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Cost-effectiveness study of Montana secondary education

Bruce L. Benson
The University of Montana

A COST-EFFECTIVENESS STUDY OF MONTANA

SECONDARY EDUCATION

By

Bruce L. Benson

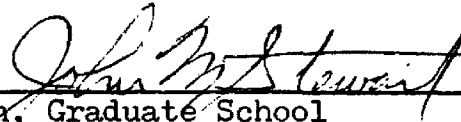B.A., University of Montana, 1973

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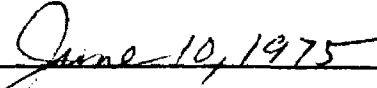Approved by:

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   The purpose of this study was to test the hypothesis that school
inputs to education, measured by high school budget components, do
effect the output of education measured by the five American College
Testing Program (ACT) test scores and college grade point average
(GPA). Although a great deal of research has been done concerning
educational inputs and outputs the results have been inconsistent
and controversial. Since a detailed disaggregation of budgets had
not been tried as educational input measures the study was justified.
   Budget components and other needed school information was obtain-
ed from forms that high schools filed with the State Superintendent
of Public Instruction. ACT's and GPA's were obtained from the Ad-
missions and Registrar's office at the University of Montana. Socio-
economic background measures came from the 1970 Census. The pri-
mary analytical tool was multiple regression.
   The results support the hypothesis that school inputs do effect
school outputs. However, it appeared as though inputs effect dif-
ferent outputs in different ways. Simply increasing expenditures
may or may not improve educational output. It will depend upon how
these expenditures are spent. The most important school inputs
appeared to be the instructional personnel variables, teachers'sal-
aries, and principals' salaries. The expenditures on library books
and periodicals, and new equipments were also important inputs for
some outputs. Several inputs had no significant effect however, and
some had negative effects. Expenditures for teaching supplies, and
for student body and auxiliary services had negative effects on some
output measures. The number of teachers per student also had neg-
ative effects. One possible reason for these results is that school
budgeters have a relatively fixed amount of money to spend and must
choose how to spend it. They may have to choose between a relatively
large number of low salary, inexperienced teachers, or fewer, high
salary, experienced or better educated teachers, for example. If
this is true these results indicate that schools should choose fewer,
more qualified teachers rather than more, less qualified teachers.
The size of the school district also appeared significant for some
output measures, particularly English performance, but not for others.
The results indicated that school administrators must choose what
outputs they feel to be most important and allocate inputs according-
ly. These results and conclusions can only be applied to college
bound students from Montana public schools, because of the sample
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ACKNOWLEDGEMENTS

Special thanks must be given to Dr. John Wicks for his advice, assistance, and encouragement concerning this project. Without Dr. Robert Vernon's help the econometric analysis would have been much more difficult and may have forced the abandonment of the project. Special recognition also goes to my wife, Terrie, for her help from the earliest, data gathering stage of the project, to the final typing and editing. Without her understanding and encouragement the thesis probably would not have been completed. All of the students and faculty who participated in Dr. Wicks' Economics 495 seminar also deserve thanks for their ideas and constructive criticism.

CHAPTER I

INTRODUCTION

The purpose of this research project was to test the hypothesis that school inputs in education, measured by high school budget components, do effect the output of education, measured by American College Testing Program (ACT) test scores and college grade point average (GPA). A great deal of research has been done concerning the inputs and outputs of education. However, certain aspects of this project differ from previous research. In other studies, total school expenditures were used as school input measures, as well as a few individual budget related items. However, in this study a more detailed breakdown of high school budgets was used. Also, the student sample in this study differed from most others since it consisted of only college students who entered the University of Montana and graduated from Montana public high schools. In Montana, there are no extremely rich school districts with upper class social backgrounds as there are in most urban areas, and there are no extremely poor school districts with lower class social backgrounds such as the ghetto areas in urban studies. Most of the work concerning the topic has used at least partially urban samples, while Montana is largely non-urban.

To establish the effect of high schools on the outputs of schools, it must be assumed that output is functionally related to school inputs.

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In this case, school inputs consisted of budget items as well as some other non-budget measures of differences between schools. It has been fairly well substantiated in other studies that the socio-economic background of students has a significant effect on the output of schools. Therefore, data was obtained concerning the socio-economic make-up of school districts, as well as school budget and non-budget inputs to education and outputs of education. To test the hypothesis multiple regression was used.

Most research concerning school inputs and outputs has been done using the assumption of a linear relationship between inputs and outputs. Therefore, several tests were carried out in order to determine whether the relationship between school inputs and outputs was non-linear. Other hypotheses were made as well, concerning the relationship of each input variable to the output measures, and the effect of school district size on student performance.

Chapter Two contains a description of the current status of knowledge concerning the topic. Chapter Three concerns the relationship of this study to that status of knowledge, the purpose of this study, and a discussion of the research model. Chapter Four describes the data used for the study, its source, and in what form it was used. Chapter Five describes the procedures used in analyzing the data, and Chapter Six is a discussion of the results of the analysis and the conclusions drawn from those results.

CHAPTER II

CURRENT STATUS OF KNOWLEDGE

A number of econometric studies have been performed concerning the relationship between inputs and outputs of education. When taking in its entirety the most striking conclusion has been the controversy resulting from the findings. The primary source of controversy concerns the importance of school inputs in education. The most well known studies have concluded that school itself has only a slight influence on measures of educational outputs such as aptitude and achievement test scores. The primary influences seem to be the students' socio-economic background as well as the innate or inherited ability of the students. Of course, the major reason that these studies are the most well known is the nature of their results. These findings go against the commonly held beliefs of educators, policy makers, and many economists. Therefore, they have lead to rebuttles and more research.

The most recent major report with findings of this nature was done by Christopher Jencks.[1] Jencks' conclusions concerning cognitive inequality, as measured by test scores, were:

1. If genetic inheritance could be equalized, inequality in test scores would fall between thirty-three and fifty percent.

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[1]Christopher Jencks, Inequality (New York: Basic Books, 1972).

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2. If the total environment of students could be equalized, test inequality would fall between twenty-five and forty percent.

3. If the economic status of students and their families were equalized, test score inequality would fall about six percent.

4. If the amount of schooling attained was equalized, inequality might fall from five to fifteen percent.

5. If there was equality in elementry schools, inequality in test scores would fall by three percent or less.

6. If secondary schools were equalized test scores inequality would fall one percent or less.

7. Elimination of racial and socio-economic segregation in schools might reduce the score gap between blacks and whites, and rich and poor by ten to twenty percent.

8. Additional school expenditures are not likely to increase achievement, and redistributing resources will not reduce score inequality.[2]

Historically, many research projects have been done concerning school effectiveness. Early studies, done primarily by professional educators, can be characterised by "Cost-Quality Relationship in Education" by Paul R. Mort.[3] A number of studies of this type were done in the early 1950's. In general, they used per pupil expenditure levels as a measure of the quality of schools. School outputs were measured in several

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[2]Ibid., p. 109.

[3]Paul R. Mort,"Cost-Quality Relationships in Education," Problems and Issues in Public School Finance, ed. R. L. Johns and Edgar L. Morphet (New York: National Conference of Professors of Educational Administration, 1952).

ways. Dollar inputs were related to such things as student performance and the rate at which schools adopted innovative instructional practices or new curriculum. Generally, these studies concluded that school districts which spent more were more effective since students performed better on tests, attended college more often, and so on.[4] The problem with these reports was that they did not take into account the students' abilities before they entered school or the background and environment of the students outside of school. Even though school districts which spent more did produce more high performance students, the background and environment of the students also indicated that they should perform better.[5]

Because of these omissions a new type of study was undertaken, mostly by researchers trained in sociology. Probably the most important work in this category is Equality of Educational Opportunity.[6] A research team headed by James S. Coleman compiled this report in 1966 for the United States Department of Education. It was the largest and most ambitious study ever done in this area, as well as the most controversial. The Coleman Report and others in this category tended to place more emphasis on the socio-economic background of students as determinants of performance, rather than school services. They demonstrated that achievement is

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[4]William E. Barron, "Measurement of Educational Productivity," The Theory and Practice of School Finance, ed. Warren E. Gauerke, and Jack R. Childress (Chicago: Rand McNally Co., 1967).

[5]James W. Guthrie, "A Survey of School Effectiveness Studies," Do Teachers Make a Difference?, ed. Alexander Mood (Washington D. C. : U. S. Department of Education, 1970), pp. 26-27.

[6]James S. Coleman et al., Equality of Educational Opportunity (Washington D. C. : U. S. Government Printing Office, 1966).

tied very closely to socio-economic status. A typical result from the
Coleman Report was as follows:

> Taking all these results together, one implication stands out above
> all: that schools bring little influence to bear upon a child's
> achievement that is independent of his background and general social
> context; and this very lack of independent effects means that inequal-
> ities imposed upon children by their home, neighborhood, and peer
> environment are carried along to become the inequalities with which
> they confront adult life at the end of school.[7]

Other studies have come up with similar results. Jencks reported
that the moderate relationship between test scores and expenditures is
due to the fact that affluent schools have students whose test scores
are already above averages and no measurable school resource shows a
consistent relationship with the effectiveness of schools in boosting
achievement.[8] Burkhead in Input and Output of Large City High Schools in
1967 reported the results of regression analysis of the relationship be-
tween educational inputs and outputs in Chicago and Atlanta.[9] In both
cities, median family income was used as a proxy for the socio-economic
background of school districts. Although several school inputs were used,
median family income accounted for ninety percent of the explanatory power
of the model in both cities; the R^2 of the stepwise regressions were .85
and .92 respectively.[10]

Although the Coleman, Jencks, and Burkhead works may be the most

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[7]Ibid., p. 325.

[8]Jencks, pp. 93-94.

[9]Jesse Burkhead, Thomas G. Fox, and John Holland, Input and Out-
put in Large City High Schools (Syracuse: Syracuse Univesity Press, 1967).

