences found among school size NMSQT means.

TABLE 37. SCHEFFÉ TESTS ON THE COMPARISONS BETWEEN MEANS OF SCHOOL SIZE LEVELS FOR THE NMSQT

School size comparisons	Difference means	F ratio	Results
Small-medium	9.8078	93.7369	Significant
Small-large	13.0114	128.4300	Significant
Medium-large	3.2036	7.2844	Significant

Critical F at .05 = 6.10

<u>PSAT - Verbal section analysis.</u> The PSAT is designed for use in secondary school guidance programs. (17:7) It is administered to high school juniors during October. The investigator found the PSAT to be the most commonly administered standardized test in the high schools of Montana. This observation applies to the number of different schools using the test and to the number of students to which it was given. In addition, there was a tendency to administer the PSAT to all or most of the students, at least those in the upper half or upper two-thirds of the class ranking. There is more descrimination in the use of the PSAT

in the large high schools than in smaller schools. Small schools using the test tend to "blanket" the entire student body.

The verbal section of the PSAT tests the student's ability to read with skill and to use words correctly with appropriate understanding. An examination of factor-level means from Table 38, page 111, shows riding time levels to be quite consistent with one another. Differences exist for school size total means and apparently favor the large high schools. The ANOVA results, as given in Table 39, page 112, shows the school size differences to be significant, while riding time and interaction effects are not evident. Both the .05 and .01 critical values of 3.02 and 4.66, respectively, were reached by the school size F ratio.

Scheffé tests on the size comparisons were conducted and are reported in Table 40, page 113. Transported students attending large high schools score significantly better on the PSAT verbal section than do bused pupils attending either small or medium high schools. Comparisons between small and medium schools favor those bus students enrolled at medium schools. Those abilities associated with verbal reasoning and skills as measured by the PSAT are more apt to be found in bus pupils attending large schools regardless of the amount of time they spend riding the school bus.

Maximum ratio of counts for the PSAT is 3.2110, indicating that the results are a statistically valid source of conclusions.

TABLE 38. PRELIMINARY SCHOLASTIC APTITUDE TEST; VERBAL SECTION: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 61		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	30	37.1000	19	34.0526	22	38.2273	24	36.7917	85	36.6737
Medium	60	39.2833	38	40.8421	28	38.6071	42	38.5714	168	39.3452
Large	38	38.4737	22	41.6818	27	42.6667	33	40.0303	120	40.4333
Riding time totals	128	38.5313	79	39.4430	77	39.9221	99	38.6263	383	38.8174

TABLE 39. ANALYSIS OF VARIANCE FOR PRELIMINARY SCHOLASTIC APTITUDE TEST: VERBAL SECTION

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	35.9624	17.9812	4.7045	Significant
Riding time	3	5.0719	1.6906	.4423	Not significant
Inter-action	6	17.8513	2.9752	.7784	Not significant
Between cells	11	58.8856	-	-	-
Within cells	373	-	3.8220	-	-
Total	384	-	-	-	-

Harmonic mean of cell count 29.0420

Maximum ratio of counts 3.2110

TABLE 40. SCHEFFÉ TESTS ON THE COMPARISONS BETWEEN MEANS OF SCHOOL SIZE LEVELS: PSAT VERBAL SECTION

School size comparisons	Difference of means	F ratio	Results
Small-medium	2.6715	113.3201	Significant
Small-large	3.7596	196.0946	Significant
Medium-large	1.0881	21.6831	Significant

Critical F at .05 = 6.04

PSAT - Mathematical section. The ability of a student to reason with numbers is the purpose of the PSAT mathematical section. Frequencies appearing in Table 41, page 114, are identical with the PSAT verbal section frequencies since both sections of the test are always administered. Means on the mathematic section did not exhibit quite the same pattern as was found on the verbal section. The ANOVA significance results for the mathematical section are given in Table 42, page 115.

There is no evidence to indicate the presence of interaction effects as measured by PSAT mathematical scores. Likewise, there is no evidence indicating the presence of singular riding time or school size effects on the bus population. Actual riding time means differ very slightly, with the 0-30 group being about one point lower than the remaining three time levels. The differences in school size means favor

TABLE 41. PRELIMINARY SCHOLASTIC APTITUDE TEST; MATHEMATICAL SECTION: FREQUENCIES AND MEANS FOR FACTOR-LEVEL COMBINATIONS, RIDING TIME LEVELS, AND SCHOOL SIZE LEVELS

School size levels	Riding time levels								School size totals	
	0 - 30		31 - 45		46 - 60		61 - over			
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Small	30	42.0000	19	40.0000	22	42.7273	24	41.5833	95	41.6631
Medium	60	43.8000	38	46.5789	28	41.9286	42	44.3810	168	44.2619
Large	38	40.7632	22	42.5000	27	45.6296	33	43.8788	120	43.0333
Riding time totals	128	42.4766	79	43.8607	77	43.4545	99	43.5353	383	42.9861

TABLE 42. ANALYSIS OF VARIANCE FOR PRELIMINARY SCHOLASTIC APTITUDE TEST: MATHEMATICAL SECTION

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F ratio	Significance
School size	2	13.1319	6.5659	1.6214	Not significant
Riding time	3	3.1948	1.0649	.2629	Not significant
Inter-action	6	24.8268	4.1377	1.0218	Not significant
Between cells	11	41.1535	-	-	-
Within cells	373	-	4.0495	-	-
Total	384	-	-	-	-

Harmonic mean of cell count	29.0420
Maximum ratio of counts	3.2110

the medium schools over small schools and only slightly over large schools.

Standardized test trends. Those attributes that are measured by standardized tests tend to be more evident in larger high schools. Performance on highly selective tests tend to favor the large sized high school transported pupil slightly over the medium sized school pupil. Both medium and large sized school students tend to score higher on standardized tests than do small sized school bused students. Riding time effects appear to not favor either short haul or long haul transported students, but tend instead to be constant across all riding time levels. There is no tendency for bus riding time and school size to interact and cause differences in standardized test achievement.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of transporting students in school buses is to give them educational opportunities that otherwise might be denied. The practice of consolidating smaller schools is based on the premise that increased enrollments will create the financial and educational climate necessary for increased learning opportunities. Transportation and consolidation are mutual concepts. The success of rural school consolidation must be measured by the achievement of the transported pupils whom it affects.

The study was designed to investigate the proposition that bus riding time and school size will affect the earned mark and standardized test achievement of transported high school rural pupils. Three null hypotheses were formulated to test the proposition, all using criterion measures of earned marks and standardized test scores: (a) bus riding time and school size have non-interacting variable effects on the achievement of transported pupils; (b) bus riding time has no singular effect on the achievement of bused pupils; and (c) school size has no singular effect on the achievement of bused pupils.

The null hypotheses were applied and tested on nine components of earned mark achievement and on four standardized tests. The achievement data came from a sample of 812 transported Montana high school rural students. These pupils were identified by a combination of one of four bus riding time levels and one of three school size levels.

Summary of Findings

Analysis of variance techniques were applied to nine components of earned marks with the following results:

1. Significance testing of ninth grade G.P.A. showed no evidence of riding time-school size interaction. There was also no evidence of effects due to riding time alone or to school size alone.

2. Tenth grade G.P.A. showed no evidence of effects due to interaction, riding time, or school size.

3. Eleventh grade G.P.A. exhibited no significant differences to indicate the presence of interaction, riding time, or school size effects.

4. Twelfth year G.P.A. indicated no interaction effects or riding time effects. Significant differences were observed among the means of the three school sizes. Transported pupils attending medium sized high schools received significantly higher marks than did bus pupils from either small or large high schools. Transported students from large schools received significantly higher marks than did pupils in small schools.

5. The achievement in required courses taken during the ninth and tenth years showed no evidence of effects due to riding time, school size, or interaction.

6. Earned marks obtained in the eleventh and twelfth years required courses showed no evidence of interaction effects. There was

also no evidence indicating the presence of significant riding time or school size effects.

7. Total G.P.A. calculated from all required and elective courses taken during all years of high school completed showed no significant mean differences. Interaction, riding time, and school size effects were not in evidence.