[10]Ibid., pp. 52, 70-71.

well known there have been several others with similar results. In 1964, the Fels Institute of Local and State Government in Pennsylvania used regression analysis to test the relationship between test scores, and socio-economic and school variables.[11] They reported that "in general this study found that educational achievement levels of public school pupils are directly correlated with socio-economic levels of homes and communities in which the pupils live."[12] Average test scores for schools were regressed on census tract data for eight rural urban classifications. Two school variables, spending per pupil and a school size variable to test for economies of scale, were used. The socio-economic variables were significantly and strongly related to test scores in all eight classifications. However, these relationships were larger in the urban areas than the rural, using R^2 as the measurement. The R^2 using only socio-economic variables was .88 for the large cities and .45 for the most rural school districts.[13] The school variables were significantly related only in the largest cities. The Fels Institute reported that the major reason for test score differences was the socio-economic background of the pupils and the effect of pupils' background was more severe in urban areas than in rural.[14]

Charles Benson headed a study of pupil achievement for the

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[11]Fels Institute of Local and State Government, Special Education and Fiscal Requirements of Urban School Districts in Pennsylvania (Philadelphia: Fels Institute of Local and State Government, 1964).

[12]Ibid., p. 1.

[13]Ibid., p. 23.

[14]Ibid., p. 23.

California Senate in 1965.[15] Stepwise regression was used, with median achievement and I. Q. test scores for fifth grade students as the dependent variables. Median family income was used as the socio-economic background variable. Expenditures per pupil along with several teacher quality and administrative variables represented school inputs. Benson's major conclusion follows the same lines as the other studies sighted. The home environment of children was strongly related to performance on both achievement and I. Q. tests.[16]

In 1965 Herbert Kiesling used data gathered by the New York State Department of Education to test the relationship between school spending per pupil and district average test scores.[17] The sample was divided into six socio-economic categories and each group was tested separately. A school size variables was also used to test for scale economies. Using multiple regressions Keisling found no evidence of economies of scale and that per pupil expenditures were significantly related to performance only in the largest cities.[18]

In 1968 Alexander Astin attempted to measure the effect of colleges

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[15] Charles S. Benson et al., State and Local Fiscal Relationships in Public Education in California, Report of the Senate Fact-Finding Committee on Revenue and Taxation (Sacramento: Senate of the State of California, 1965).

[16] Ibid., p. 58.

[17] Herbert J. Keisling, "Measuring a Local Government Service: A Study of School Districts in New York," Review of Economics and Statistics 49 (August 1967), p. 356.

[18] Ibid., p. 366.

on their students.[19] The Graduate Record Examination was the output

measure used. Several background variables for the students in the sample

and a number of institutional quality measures, including expenditures per

pupil, were regressed on Graduate Record Examination scores. The most

important determinant of student performance was the students' academic

ability mearused in high school by the National Merit Scholarship Qualify-

ing test.[20] There was no evidence that the level of academic competitive-

ness or financial resources of the college attended had any significant

effect on the performance of college seniors. Instead, the analysis indi-

cated that senior performance was highly dependent on student character-

istics that existed before entering college.

Elchanan Cohn used district average changes in the Iowa Tests of

Educational Develepment from tenth grade to twelveth grade as the depen-

dent variable in a regression analysis of Iowa high school districts in

1968.[22] Cohn used several school input variables but had no socio-eco-

nomic background measures. His primary objective was to test for economies

of scale. The highest R^2 obtained was .07, and Cohn concluded that school

inputs measured by the variables he used explained only a minor portion

of the variation in the test scores, but he did find evidence of scale

economies.[23]

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[19]Alexander W. Astin, "Undergraduate Achievement and Institutional Excellance," Science 161 (August 1968), pp. 661-668.

[20]Ibid., pp. 662-663.

[21]Ibid., p. 667.

[22]Elchanan Cohn, "Economies of Scale in Iowa High School Operations," Journal of Human Resources 3 (Fall 1968), p. 424.

[23]Ibid., p. 425.

In 1968, Richard Raymond used the composite ACT scores and cumulative GPA of 5,000 West Virginia University students as output measures of West Virginia high schools.[24] The district averages of these output measures were regressed on several teacher variables, the student-teacher ratios, the number of library volumes in excess of standard, and expenditures per pupil, as well as several social variables taken from census data. Only one school input, teachers' salaries, appeared significant while several of the social variables were significantly related to student performance.[25]

In 1969 Arthur Corrazzini reported the results of his study of higher education in the Boston metropolitan area.[26] Tests scores of high school seniors were regressed on several school and socio-economic background variables. The most important determinants of performance were parental education and family income.[27] Corrazzini did find significant school variables but reported that these variables simply reinforced the positive or negative influences of the students background since students from high income and well educated families attended schools with better teachers and higher expenditures.[28]

A study of Public Education in New York City was published by the

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[24]Richard Raymond, "Determinants of the Quality of Primary and Secondary Public Education in West Virginia," Journal of Human Resources 3 (Fall 1968), p. 450.

[25]Ibid., p. 467.

[26]Arthur J. Corrazzini, Study of Higher Education, Metro 2 (Boston: Tufts University, 1969).

[27]Ibid., p. 23.

[28]Ibid., p. 13.

First National City Bank of New York in 1969.[29] A stepwise multiple

regression was used to test the relationship between fifth grade acheive-

ment test scores and a group of background and school variables. The

variables accounted for about three-fourths of the variation in the test

scores.[30] The report concluded that in New York City middle-class child-

ren, who are predominantly white perform better than children from lower

socio-economic strata, made up primarily of minority groups, and school

input only played a minor role in relation to achievement.[31]

Another study was done in 1969 by Robert Hauser.[32] Path analysis

and covariance analysis were employed to interpret the influence of

socio-economic origins and school differences on the performance of

sixth grade students in the Nashiville Standard Metropolitan Statistical

Area. Although no solid conclusions about the influence of social ori-

gins on educational outcomes could be drawn, Hauser did conclude that

school differences in educational outcome were small and may have been due

to differences in student body composition.[33]

This is not an exhaustive list of the literature concerned with

inputs and outputs of education that has similar results. Studies of this

kind using similar procedures have been performed in other parts of the

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[29]First National City Bank of New York, Public Education in New
York City (New York: First National City Bank of New York, 1969).

[30]Ibid., p. 16.

[31]Ibid., p. 16-17.

[32]Robert M. Hauser, "Schools and the Stratification Process,"
American Journal of Sociology 74 (May 1969), pp. 587-611.

[33]Ibid., p. 587.

world, particulary in Great Britian.[34] There are also several studies
which have used output measures other than test scores.[35] Several of
the studies already mentioned used such measures as dropout rates and
the percentage of students attending college.[36] However, results using
test scores were of major concern for this project.

Even with all of this evidence indicating that schools have only
a minor influence on the performance of students there were reasons to
doubt this conclusion. First, critics of the Coleman Report hold that
its conclusions were not necessarily warranted. Many of the criticisms
of the Coleman Report could also apply to many of the other studies
sighted. The second source of doubt comes from the fairly substantial
body of literature which has found that school inputs do significantly
influence output.

There were three major points brought out by the critics of the Cole-
man Report. These points are concerned with the possiblity of 1) inade-

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[34]For example: Leslie Kemp, "Environmental and Other Character-
istics Determining Attainment in Primary Schools," British Journal of Edu-
cational Psychology 25 (1955), pp. 67-77; Gilbert F. Peaker, "The Regres-
sion Analysis of the National Survey," Children and Their Primary Schools,
Vol. 2, App. 4, ed. Central Advisory Council for Education (London: Her
Majesty's Stationary Office, 1967), pp. 347-400; F. W. Warburton, "Attain-
ment and the School Environment," Education and Environment," ed. Stephen
Wiseman (Manchester, England: Manchester University Press, 1964), pp.
101-125.

[35]Samuel Bowles, "Towards an Educational Production Function," Edu-
cation, Income and Human Capital, ed. W. Lee Hansen (New York: Columbia
University Press, 1970), pp. 11-70; Martin T. Katzman, The Political Econ-
omy of Urban Schools (Cambridge: Harvard University Press, 1971); George
W. Mayeske et al., A Study of Our Nations Schools (Washington D. C. :
Office of Education, National Center for Educational Statistics, 1968);
Howard P. Tuckman, "High School Inputs and Their Contribution to School
Performance," Journal of Human Resources 6 (Fall 1971), pp. 490-509.

[36]For example: Burkhead; Coleman.

quacy of the measurements used, 2) imprecise manipulation of those measure-

ments, and 3) inappropriate statistical techniques.[37]

Point one was exemplified by the measures of school facilities

used in the Coleman Report. Two measures were used, volumes per student

in school libraries, and the presence or absence of science laboratories.

Critics felt that more measures of facilities should have been tried and

that the measures employed were too simplistic. With so few and such

simple measures of school facilities, critics claimed that the attempt to

understand the significance of schools in explaining performance was

inadequate.[38]

An example of what the critics of the Coleman Report meant by the

second point of criticism can be seen by looking at the treatment of the

statistic, instructional expenditures per pupil. To use this statistic,

it must be assumed that each student receives the same benefit from an

annual instructional expenditure equal to the mean for the school dis-

trict. This does not account for intradistrict differences which may be

substantial. Therefore, the report weighted the data against finding a

significant relationship.[39]

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[37]Samuel S. Bowles and Henery M. Levin, "More on Multi-collinear-
ity and the Effectiveness of Schools," Jounal of Human Resources 3
(Spring 1968), pp. 393-401; Samuel S. Bowles and Henery M. Levin, "The
Determinants of Scholastic Achievement-An Appraisal of Recent Evidence,"
Journal of Human Resources 3 (Winter 1968), pp. 3-24; Glen G. Cain and
Harold W. Watts, "Problems in Making Policy Inferences from the Coleman
Report," American Sociological Review 35 (April 1970), pp. 228-242;
Guthrie, p. 27.

[38]Guthrie, p. 27.

[39]Ibid., p. 28.

The third point of criticism had to do with the form of regression analysis used. Critics claimed that the regression used was inappropriate because of the high degree of intercorrelation among independent variables. Coleman used a stepwise regression to explain the variance in achievement scores. However, results of a stepwise regression are highly sensitive to the order in which variables are added when they are inter-related. The socio-economic background of students has been found to be highly related to school service variables. In other words, high quality school services are available to students from high socio-economic strata while students from low socio-economic strata generally receive low quality school services. When variables or groups of variables are interrelated in regression, the variable or group of variables added first pick up most of the explanatory power. Coleman added the socio-economic variables first.[40]

For these reasons, critics claim that studies like the Coleman Report place an overemphasis on the socio-economic background of the students. Two other problems can be applied to most research in this area. The first concerns the inability to identify the crucial instructional components of schools. The second has to do with the slow development of research strategies and measurement methodologies applicable to education. For example, information on school inputs is frequently limited. Most of the econometric studies of the inputs and outputs of education suffer from high correlation among school resources and social class variables, that make identification of district resource effects very difficult, and in

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[40]Ibid., p. 29.

many cases, from a lack of substantial variation in school resources that becloud any attempts to predict effects of radical resource changes on performance. These shortcomings result from the inability of researchers for political and ethical reasons to perform controlled educational exper-iments.[41]

Judging from the criticisms of the Coleman Report which indicate that the methods used may have biased the results against the school vari-ables, it was interesting to note that Coleman did find significant school variables. Several school variables were positively and significantly related to student performance measured by vocabulary test scores. The most important was a teacher characteristic, teacher's verbal ability.[42] Other studies that the criticisms might also apply to also found signif-icant school inputs. Burkhead used similar statistical procedures to the Coleman Report and the same problems may have existed. However, teachers' experience was significantly linked with achievement test scores in Chicago, and low rates of teacher turnover were positively associated with incre-ments in scores on verbal ability in Atlanta.[43] In addition to the anal-ysis carried out for Atlanta and Chicago, Burkhead performed a similar analysis for a sample of rural school districts. The socio-economic vari-able, median family income, was not nearly as important for rural districts as it had been for cities, but teachers' experience, starting teachers' salaries, and building age were all significant at a .05 level. These

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[41]Ibid., pp. 30, 45-46.

[42]Coleman, pp. 290-332.

[43]Burkhead, pp. 56-72.

three variables were almost as important as median family income.[44]

Other studies that found school to be of only minor importance found

some school variables to be significant as well.[45] There were also

several studies that found school inputs to be much more important

than these studies contend.

One of the earliest studies that attempted to take both the

socio-economic and school inputs into account was done by Mollenkopf

and Melville in 1956.[46] The attempts to control the socio-economic

factors were poor, however. Aptitude and achievement tests for high

school students from throughout the United States were significantly

related to several school services using correlation analysis. They

were the number of special staff such as psychologists, reading special-

ists, and counselors in the school, class size, the pupil teacher ratio,

and instructional expenditures per student.[47] Socio-economic factors

were found to be important as well but because of the statistical tech-

niques employed the importance of the school variables compared to the

social variables could not be accurately assessed. Another early attempt

was done for the New York State Education Department by Samuel Goodman

[44]Ibid., p. 81.

[45]For example; Astin; Benson; Cohn; Corrazzini; Keisling; Peaker; Raymond; and Wiseman.

[46]William G. Mollenkopf, and Donald S. Melville, A Study of Second-ary School Characteristics as Related to Test Scores (Princeton: Educa-tional Testing Services, 1956).

[47]Ibid., pp. 28-29.

in 1959.[48] A large sample of fourth, seventh, and tenth grade students'

achievement test scores was used as the output measure. The sample was

divided into several socio-economic classifications using the students'

fathers' occupation as the criteria. Other socio-economic variables

were used as well. Per pupil instructional expenditures and the number

of special staff per 1000 students were significantly correlated to

achievement scores of seventh grade students. Teachers' experience, and

a measure of "classroom atmosphere" were also significantly related to

performance.[49] The classroom atmosphere variable consisted of an ob-

server's rating of the degree to which the teacher attempted to relate

the subject matter under consideration to the interests and ability levels

of students. These two studies were two of the earliest that attempted

to account for both the social and school influences on students.

Although they used correlation analysis rather than multiple regression,

their results were the first of several studies that point to the signif-

icance of school's personnel on student performance. Their results were

consistant with the results of many research projects which followed them.

In 1962 the first of a series of reports concerned with Project

Talent was published. J. C. Flanagan reported the results of a nation-

wide study concerning rural high schools in Studies of the American High

School.[50] The sample consisted of 206 public high schools in towns be-

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[48]Samuel M. Goodman, The Assessment of School Quality (Albany:
New York State Education Department, 1959).

[49]Ibid., pp. 26, 31, 34, 45.

[50]J. C. Flanagan, Project Talent: Studies of the American High
School (Pittsburgh: University of Pittsburgh, 1962).

tween 2,500 and 25,000 population that had only one high school, so
the social data could be taken from census tract data. Using stepwise
regressions, teachers' starting salary was the most important variable
followed by median family income.[51] This is not consistent with the
Coleman and Burkhead studies. The most important school factors related
to English achievement were: being in an academic curriculum rather than
in a vocational high school, having well paid and experienced teachers,
having an adequate library in the school, having considerable homework,
and having study halls, while the main school influences on all the out-
put measures were, teacher salaries, amount of teachers' experience, num-
ber of books in the school library, and per pupil expenditures.[52]

In 1959 the board of education of Prince Edwards County Virginia
closed all public schools to avoid the supreme court's racial desegrega-
tion decree. This provided the imputus for a study of The Educational
Status in a District Without Public Schools.[53] As a result of the school
closure, most white students attended segregated private schools. Howev-
er, the blacks and poor whites were forced to follow one of three courses.
They could attend school in another county, participate in a variety of
volunteer makeshift schools, or forgo formal education altogether. The
first group had significanly different background from the other two,
but the students in the volunteer programs and those who did not attend

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[51]Ibid., p. 9-6.

[52]Ibid., p. 9-36.

[53]Robert L. Green et al., The Educational Status in a District
Without Public Schools (East Lansing, Michigan: Bureau of Educational
Research Services, College of Education, Michigan State University,
1964).

school had very similar backgrounds. The students from all of these groups as well as a control group from an adjacent county were given standardized achievement tests. In almost every age group the scores were higher for those who had some sort of schooling than for those who did not. This difference was significant but minimal for students between six and ten, but for students between eleven and seventeen the differences were significant and substantial using regression analysis.[54]

In 1967 Marion Shaycoft completed a follow-up study of Project Talent.[55] Twelveth grade students who were originally tested as nineth graders for the Flanagan report were retested. Therefore, the changes in test scores through the high school years could be measured. Several statistical tools were employed to analyze the data, including correlation, analysis of variance between schools, and stepwise multiple regression. The amount of change in test scores from nineth to twelveth grade was both significant, and fairly large, and the largest gains were in school-taught subjects.[56] The analysis suggested that schools were affecting performance in a number of areas tested and these effects were substantial. According to Shaycoft, whatever direct effects socioeconomic background may have on performance, it has had its full effect before the high school level. However, there may be indirect effects operating, which effect such things as the kinds of classes a student

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[54]Ibid., pp. 218-220.

[55]Marion F. Shaycoft, The High School Years, Growth in Cognative Skills (Pittsburgh: University of Pittsburgh, 1967).

[56]Ibid., p. 9-3.

takes. These in turn effect achievement more directly.[57] Shaycoft also

reported that in most areas of study the amount of course work done was

significantly related to scores on tests of the subject.[58] Both the Green

and Shaycoft studies support the hypothesis that school does effect per-

formance, although they have little to say about what school factors

are important.

In 1968, a research team lead by George Mayeske re-examined the

data gathered by the Equal Education Opportunity Survey for the Coleman

study.[59] This survey consisted of about 400 items of information on

students and their background, schools, teachers, and principals for

approximately 650,000 students from thousands of schools throughout the

United States. This overwhelming amount of information was reduced to

less than seventy variables by Mayeske, measuring the socio-economic

background of the students, and school characteristics. Variables also

measured school outcomes, including achievement test scores. These

variables were analyzed using regression analysis and multiple correla-

tion. Mayeske found that very little of the influence of schools could

be separated from the influence of the students' socio-economic back-

ground. However, the converse was also true. Very little of the influ-

ence of the students' socio-economic background could be separated from

the influence of the schools. Until the twelveth grade, the part of the

influence of the students' social background that could be separated out

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[57]Ibid., p. 9-6.

[58]Ibid., p. 9-7.

[59]Mayeske, pp. 2-3.

was larger than the part of the school's influence that could be separated out, but for the twelveth grade the opposite results occured.[60] The school variables that had the most influence on school outcomes were those representing the schools' personnel. The most important among these were the variables representing teachers' experience.[61]

Another study that re-examined part of the data from the Equal Education Opportunity Survey was reported by Samuel Bowles in 1969.[62] Bowles regressed verbal scores on a group of non-school environment, school environment, teacher quality, and teacher quanity variables. Although the explained variance was fairly small with an R^2 of .18, teacher quality, measured by teachers' verbal ability test scores, was highly significant along with a measure of the physical facilities of schools, science laboratories.[63]

In 1969, James Guthrie used the data gathered by the Equal Education Opportunity in Michigan to examine the relationship between student performance and schools.[64] An attempt was made to avoid the possible methodological problems of the Coleman Report by dividing the 5,284 sixth grade students in the sample into ten socio-economic groups using parental education and income as the critieria. These ten socially

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[60]Ibid., p. 4.

[61]Ibid., p. 7.

[62]Bowles, p. 41.

[63]Ibid., pp. 43-45.