8. Marks earned in English courses do not exhibit any significant differences and do not therefore indicate the presence of interaction, riding time, or school size effects.

9. There was no evidence of interaction effects or riding time effects on the marks received for elective courses taken in high school. Bus students attending small high schools received significantly lower elective course marks than those attending medium or large schools. Pupils from medium schools earned significantly higher G.P.A.'s for elective subjects than did students from large high schools.

Non-significant mean differences tend to show highest achievement for bus pupils riding for 61 or more minutes, up to an observed maximum riding time of 90 minutes. This tendency occurred in about two-thirds of the earned mark components. Students riding buses from 31 to 45 minutes tend to achieve lower than pupils from the shorter or two longer riding time categories. School size means tend to favor the 100-499 enrollment high schools in all of the nine G.P.A. components, although significant differences appeared only during the senior year and for elective school subjects.

<u>Standardized</u> <u>tests</u>. Four standardized tests were selected for analysis out of the eleven different test titles that were encountered. Analysis of variance was applied to each of the four with the following results:

1. The ACT showed evidence of significant interaction. Lowest ACT scores were made by small school bus pupils riding for 31 minutes up to 90 minutes. Medium sized school bus students tended to score generally higher than students from small and large sized level schools, but the highest ACT scores were made by large sized school bus pupils in the 31-45 minute time level. Exceptions to the interaction pattern and low frequencies casts doubt on the validity of the interaction trends as measured by the ACT instrument.

2. Achievement on the ITED gave no indication of significant interaction effects, riding time effects, or school size effects. The ITED is confined chiefly to medium and large Montana high schools and is a doubtful measure when comparing all three sizes of schools.

3. NMSQT administration is much more selective in large schools as compared to smaller schools. Small schools have a bus population that scores significantly lower on the NMSQT than either medium or large high school bus populations. The mean differences between medium and large schools is significant on the NMSQT.

4. The PSAT verbal test section showed significant differences in the achievement of bus pupils between large and small schools and

between medium and large schools, favoring the large in both instances. There was no evidence of interaction or bus riding time effects.

Achievement on the PSAT mathematical section gave no indication of any interaction influence. Riding time singular effects and school size singular effects were also not evident.

Transported students attending large schools tend to receive higher scores on standardized tests than do bus pupils from smaller schools. Riding time interacted with school size on one test but with inconclusive results. The effects of bus riding up to 90 minutes have no differential influence on the standardized test achievements of transported pupils.

Conclusions

The results of this study indicate that there are very few, if any, evidences of interaction between school bus riding time and school size. If pupils riding the bus for short periods of time achieve at a certain level, it is not the combination of the short ride and the size of enrollment functioning together that accounts for their achievement. Likewise, students riding the bus up to 90 minutes one way need not expect a certain level of achievement simply because they are long riders attending a certain sized school.

The first conclusion of this study therefore states: <u>Specific combinations of school bus riding time and school size do not exist</u>

<u>that could account for any given level of earned mark or standardized test achievement within the transported Montana high school rural population</u>.

The evidence is conclusive to show that school bus riding time up to 90 minutes does not affect the achievement of the transported pupil as measured by earned marks and standardized test scores. For any given school size, high school students transported for intervals of 0-30 minutes, 31-45 minutes, 46-60 minutes, and 61 or more minutes up to 90, will not experience true differences in academic achievement. The second conclusion of this study therefore states: <u>Within any one of the three sizes of Montana high schools, transported rural pupils riding the bus for up to 90 minutes one way will not experience any given level of earned mark and standardized test achievement that can be attributed to the bus ride itself</u>.