[64]James W. Guthrie et al., Schools and Inequality (Washington D. C. : The Urban Coalition, 1969), pp. 43-45.

homogeneous groups were analyzed separately using student test scores from a variety of tests. Several school variables were found to be significantly related to performance. They were teachers' verbal ability, experience, and job satisfaction, school site size, building age, percent of make-shift classrooms, school size by enrollment, classrooms per 1,000 students, percent of students transferring, library volumes per student, and supply of textbooks.[65] In 1970, Henry Levin also found teachers' verbal scores and experience to be significantly related to achievement scores when he used data from the Equal Opportunity Survey, although he only regressed teacher variables on achievement scores.[66]

Theodore Katzman examined production in Boston's elementry schools in 1971.[67] Several tests of cognative development and achievement were regressed on several school and social variables. Katzman found that just spending more money on education did not improve performance, but spending more money in specific ways did. Spending money to reduce crowding and to hire more accredited and more experienced teachers would improve performance, while spending more money to reduce class size or to hire teachers with more formal training would not.[68] Katzman further concluded that changes in school resources could make a substantial impact

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[65]Ibid., 85-90.

[66]Henery Levin, "A Cost-Effectiveness Analysis of Teacher Selection," Journal of Human Resources 5 (Winter 1970), pp. 24-33.

[67]Katzman.

[68]Ibid., pp. 73-74.

on student performance. To be more specific, Katzman concluded that a change of ten percent in the level of resources could cause a performance change of from one to twenty percent, and the elimination of resource inequalities among Boston schools could reduce interdistrict variation from twenty-two to fifty-seven percent.[69]

A study by Lewis Perl in 1973 supported, in two ways, the hypothesis that schools do improve performance.[70] Not only is this study another that found significant school variables, but Perl specifically took the critcisms of the Coleman Report into account in performing his analysis. All of the alternative statistical techniques suggested by Coleman's critics were applied to a different set of data. Data from the Project Talent study was used. Composite scores of all of the achievement and aptitude tests given to students in the Project Talent sample were used as output measures and regressed on the socio-economic background of students, represented by family income, and the level of fathers' education, and several school variables concerned with the quantity of teacher time available to students, teacher quality, and the quality of school facilities. Perl found that students attending high expenditure schools did perform significantly better. Both reducing the number of students per classroom and increasing teachers' salaries were associated with increases in student achievement.[71] Several school variables were signif-

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[69]Ibid., p. 79.

[70]Lewis J. Perl, "Family Background, Secondary School Expenditure, and Studeny Ability," Journal of Human Resources 8 (Spring 1973), pp. 156-180.

[71]Ibid., p. 167.

icantly related to student performance including starting teachers' salaries, the percentage of teachers with M. A. degrees, the percentage of teachers with Ph. D.'s, the percentage of teacher's time spent in his area of specialization, class size, number of days in the school year, percentage of teachers who were male, and the number of books in the school library.[72]

There is, then, a great deal of evidence that contradicts the findings of the Coleman Report and other studies with similar results, including criticisms of the methodology several of these studies employed, and several studies which have found significant school effects on student performance.[73] Some of these studies re-examined the data from the Coleman Report and some took the criticisms of the Coleman Report into account in finding significant school effects.

There were some consistant findings in most of the research done concerning the relationship between schools and student performance. Almost every study found variables having to do with school staff, and in particular teachers, to be significantly related to student test scores. Even though many of the studies, such as Coleman and Burkhead, found school inputs to be of minor importance, they did find teacher and/or staff variables to be significantly related to school output.[74] Since many of these studies may have results which were biased against school inputs,

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[72]Ibid., p. 168.

[73]For summaries of other reports not sighted see the literature surveys in: Guthrie, "A Survey of School Effectiveness Studies ,"; and Katzman, pp. 35-45.

[74]For example: Burkhead; Cohn; Coleman; Keisling; Peaker; Raymond; and Wiseman.

this type of consistant results was even more striking. Other significant school input measures have been found as well, but no consistant pattern over all of the literature in the field is easily distinguishable. Such variables as class size, and student-staff ratios, representing the amount of contact between students and staff have been significantly related to test scores in some studies and insignificant in others. Variables measuring school service components, such as building age, science laboratories, and library books per pupil have been both significant and insignificant in various reports.

Another fairly consistant result of particular interest because of its applicability to this research project has to do with results using rural samples in contrast to results with urban samples. The Fels Institute Report and Burkhead's study both used separate rural and urban samples. Both found that the socio-economic background measures were far less signficant in the rural samples than in the urban samples. This finding was partially attributed to the assumption that the data from urban areas fits the school districts and student samples better than the data from the rural areas fits its sample. This may be true, but an alternative hypothesis could be postulated. The influences of student's socio-economic background are usually divided into three components, the student's home and family environment, his community environment, and the influences of his peer group. In a rural community, the home and family influences may be just as strong as in an urban area, but it can be hypothesized that the influences of the community and peer group might be less significant. Urban areas can generally be divided into communities

using socio-economic criteria. The poor minorities tend to cluster in central city ghettos. The middle and upper classes live in the suburbs. These communities are generally homogenious along socio-economic lines. Consequently, students attend schools with other students, peers, who come from the same community and the same family background. However, in rural communities all of the students, no matter what their family income, race, or other socio-economic background might be, live in the same community. They all attend the same school, so their peers come from a wide range of backgrounds. It seems possible that the influence of a rural student's community and peers might be less than for an urban student.

Even if the social influences are as strong in rural areas, it can be hypothesised that they are not the same. In urban areas almost everything a student comes in contact with probably has similar influences on the student. In other words, the socio-economic causal forces have the same direction of effect. This would explain why Burkhead could use only one socio-economic variable, the median family income of school districts, in his urban studies, and get such significant and large relationships with it. In rural areas, students come in contact with people and community influences from a variety of backgrounds, particularly in school. It seems that the socio-economic influences in rural communities would have a broadening rather than a concentrating effect. This might allow schools to have more influence on students in rural areas. This proposition is supported by several studies that used rural data. The Project Talent data, for example, was gathered from rural schools and all of the

studies that used this data found significant school influences.

Even with the criticisms of the Coleman Report, the large number of studies that have found schools to be important influences on output, the consistant findings of important teacher influences on output, and the possibility of more significant school effects in rural areas, the most consistant and important result of all of this work is that the socio-economic influences on student performance were larger and more significant than the school influences. However, the school influences are probably more important than Coleman, Jencks, Burkhead, and others reported them to be.

In general, many in school variables appear significant but in comparison with socio-economic background their importance appears minimal. Some expenditures on particular inputs probably will influence test scores but overall expenditures per pupil has generally had only a weak relationship to performance.

CHAPTER III

MODEL

This research project follows the general mode of most of the research done concerning inputs and outputs of education. That is, the purpose of the project was to test statistically, using multiple regression, the relationship between educational outputs and inputs. However, there were some basic differences between this study and others in the field which justified its undertaking.

The first, and most important difference has to do with the data used as the measures of school inputs to education. School inputs were represented by a fairly detailed breakdown of school budgets in this analysis. Other studies have used certain expenditure components such as teachers' salaries to represent school inputs and several studies used total expenditures, but no study has been found which used a detailed disaggregation of school budgets into several components used by school budget planners. Although there were several ways to measure school inputs, using expenditure components had definite advantages. One advantage was that expenditure components are more easily quantifiable than many other measures of school inputs. Another, much more important advantage, was that expenditure variables are more meaningful from a policy standpoint than quantity variables. It seems reasonable to assume that there is a strong relationship between the quality of inputs and their

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cost. It should be of some help to education policy makers in Montana and elsewhere to find out which expenditure components are related to improvements in school outputs. School district boards of trustees do exercise considerable discretion over the relative size of various school budget components.

Another reason for using school budget components as input measures was, simply, the fact that they have not been tried. One criticism of the bulk of the research done in this area has been the inability to identify important school resources. Since the use of school budget components has not been fully exploited, it seemed appropriate to try them to see if they were better proxies for school inputs than other measures.

This study also differs from many others in the sample used. The sample consisted of students that entered the University of Montana in the fall of 1972, after graduating from public schools in Montana. Other studies, such as those using Project Talent data, looked at rural samples such as this one. Project Talent data covered rural schools from all over the country. There were interstate differences, such as school laws, which may have had some influences on school performance. This sample avoided this potential problem. Studies which looked at rural samples indicated that the socio-economic background of students may not be as important an influence on performance in rural areas as it is in urban areas. There were only a small number of studies which used a rural sample from one state. These samples still differ from this sample in some respects. The Fels Institute study looked at a rural sample from Pennsylvania and

the Raymond study used only students from West Virginia. Although this was only speculation, it appeared as though these samples would have more variation in the socio-economic background than a Montana sample. Both, for example, have part of the Appalachia region within their boundaries which is reputed to be one of the poorest areas in the United States.

There was another reason why the socio-economic background of this sample might be hypothesized to have a less significant influence than the background of other samples. This sample consisted of college students only. College students tend to be from middle class or higher income families. For example, in 1967, eighty-seven percent of the high school graduates from families earning $15,000.00 or more entered college, while only twenty percent of the high school graduates from families earning less than $3,000.00 entered college.[1] Therefore, the sample should have been predominantly from middle class or higher backgrounds. It was possible that the social effects on performance were not as important as with other samples and the school effects would be more easily seen because the sample consisted of rural college students.

Another possible difference between this sample and others had to do with one of the major problems in many econometric studies involving inputs and outputs of education. There tends to be a high correlation between the socio-economic strata of school districts and the amount that districts spend on school. In Montana, this problem may not be as significant. For example, the school districts at the lower end of the socio-economic scale, using income, education level, employment, minority

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[1]Jencks, p. 20.

race, and other common measures of background as criteria, appeared to be on or near Indian reservations. However, the various programs of government support for education in these dirstricts brought them up to a spending level equal to or in many cases higher than districts that were higher on the social scale.

There were definite differences between the school input measures employed in this study as compared with others and possible differences in the sample. These were the primary reasons for doing the research.

The educational output measures employed in the analysis were college grade point averages (GPA) and the scores from the four parts of the American College Testing Program (ACT) tests, English, mathematics, social science, and natural science, as well as the composite or average ACT score. The ACT tests are required by the University of Montana of all first time entering college students because they are suppose to predict college performance.[2] Both the ACT scores and cumulative college GPA may be considered measures of the adequacy of students' preparation for higher education, although ACT scores may be a more comprehensive measure of the quality of education received. However, the results of this analysis probably can only be applied to college bound students from Montana schools.

Statistical analysis was used to test the relationship between these output or quality measures of education and several input measures.[3]

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[2]GPA regressed on the four ACT scores for the sample used resulted in an R^2 of .256.

[3]Detailed lists of the variables used and the reasons for choosing the variables are in the data chapter, Chapter Four.

The school budget components were the most interesting. However, budget variables do not measure all of the effects of schools on their students. Therefore, several non-budget variables concerning the number of classes available for students in the various college preparatory curriculums tested by ACT and the number of teachers available for students were also used.

Even though there have been indications that the socio-economic background of students may not have as much influence on student performance in rural areas or that variables used to measure background effects in urban areas do not work as well in studies using rural samples, an attempt to account for the social effects on performance had to be made. Therefore several social strata measures that had been found to be important in other studies, as well as others which appeared as though they might be important with this Montana sample, were used as input measures.

To establish the effect of these inputs on the outputs of school, it must be assumed that output, O, is functionally related to inputs, I.

$$O = f (I)$$

In this case, school inputs consisted of budget items, B, and non-budget measuers, N. It has been well established that the socio-economic background, S, of students also effects how well a student performs. Therefore, the inputs to education measured in this study should be functionally related to the outputs.

$$O = f (B,N,S)$$

To test this relationship multiple regression was used. That is:

$$O = a + b_1 B + b_2 N + b_3 S$$

This tests the linear relationship between the output or dependent variables and the input or independent variables. Since it is possible that this functional relationship is not linear, various functional forms were tested as well. These tests were made because most research in this field has assumed a linear relationship between school inputs and outputs. Since many studies found school inputs to have minor influences on outputs using linear relationships, it is possible that this assumption was incorrect. School inputs may be significantly related to outputs, but the relationship may not be linear. This was another reason for carrying out the analysis.

This has been a brief discussion of the statistical model and tests made. More detailed discussions follow. The primary reason for doing the research was the nature of the school inputs, specifically budget components. The use of a different sample was a secondary justification, as were the tests of different functional forms made.

CHAPTER IV

DATA

Data for variables measuring three different aspects of this analysis was needed. Measures of educational output, school inputs to education, and the socio-economic strata of school districts were necessary.

The scores from the four sections of the ACT as well as the composite score were kept on cumputer tapes by the University of Montana Registrar's office. This tape also had students' cumulative GPA, a code for the high school from which students graduated, student identification numbers, and several other items concerning each student. Since the last three digits of students' identification numbers indicate the quarter and year a student entered the University, any information on the tapes for a given entering class could be obtained. Therefore, the ACT scores, cumulative GPA, high school code, and student identification numbers of all students entering the University during the fall term of 1972 were printed out for use in this analysis. The identification numbers were needed to obtain any missing ACT scores from files kept by the Admissions' office.[1] The ACT scores and GPA constituted the educational output measures. The high school code was needed to match the outputs with the input and social

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[1]After the ACT scores were obtained from the files in the Admissions office all personal references, identification numbers, were discarded.

data from the school districts.

The entering class of fall quarter of 1972 was chosen as a sample to maximize the availability of needed data such as school budget information. Also, with fall of 1972 data the GPA could be based on four academic quarters since the information was obtained in the spring of 1974. If fall 1973 data had been used only one quarter of GPA would have been available. A fall quarter entering class was the optimal sample for two reasons. First, it provided a large enough sample for the statistical analysis employed, much larger than other quarters would be, and second, a higher percentage of the sample graduated from high school the previous spring and would, therefore, fit the high school budget data better. Budget data was obtained for the four academic years preceding the samples' enrollment at the University of Montana.

Included in the sample were students who graduated from high schools outside of Montana, students from private schools in Montana, students that had not graduated from high school but took the General Educational Development Test, GED, and students that had attended another college and transferred to the University of Montana. Nearly all of these observations were eliminated from the sample. The first three groups were easily eliminated, using the high school codes. The last group, transfer students, did not have ACT scores recorded if they took more than forty-five credits at another college and were, therefore, easily recognized. Although other transfer students, with less than forty-five credits from another college probably remained in the sample, their numbers were small

and the only way to find them would have been to examine each student's file.[2] After eliminating these four groups of students, 866 observations from 107 public schools in 103 Montana high school districts remained to be used as measures of educational output.

All data to be used as school inputs to education was obtained from three reports that school districts are required by law to file with the state Superintendant of Public Instruction. Budget components were taken from the Budget and Application for Tax Levies forms, and Trustees' Report. The Budget and Application for Tax Levies were used by school administrators to estimate their budget for the upcoming year. To aid in this estimation procedure there was an area on the form for the actual budget components from the previous school year. There were also areas to record the number of teachers employed and the "Average Number Belonging", ANB. ANB is the term used for the average number of students attending school each day. Therefore the budget component figures, number of teachers, and ANB for the 1969-70, 1970-71, and 1971-72 school years were obtained from the 1971, 1972, and 1973 Budget and Application for Tax Levies. Because of a change in the report format, the number of teachers was not available on the 1970 form for the 1968-69 school year. Since the previous years' budget was not a required part of these forms, in many cases the budget components could not be obtained from them. However, the County Trustees are required to file the Trustee's Report at the end of

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[2]University of Montana Admissions officials felt that the number of transfer students still in the sample would be quite small.

each school year. This report has the actual budget for the school year on it, disaggregated by the same components as on the Budget and Application for Tax Levies. Whenever the budget components were not recorded on one report, they were on the other.[3]

Schools are also required to send class schedules to the Superintendant's office each year. The number of classes in English, mathematics, social science, and natural science, the four areas tested by ACT, were counted from these class schedules. Two potential problems did arise with these variables. First, the class schedules used were for the 1973-74 school year since only the most recent schedules are retained by the Superintendant's office. Earlier class schedules are discarded. However, interviews with school officials from several high school districts indicated that the number of classes offered in these four areas had not changed significantly over the last few years. The second potential problem was that some of the classes were difficult to classify just by the name of the class. The number of these classes was small, however, compared to all of the class names that were obvious.

Along with the number of classes in the disiplines tested by ACT for each high school district in Montana, the expenditure figures for these budget components were obtained:

1. administrative salaries

2. principals' salaries

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[3]A copy of the General Fund Budget section of the Budget and Applications for Tax Levies is in Appendix 2. The General Fund Budget section is the same for both the Budget and Application for Tax Levies and the Trustees' Report.

3. teachers' salaries

4. clerical salaries

5. textbooks

6. teaching supplies

7. other instructional expenditures

8. library salaries

9. library books and periodicals

10. total operation of plant

11. total maintenance of plant

12. student body and auxiliary services

13. new equipment

Other reported information needed as data was:

14. number of teachers

15. total ANB

16. special education ANB

All of the budget components which could be reasonably hypothesized to have some influence on educational output were chosen. It was assumed that the expenditures per pupil on a school input correlated highly with the quality of the input.

It was hypothesized that quality administrators effect output in several positive ways since administrators make many of the final decisions concerning budget, teacher hiring, textbooks, and so on. Administrative salaries were used rather than total administrative expenditures because salaries are easier to interpret than the other components of administrative expenditures. All of the budget components classified

as instructional expenditures on the forms were obtained since higher quality instruction should have the most direct effect on student performance. The instructional components were principals' salaries, teachers' salaries, clerical salaries, textbooks, teaching supplies, and other instructional expenditures. The effect of clerical services on performance was difficult to hypothesize, but since it was classified as an instructional expenditure it was retained. The quality of school library services should assist students in improving their knowledge and therefore their test scores.

Two alternative hypotheses were postulated for the effect of the quality of operation and maintenance of plant. If more was spent on school upkeep, the environment for students might be more conducive to study and, therefore, improve performance. Alternatively, if more was spent for upkeep it may indicate that the school building was old and run down. In the latter case, the study environment could be poor and have a negative effect on performance. Student body and auxilary expenditures consists of the expenditures for extra-curricular activities. Again, two hypotheses seemed possible. It has been claimed that students enjoy school more when extra-curricular activities are available to them and therefore perform better. It also seems possible that participation in extra-curricular activities might take away from study time and hinder performance. New equipment included such things as audio-visual equipment and office equipment for business classes. These instructional aids should improve educational output.

There were two reasons for obtaining data on the number of teachers.

First, average teachers' salaries had been significantly related to per-
formance in other econometric analyses of educational inputs and outputs.
The number of teachers was needed to compute this variable. Second,
various measures of teacher-student contact has been significant in
various studies. One measure of teacher-student contact is the ratio
of teachers per students in schools.

The ANB figures were needed to standardize all of the other school
variables.[4] Since the size of the school districts and their budgets
vary widely, the budget components and number of classes had to be stan-
dardized on a per student basis so they could be compared. However, stan-
dardizing the budget components took away all of the influences that the
size of school districts may have on performance. Since ecomonies of
scale were possible in education, the ANB figures were also needed to
test for these size influences.