The size of school attended does explain some of the achievement variation found within the transported population. Those bus students attending medium sized Montana high schools attain higher marks during the senior year and in elective subjects than do pupils attending either small or large high schools. Large size school bus enrollees earn higher marks in the twelfth grade and in elective subjects than do bus pupils from small sized high schools. Achievement during the first three years of high school and in required courses is nearly equal regardless of school size, although there is a tendency to receive higher marks in medium sized schools. A third conclusion of this study therefore states: <u>Any given level of earned mark achievement experienced by transported Montana high school rural pupils during the first three years of school, or experienced within required school courses, cannot be attributed to the size of high school attended; twelfth grade and elective course earned mark achievement can be attributed to school size and favors the medium sized high school.</u>

The achievement of transported pupils on standardized tests is generally higher in large high schools, under the conditions of increasing selectivity practiced by Montana high schools as they become larger. The PSAT is the most commonly administered standardized test taken by transported Montana high school students. Verbal performance favors the large school student. A fourth conclusion of this study therefore states: <u>Any given level of PSAT verbal achievement or NMSQT achievement experienced by transported Montana high school rural pupils can be attributed to the size of school attended; those attributes measured by standardized tests are most apt to be found in transported pupils attending large high schools.</u>

General Conclusions for Pupil Transportation and School Consolidation

The purpose of pupil transportation is to increase educational opportunity. That purpose is being realized in Montana to the extent that the academic achievement of transported high school pupils is not harmed by the amount of time they spend riding the bus, up to an existing maximum one-way riding time of 90 minutes.

Transported pupils are able to realize the advantages of larger school enrollments insofar as their achievement is constant regardless of the length of bus ride experienced. Transported pupils are better able to realize the opportunities of consolidation if the school is large, when considering standardized test achievement, or if medium sized when considering earned mark achievement.

Recommendations

This study covered a high percentage of the long riding bus population in Montana. Another sample of equally long riding times could not be found within the state until after a four-year time lapse. Recommendation: The study should be replicated in another state having a large land area and low population density.

The measures used in this study were earned marks and standardized test scores. It is possible that other aspects of the bus student's school life are being affected by riding time. Recommendation: Social criteria should be used as a basis of measurement in a replication of this study.

The study was confined to high school pupils whose resiliency may be accounting for the lack of time effects of the school bus ride.

Recommendation: Young elementary school children should be used as a sample in a transportation study on riding time effects.

The subjective criterion of "reasonableness" was not used in this study as a limit to school bus riding time. Recommendation: Pupil transportation as seen from the parent's point of view should be studied. Attempts should be made to find a balance between sacrifices made by the home and those made by the school in the name of transportation. The balance of sacrifices should be one means of arriving at a time limit for bus riding.

Marks earned by the bus population seems to favor the medium sized high school of between 100 and 499 students. Recommendation: Studies should be aimed at finding out why the congruency exists between the medium sized high school and the transported pupil. The attitude of the medium sized school faculty in relation to small and large staffs should be gauged, as it is the teachers who award the earned marks to the bused pupils.

Riding time was found to have no effect on the achievement of high school bus pupils. Recommendation: The consolidation of very small high schools should proceed without delay. The concept of "isolated school" could be redefined in terms of acceptable transportation riding limits.

APPENDIX

Appendix A

T-1 Transportation
Form for Montana

State of Montana Department of Public Instruction Harriet Miller, Superintendent Helena, 59601	SCHOOL DISTRICT APPLICATION FOR REGISTRATION OF SCHOOL BUS AND STATE REIMBURSEMENT FOR SCHOOL YEAR 19____-19____	Form T-1
	DUE: { by October 1, to County Superintendent; by October 15, to State Superintendent.	

This form, completed in its entirety, is required in accordance with Chapter 34, Title 75, R.C.M., 1947, as amended.

( ) Elementary
( ) High School District No.______, ____________________, ____________________
City (if none, School) County

DIRECTIONS:

1. **District Official:** Prepare one original and two copies* of this form; transmit all copies to County Superintendent by October 1 of the school year shown above.

2. **County Superintendent:** Transmit all copies of this form, along with all copies of this form for all districts in the county, to the State Superintendent by October 15. (Following State approval, one copy will be returned to the District; one copy to the County Superintendent.)

*Note: If a joint district, prepare one original and three copies; transmit all four copies to the County Superintendent of County in which the school house is located. Following State approval, one copy will be returned to the District and one to each County Superintendent concerned.

School Bus Identification Number**______-______-______-______
County No. Dist. No. Route No. Miles Per Day

**The School Bus Identification Number is found as follows: The County Number corresponds to the county number on license plates. The District Number is the number of the school district which is responsible for the operaton of this bus (owns or contracts). The Route Number is the number of the district's bus route traveled by this bus. The Miles Per Day is the number of miles this bus travels per day on this route to transport pupils to and from public school as approved by the County Transportation Committee.