Data from the 1970 Census of Population and Census of Housing was
obtained to measure the socio-economic strata of school districts. Census
data does not conform to school district boundries, but there was no
compilation of social data for school districts in Montana. Census data
was all that was available, and the 1970 census fit the sample best. An
attempt was made to fit school districts to their socio-economic strata as
accurately as possible. Therefore data was obtained for all of the coun-

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[4]ANB is calculated by using the number of students enrolled in
school, minus the number of absentees. A 180 day average is taken. How-
ever, special education ANB is calculated differently. For each special
education student in school, fifteen ANB can be added. Therefore, to get
a more accurate figure on the number of students in schools the special
education ANB was subtracted from the total ANB.

ties with school districts from the sample in them, and for all communities in these school districts with populations of 2,500 or more. Census data is not compiled for communities with populations less than 2,500. Data was taken from the appropriate census concerning these topics:

A. Number of Inhabitants[5]

    1. 1970 population

    2. percentage change 1960-70

    3. total urban

    4. total rural

B. General Population Characteristics[6]

    5. Indian population

C. General Social and Economic Characteristics[7]

    6. residence in same house in 1965

    7. number of adults 25 and over

    8. median school years completed by adults 25 and over

    9. males in civilian labor force

    10. females in civilian labor force

    11. total employment

    12. employed in public administration

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[5]U. S. Bureau of the Census, Census of Population: 1970 Number of Inhabitants, Final Report PC(1)-A28 Montana (Washington D. C. : U. S. Government Printing Office, 1970).

[6]U. S. Bureau of the Census, Census of Population: 1970 General Population Characteristics, Final Report PC(1)-B28 Montana (Washington D. C. : U. S. Government Printing Office, 1971).

[7]U. S. Bureau of the Census, Census of Population: 1970 General Social and Economic Characteristics, Final Report PC(1)-C28 Montana (Washington D. C. : U. S. Government Printing Office, 1971).

13. total number of families

14. median family income

15. with wage or salary incomes

16. with farm self-employment income

17. with non-farm self-employment income

18. percentage of persons with income less than the poverty level

D. Detailed Housing Characteristics[8]

19. No completed bathroom or used by another household

E. General Housing Characteristics[9]

20. all housing units

21. 1.01 or more persons per room

22. kitchen used by another household

23. no kitchen

24. mobile home or trailer

25. median value of owner occupied units

26. median rent of renter occupied units

From this data the following potential variables were calculated

for each school district:

1. percentage change in population from 1960 to 1970

2. percentage of the population not in communities over 2,500

3. percentage of the population in the same house in 1965

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[8]U. S. Bureau of the Census, Census of Housing: 1970 Detailed Housing Characteristics, Final Report HC(1)-B28 Montana (Washington D. C. : U. S. Government Prinjng Office, 1971).

[9]U. S. Bureau of the Census, Census of Housing: 1970 General Housing Characteristics, Final Report HC(1)-A28 Montana (Washington D. C. : U. S. Government Printing Office, 1971).

4. median school years completed by adults 25 and over

5. percentage of civilian labor force which was female

6. percentage of total employment in public administration

7. median family income

8. percentage of families with wage or salary income

9. percentage of families with non-farm self-employment income

10. percentage of families with farm self-employment income

11. percentage of persons with income less than the poverty level

12. percentage of households with no completed bathroom or with a bathroom used by another household

13. percentage of households with 1.01 or more persons per room

14. percentage of households with no kitchen or with a kitchen used by another household

15. percentage of housing which was mobile home or trailer

16. median values of owner occupied units

17. median rent of renter occupied units

18. percentage of the population which was Indian

These potential variables were chosen because they represented parts of the socio-economic background of the students that might influence a student's performance. The percentage change in population could have indicated something about the economic well being of the community as well as its social stability. Other studies have shown the economic background of a student to be significantly related to student performance. The percentage of population that was rural could have been an important background measure because there is such a large rural population in Mont-

ana. Other studies indicated that the background of rural samples does not have as significant an effect on performance, or at least has a different sort of effect, when compared to the effect of the background of urban samples. This measure of the amount of rural population in a school district could have been a proxy for the different social effects on performance for rural and urban students. The percentages of families with farm or non-farm self-employment income were chosen for similar reasons. Agriculture is a major industry in Montana, and this rural life style may have influenced performance.

Two variables were chosen because it seemed that the mobility or lack of mobility of the population in a school district might influence the performance of some students. The variables were the percentage of the population living in the same house in 1965 and the percentage of housing which was mobile home or trailer. The change in population might be a measure of the same thing. If students moved from one school to another it was possible that they would not perform as well as students who stayed in one school and followed one program of study.

The median school years completed was chosen because the education level of students' parents had been found to be significant in other studies. If students' parents were well educated it followed that they might help their children much more than poorly educated parents. Also the students' home environment might have been different depending on their parents' education. The percentage of the civilian labor force that was female was chosen because it seemed possible, with more women working and therefore fewer women at home, that the children of these wo-

men might not perform as well because their mothers were not home to work or play with them. The opposite might have been true as well. If a mother worked, the family income might have been higher and therefore the student's home environment might be better.

Several housing variables were calculated because the home environment has been demonstrated to be an important influence on performance in other studies. The quality of housing is an indicator of socio-economic strata. The bathroom, kitchen, and persons per room variables were commonly used measures of poor housing. The median value and median rent variables should have taken all the conditions of homes into account and therefore been an overall measure of housing quality.

Several income variables were obtained as well, since economic standing has been shown to be very influential on student performance in a number of studies. Median family income was probably the best measure of the overall economic standing of a community available for this study. The percentage of persons with income less than poverty level could have been significantly and negatively related to performance. If school districts had more persons from lower strata, students might not have performed as well. The poverty level variable along with the farm and non-farm self-employment, and wage and salary variables represented different economic groups in the school districts.

The racial make-up of school districts has been a significant variable in past studies as well. In Montana, the only racial minority of any significant size is Indian. Therefore this variable was included.

Communities with county, state, or federal government agencies located in them have an additional economic base above other similar commu-

nities. They also may have more political influence. It seemed possible that with these advantages a better community environment may result. The public administration variable was included for this reason. Better communities have high performance students.

All of these socio-economic variables were adjusted to fit the school districts as well as possible. In the case of county wide school districts, county data was used. There are a number of Montana high school districts which encompass entire counties. County data was also applied to school districts in counties with no communities with 2,500 people or more, but with more than one district in the counties. This was necessary because the census does not report for communities with populations under 2,500. The variable, percentage change in population, was the only exception to this procedure. Total population and change in population were reported for several smaller communities. This variable was adjusted in the same way as data was adjusted in counties with more than one school district and communities with 2,500 people or more, as descibed below.

In counties with two or more school districts and at least one community of 2,500, an attempt was made to adjust the data to fit the school districts. It was assumed that total ANB for a county and county population were proportioned approximately the same by school district.

The first step in adjusting the variables was to subtract the city data from the county data. The resulting data would fit the rural section of the county. The resulting rural data was applied to all school districts in the county not containing a community with a population of 2,500

or more. Since there are rural students as well as urban students in districts containing communities of 2,500 or more, a method of taking this into account seemed appropriate. This was done by deriving weights to apply to the urban and rural data. This is why the assumption that ANB for a district was proportioned the same as the district population was made. The portion of total county ANB in the urban districts, A, was calculated. The portions were applied to county population, CP, to estimate the school districts' population, DP.

$$A \times CP = DP$$

The population of the urban community involved, UP, was compared to the estimated population of the school districts. The weights to be applied to the urban and rural data were derived from this comparison. The proportion of the estimated population in the urban area, UW, was used as the weight for the urban data.

$$UP \div DP = UW$$

The proportion not in the urban area, RW, was the weight applied to the rural data.

$$1 - UW = RW$$

When each variable was calculated for a school district containing a large community, the urban weight was multiplied times the urban data, UD, and the rural weight was multiplied times the rural data, RD. These were added to obtain the district variable, V.

$$UW \times UD + RW \times RD = V$$

This procedure was followed to obtain all the variables for multiple district counties with one or more communities of 2,500 people, as well as the percentage change in population variable for several of the rural dis-

tricts. All of the variables measuring educational output, school inputs, and socio-economic background were retained for analysis.

CHAPTER V

ANALYSIS

Before testing the hypothesis that school inputs, measured by
budget components, effect school output, measured by ACT scores and
cumulative college GPA, the data had to be examined using various statis-
tical tools. This examination was carried out for various reasons. For
example, several variables had to be eliminated before testing the hypoth-
esis using multiple regression.

The six potential output measures were examined first. Since vari-
ables must vary in regression analysis, a test of the significance of the
variance of these potential dependant variables seemed appropriate. If
any of these variables did not vary significantly they would have been
eliminated from further consideration. One method of testing variance
is analysis of variance.[1] This seemed the most appropriate approach to
this question given the availability of computer facilities and the method
used to store the data on the computer.

One readily available classification for analysis of variance was
the size of school district from which the student came. The size class-

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[1]This statistical test was also an indirect test of the hypothesis.
If no significant variance for these output measures could be found, this
would have indicated that nothing in the school districts effected school
output, including school inputs. This would only be an indication, how-
ever, and several other tests would had to have been performed to verify
it.

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ifications used were those used by the school foundation schedule in

Montana.[2] The F-test for the significance of the variance of the dependent variables using five classes with four and 861 degrees of freedom are given in Table 1 in the column for test one. Only the mathematics ACT scores varied significantly at the one percent level of significance. English was not significant at the five percent level, but it was at ten percent.

Since these results were not satisfactory, another classification was tried. When the five foundation schedule classifications were used there were 36, 69, 51, 115, and 595 observations in the classes. The largest size classification had over half the observations in it. To break up this classification, students from multiple high school districts were placed in a sixth classification. Classes one through four remained the same; classes five and six had 269 and 326 observations respectively. The F-test with five and 860 degrees of freedom are in Table 1 under test two. The results changed only slightly. Again, mathematics ACT was significant at one percent and English ACT was significant at the ten percent level.

Since size classifications did not indicate significant variance for most of the potential dependant variables, another classification system was tried. The five ACT scores were classified by GPA. First, a dis-

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[2]The school foundation schedule has seven size groupings. However, none of the students in this sample came from school districts in the two smallest classifications, zero to twenty-four ANB, and twenty-four to forty ANB. Therefore, the size classifications for this analysis were forty to 100 ANB, 101 to 200 ANB, 201 to 300 ANB, 301 to 600 ANB, and 601 or more ANB.

tributional graph of GPA's was prepared.[3] The GPA classifications were established after examining this distribution. Five classifications were chosen so each would consist of approximately the same number of students over a similar range of GPA.[4] With five GPA classifications, all of the F-tests indicated highly significant variance at the one percent level. The F-tests with 4 and 861 degrees of freedom are in Table 1 under test three.

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[3]GPA was divided in units of tenths so all GPA between zero and .1 were in a group, followed by GPA between .1 and .2, on up to GPA between 3.9 and 4.0 with a final group of 4.0 GPA's only. The distribution of GPA for this sample was:

NUMBER
OF
STUDENTS

GPA
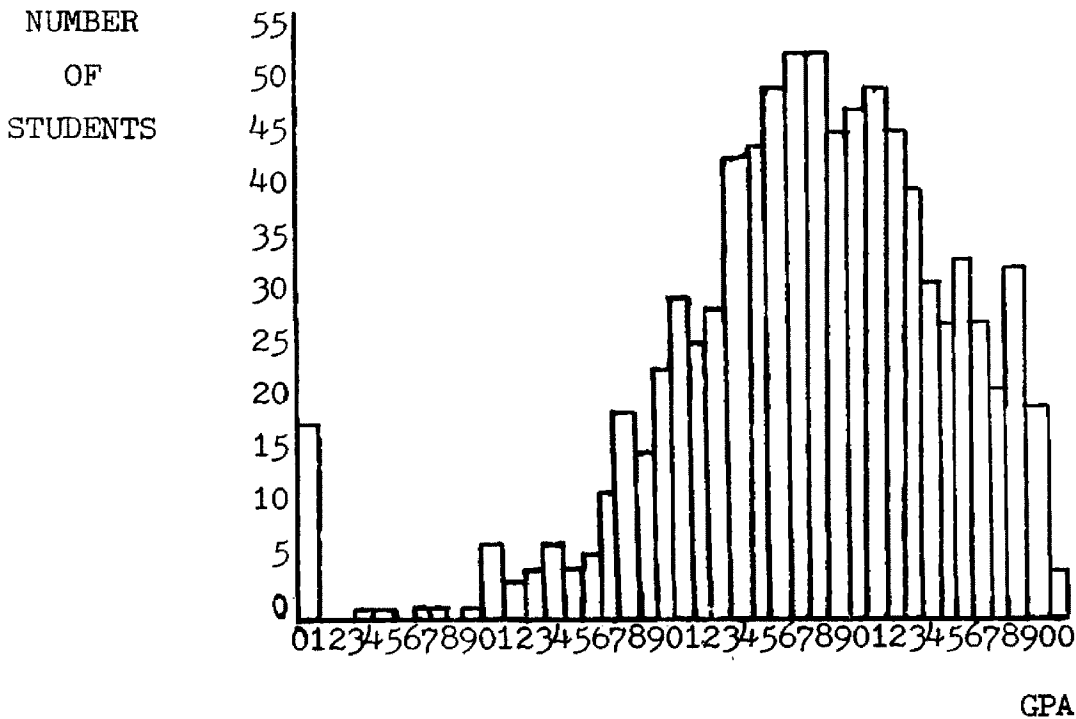
[4]The five GPA classifications for analysis of variance were GPA less than 1.700, GPA greater than or equal to 1.700 and less than 2.300, GPA greater than or equal ot 2.300 and less than 2.800, GPA greater than or equal to 2.800 and less than 3.300, and GPA greater than or equal to 3.300.

TABLE 1

ANALYSIS OF VARIANCE OF SCHOOL OUTPUT DATA

Output Variables	F-Tests		
	Test 1	Test 2	Test 3
GPA	0.915689	0.899633	. . .
English ACT	2.25926	2.13332	54.4702[a]
Mathematics ACT	3.65098[a]	3.27844[a]	38.1998[a]
Social Science ACT	0.727446	0.846174	48.2616[a]
Natural Science ACT	1.13878	1.68024	27.0276[a]
Composite ACT	2.03782	1.81882	63.2121[a]

a - significance level of one percent

Since the dependent variables did vary significantly, the next step was to check the type of relationships that existed between the dependent variables, using multiple regression. First GPA was used as the dependent variable and regressed on the four ACT scores, leaving composite ACT scores out since it is an average of the other four. The analysis was undertaken to indicate the strength and significance of the relationship between GPA and ACT scores. The regression results, with E, M, S, and N representing English, mathematics, social science, and natural science ACT scores respectively, were:

$$GPA = 1027.47 + 46.8473E + 23.0314M + 28.2635S + (-16.8188)N$$
$$ 9.45756 \quad 7.4696 \quad 5.20839 \quad 5.27523 \quad -2.89314$$

$R^2 = 0.257384$
$F = 98.9517$

The regression was significant at the one percent level and the T-tests

indicated that all of the ACT scores were significantly related to GPA.[5]

The next step was to check for the relationships between the ACT scores.

The results were:

$$E = 7.73571 + 0.115539M + 0.30058S + 0.130578N \qquad R^2 = 0.409723$$
$$14.6539 \quad 4.8771 \qquad 11.0362 \quad 4.1776 \qquad\qquad F = 299.165$$

$$M = 1.89648 + 0.232417E + 0.695782S + 0.58832N \qquad R^2 = 0.446827$$
$$2.27315 \quad 4.87711 \qquad 1.68878 \qquad 14.6922 \qquad\qquad F = 348.141$$

$$S = 1.8724 + 0.411876E + 0.473945M + 0.47733N \qquad R^2 = 0.532306$$
$$2.72289 \quad 11.0363 \qquad 1.68877 \qquad 14.3828 \qquad\qquad F = 490.543$$

$$N = 3.95784 + 0.151598E + 0.340405M + 0.405457S \qquad R^2 = 0.591945$$
$$6.36232 \quad 4.17767 \qquad 14.6922 \qquad 14.03828 \qquad\qquad F = 625.231$$

There appeared to be no highly distinguishable relationships that would indicate that any of the potential dependent variables should have been eliminated. Therefore, all six potential dependent variables were re-tained to be used in the final analysis.

At this point, the potential independent variables were examined. When referring to these variables in tables the following codes will be used.

Socio-economic variables:

CP--percentage change in population from 1960-70

RU--percentage of the population in rural communities (not in communities with more than 2,500 people)

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[5]It was interesting to note that GPA at the University of Montana with this sample was negatively related to natural science ACT scores and significantly so.

SH--percentage of the population in the same house in 1965

MS--median school years completed

FL--percentage of the civilian labor force which was female

PA--percentage of total employment which was in public administration

MY--median family income

WY--percentage of families with wage or salary income

NY--percentage of families with non-farm self-employment income

FY--percentage of families with farm self-employment income

PY--percentage of persons with income less than the poverty level

NB--percentage of households with no completed bathroom or with a bathroom used by another household

PR--percentage of households with 1.01 or more persons per room

NK--percentage of households with no kitchen or with a kitchen used by another household

MH--percentage of housing which was mobile home or trailer

MV--median value of owner occupied units

MR--median rent of renter occupied units

IP--percentage of population which was Indian

School Input variables:

AS--administrative salaries per ANB

PS--principals' salaries per ANB

TS--teachers' salaries per ANB

CS--clerical salaries per ANB

SU--expenditures for teaching supplies per ANB

TB--expenditures for textbooks per ANB

OE--other instructional expenditures per ANB

LS--library salaries per ANB

LB--expenditures for library books and periodicals per ANB

OM--expenditures for operation and maintenance of plant per ANB

SA--expenditures for student body and auxiliary services per ANB

NE--expenditures for new equipment per ANB

TE--number of teachers per ANB

EC--number of English classes per ANB

MC--number of mathematics classes per ANB

SC--number of social science classes per ANB

NC--number of natural science classes per AN3

Because of the sample size and computer time constraints, there were too many independent variables to work with. However, it appeared as though interrelationships probably existed between several of the socio-economic variables. Since this could cause multicollinearity, steps were taken to eliminate several of these variables. First, analysis of variance was performed on each socio-economic variable using both of the school district size classifications used in analyzing the dependent data. Table 2 contains the resulting F-tests, all of which have five and 101 degrees of freedom. Using a five percent significance level as a criteria, the non-farm income, public administration, persons per room, and mobile home variables were eliminated from further consideration.

The remaining variables were divided into three groups made up of variables that could reasonably be hypothesized to be related. These groups consisted of 1) housing variables, 2) family background and income vari-

TABLE 2

ANALYSIS OF VARIANCE OF SOCIO-ECONOMIC DATA

Variable	5 Classifications	6 Classifications
CP	5.34962^a	6.11904^a
RU	$6.44017E+1^a$	$5.32862E+1^a$
SH	6.18136^a	6.06245^a
MS	4.83594^a	5.55049^a
FL	$1.13786E+1^a$	9.89722^a
PA	2.699^b	2.12346^c
MY	9.48114^a	7.79159^a
WY	9.90364^a	8.36231^a
NY	1.54364^c	1.32894^c
FY	$1.56114E+1^a$	$1.27366E+1^a$
PY	4.6077^a	3.67091^a
NB	$1.30805E+1^a$	$1.1066E+1^a$
PR	1.30299^c	1.03246^c
NK	4.58994^a	3.87237^a
MH	0.794079^c	0.66074^c
MV	$1.5085E+1^a$	$1.65273E+1^a$
MR	$1.03845E+1^a$	$1.51128E+1^a$
IP	3.35274^b	2.65616^b

a - significant at one percent
b - significant at five percent
c - not significant

ables, and 3) population variables measuring population shifting and rural-urban standing.[6] The statistical procedure followed to eliminate

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[6]The first group consisted of the bathroom, kitchen, median value, and median rent variables. Group two included the median income, wage income, farm income, and poverty level variables as well as the median school years, female labor force, and Indian population variables. The

socio-economic variables from further consideration was the standard procedure used to eliminate variables causing multicollinearity. Each group of variables was examined individually. Each variable in a group was used as a dependent variable and regressed on all of the other variables in the group, acting as independent variables. The dependent variable with the highest R^2 was eliminated since it was the variable most significantly related to the other variables in the group and therefore the variable causing the most multicollinearity. After eliminating one variable from each group, the same process was repeated. Each of the remaining variables was regressed on the others in the group and the dependent variable with the highest R^2 was eliminated. This procedure was continued until two variables remained in each group.[7] The remaining six socio-economic variables, two from each group, were retained for the hypothesis testing phase of the analysis. The variables were:

1. percentage change in population from 1960 to 1970

2. percentage of the population not in communities with more than 2,500 people

3. percentage of the civilian labor force which was female

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third was made up of the change in population, rural population, population in the same house, and farm income variables.