Make of Bus Body____________ Year______ Make of Chassis____________ Year______

Rated Capacity*____________ License Number____________ Owner of Bus____________
*Based on 13 inches of seating space per pupil.

Date This Bus Was Approved by Highway Patrol____________

Name of Regular School Bus Driver____________ Montana School Bus Driver Certificate No.______

Name of Substitute School Bus Driver____________ Montana School Bus Driver Certificate No.______

We hereby certify that this bus will operate entirely on the route established by the Board of Trustees and within the transportation area assigned and approved by the County Transportation Committee. We further certify that this bus transports pupils eligible for school transportation as defined by Sections 75-3402, 75-3407, and 75-3409, R.C.M., 1947, as amended. The load list below includes all pupils (eligible and ineligible transportees) riding this bus.

We agree to supervision of this bus and bus route by the State Superintendent; to make such reports to the State Superintendent and County Superintendent as are required; to provide a vehicle which meets minimum standards as established by the State Board of Education, the Montana Highway Patrol and the State Superintendent; and to provide a licensed, qualified and approved driver to operate such vehicle as required by Sec. 75-3308 and Sec. 75-3403, R.C.M., 1947.

We also agree to refrain from soliciting or causing others to solicit students from other transportation areas.

We understand that violation of the laws, rules or regulations governing school bus transportation will be sufficient cause for withholding State and County reimbursement for this bus route.

The following conditions with respect to State reimbursement for this bus and bus route apply:

(1) The total State reimbursement to which this bus and bus route is entitled is to be paid to this district. Yes____ No____
If answer to item (1) is no, complete item (2).

(2) The total State reimbursement to which this bus route is entitled is to be shared between the following districts in the proportions as indicated:

High School District No.____, ____% Elementary District No.____, ____% Elementary District No.____, ____%

Elementary District No.____, ____% Elementary District No.____, ____% Elementary District No.____, ____%

I certify that this Application for School Bus Registration and State Reimbursement is true and complete to the best of my knowledge and belief.

Date____________ District No.______ Signed____________
Chairman, Board of Trustees

For County Transportation Committee Approval

I have reviewed this Application for School Bus Registration and State Reimbursement. I certify that this bus operates within the transportation area assigned to it by the County Transportation Committee and that this report is true and complete to the best of my knowledge and belief.

COUNTY TRANSPORTATION COMMITTEE

Date____________ By____________
County Superintendent of Schools, Chairman

For State Department of Public Instruction Approval **APPROVED RATE PER MILE**____¢ HARRIET MILLER, State Superintendent
Sec. 75-3407, R.C.M., 1947 as Amended

Date____________ By____________
Supervisor, Pupil Transportation

To Be Completed By District Official | To Be Completed by County Superintendent: If school attended is outside of resident district (for elem.) or resident county (for high school), complete the following

Name all pupils riding this bus (last name first, no abbreviations or nicknames)	List pupil's residence by District No.	District No. of school attended (if non-public, give name of school): Elem. Gr. K-8	H. S. Gr. 9-12	Actual no. of miles (one-way) from pupil's home to school	Total miles per day pupil rides bus	Individual payment to bus***	Permission of County Superintendent: Applied for (Date) Mo.	Day	Yr.	Granted (Date) Mo.	Day	Yr.
1.												
2.												
3.												
4.												

***Check (✓) this column if pupil receives individual (or isolated) transportation payments from home to bus route

Appendix B

Student Data
Recording Form

Pupil Name________________ Bus route #_____ Minutes _______

School____________________ Capacity _______ Miles _________

Comments:

<u>Standardized</u> <u>tests</u>:

Test				
Date or grade				
Raw score				
Percentile				
Mean				
Z-score				
Mean Z				

Comments:

<u>School</u> <u>Marks</u>:

Grade level	9	10	11	12
G.P.A.				
Cummulative G.P.A.				
Isolated marks				
English				
Soc. St.				
Math				
Science				
Electives				

Comments:

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