[7]One exception to this procedure was made. Although the test rule indicated that the median value variable should have been eliminated from the housing group, the median rent variable was eliminated instead. The two variables were highly correlated with each other but the median value variable resulted in a slightly higher R^2 when it was used as a dependent variable. The median value variable was retained because its relationship to the output measures could be more easily hypothesized, since the median value of homes probably represents housing quality of a school district better than median rent.

4. median family income

5. percentage of the households with no kitchen or with a kitchen used by another household

6. median value of owner occupied units

The school input data was examined as well. Although all of the variables were of interest, analysis of variance was performed on each to find out if there were strong indications that any of the variables should have been eliminated. The analysis of variance was done using five school district size classifications for each variable for each of the four years of data. Six size classifications were used for the 1972 data with similar results to tests using five classifications. The test results are shown in Table 3 under the appropriate columns. None of the variables were eliminated immediately, although the results for the clerical salaries, library salaries, and auxiliary services variables indicated that further examination of these variables was necessary.

Four years of budget data had been obtained for school districts. If the budget components differed from one year to the next, they could have a different relationship to output from one year to the next. Therefore, analysis of variance was used to check for a difference or variation in each variable from year to year, using the four years as classifications. Since there were significant differences in spending over time, the next step was to see if this difference resulted from inflation. As a preliminary test, each successive year was deflated by seven percent. This seven percent figure was chosen since that was the permissive levy increase for schools in Montana. This permissive levy did not apply to the budget years in this sample, but it seemed an appropriate preliminary

TABLE 3

ANALYSIS OF VARIANCE OF SCHOOL INPUT DATA

Variables	Size				
	Six Classes	Five Classes			
	1972	1972	1971	1970	1969
AS	$4.5111E+1^a$	$5.69416E+1^a$	$3.74627E+1^a$	$3.65879E+1^a$	$2.80888E+1^a$
PS	4.40236^a	5.55722^a	5.33104^a	2.42237^c	0.275894^c
TS	7.92289^a	6.0727^a	8.3194^a	2.21414^c	1.43625^c
CS	0.950319^c	0.801969^c	1.2647^a	0.646095^c	1.07326^c
TB	0.92864^c	1.16425^c	$1.22848E+1^a$	6.4885^a	7.56031^a
SU	4.49755^a	5.67751^a	$1.01058E+1^a$	6.27376^a	6.43214^a
OE	2.1801^c	1.76546^c	5.52476^a	4.1894^a	3.15085^b
LS	1.22101^c	1.53422^c	1.01334^c	2.17995^c	1.64975^c
LB	$1.54327E+1^a$	$1.85421E+1^a$	$1.76122E+1^a$	$3.15403E+1^a$	$1.84338E+1^a$
OM	$2.62563E+1^a$	$3.29718E+1^a$	$3.2082E+1^a$	$1.1174E+1^a$	$1.92534E+1^a$
SA	1.50984^c	1.90211^c	0.950533^c	0.773005^c	0.689804^c
NE	2.39599^b	3.00782^b	9.04128^a	3.04056^b	6.43413^a
TE	$4.67644E+1^a$	$5.82796E+1^a$	$4.09603E+1^a$	3.35783^a	. . .
EC	$1.11353E+1^a$	$1.39376E+1^a$	. . .	. .	. . .
MC	$1.70187E+1^a$	$2.14824E+1^a$	. . .	. .	. . .
SC	$1.31237E+1^a$	$1.65497E+1^a$	. . .	. .	. . .
NC	$1.50782E+1^a$	$2.01604E+1^a$	. . .	. .	. . .

a - significant at one percent
b - significant at five percent
c - not significant

TABLE 3 — <u>Continued</u>

Time	
Not Deflated	Seven Percent Deflator
2.95091^{b}	0.359515^{c}
2.81828^{b}	0.447076^{c}
6.70327^{a}	0.932022^{c}
6.65161^{a}	2.84132^{b}
2.54992^{c}	1.021^{c}
4.32978^{a}	0.29936^{c}
2.16704^{c}	0.83515^{c}
1.06094^{c}	0.198752^{c}
1.90113^{c}	0.0454557^{c}
3.60987^{b}	0.439299^{c}
4.98526^{a}	1.44089^{c}
0.980647^{c}	2.76633^{b}
0.211462^{c}	. . .
. . . . . .	
. . . . . .	
. . . . . .	
. . . . . .	

test. When deflated by seven percent annually, most of the variance in spending over time became insignificant. The resulting F statistics for all of these tests are shown in Table 3 under the appropriate column. Since it appeared that inflation was the major cause for the differences in spending between the four years, the next step was a two way analysis of variance using five size classifications and the four years of data as time classifications. This was done first without deflating the data and then again using the deflator for state and local government purchases of goods and services.[8] Using this analysis, no deflated budget component varied significantly over time at the one percent level of significance. Every variable, except clerical salaries varied significantly by size at the one percent level of significance. The F-test results of the two way analysis of variance are shown in Table 4.

The relationship between clerical salaries and student performance had been difficult to hypothesize, and since this variable turned out to be the only variable that did not vary significantly by size at the one percent level it was eliminated from further consideration. All of the other school input measures were retained to be used as independent variables in the hypothesis testing stage of the analysis. A four year deflated average was used for all of the budget variables. A three year average of the number of teachers per ANB was used since this variable did not vary significantly over time.[9] The other four non-budget school vari-

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[8]Council of Economic Advisors, Economic Report of the President, (Washington D. C. : U. S. Government Printing Office, January, 1973), p. 197.

[9]Data for the number of teachers was only available for three years.

TABLE 4

TWO WAY ANALYSIS OF VARIANCE OF SCHOOL INPUT DATA

Variables	Not Deflated		Deflated	
	Time	Size	Time	Size
AS	7.13152^a	$1.51173E+2^a$	0.992642^c	$1.54111E+2^a$
PS	3.08203^b	$1.09204E+1^a$	0.55284^c	$1.02496E+1^a$
TS	7.9793^a	$1.48798E+1^a$	0.875139^c	$1.44015E+1^a$
CS	6.76555^a	2.81573^b	2.99269^b	2.8787^b
TB	2.64938^b	5.13457^a	1.13322^c	5.81818^a
SU	5.37645^a	$2.66242E+1^a$	0.463841^c	$2.68373E+1^a$
OE	2.38799^c	$1.18078E+1^a$	0.998496^c	$1.23642E+1^a$
LS	1.10864^c	5.76498^a	0.201049^c	5.84932^a
LB	3.34369^b	$8.14312E+1^a$	0.0862833^c	$8.08993E+1^a$
OM	6.33404^a	$8.09922E+1^a$	0.881632^c	$7.78063E+1^a$
SA	5.10436^a	3.53252^b	1.59364^c	3.4303^a
NE	1.11852^c	$1.59029E+1^a$	3.06462^b	$1.55202E+1^a$
TE	0.550264^c	$1.28374E+2^a$	.	.	.	.	.	.

a - significant at one percent
b - significant at five percent
c - not significant

ables, the number of classes in English, mathematics, social science, and natural science per ANB, were also retained. The final school budget variables were four year deflated averages of:

1. administrative salaries per ANB

2. principals' salaries per ANB

3. teachers' salaries per ANB[10]

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[10]Average teachers' salaries was tested as a variable but teachers'

4. expenditures for textbooks per ANB

5. expenditures for teaching supplies per ANB

6. other instructional expenditures per ANB

7. library salaries per ANB

8. expenditures for library books and periodicals per ANB

9. expenditures for operation and maintenance of plant per ANB

10. expenditures for student body and auxiliary services per ANB

11. expenditures for new equipment per ANB

The final non-budget school variables were:

13. three year average of the number of teachers per ANB

14. number of English classes per ANB

15. number of mathematics classes per ANB

16. number of social science classes per ANB

17. number of natural science classes per ANB

The hypothesis testing stage of the analysis involved statistically testing for relationships between the six output measures and the remaining twenty-two input measures. There were 865 observations of GPA and ACT test scores and 103 observations of school district and socio-economic variables used in the analysis.[11]

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salaries per ANB indicated much more significance. An explanation for this result is in Chapter Six, Conclusions.

[11]One output observation was eliminated from the sample. The one observation from Seeley Swan High School was the only observation from a multiple high school district that had different socio-economic background data than the other high schools in the district. All high schools in each of the three multi-school districts had the same school variables and all had the same socio-economic variables but this one. The observation was eliminated because district average output measures were regressed on district inputs as explained later. The results of these regres-

A backwards elimination regression was used for all of the hypothesis testing. This process involved regressing each dependent variable on all twenty-two independent variables. After this first regression, the variable with the least significant relationship to the dependent variable in question, judging from T-tests, was eliminated. The dependent variable was regressed on the remaining twenty-one independent variables, and the least significant variable in this regression was eliminated. This process was continued, eliminating one variable at a time, until all remaining variables were related to the dependent variable at the ninety-five percent significance level or higher.

Before proceeding with these backwards elimination regressions, several test regressions were performed to see in what form the data should be used to test the hypothesis. Regressions were performed using all 865 observations of the dependent variables and using district average dependent variables. This was done because all of the independent variables were district wide measures. There were no measures of within school district differences for school or socio-economic background effects on students. Only between school differences were measured. However, when all 865 observations were used, there were within school differences in the output measures. This disparity was taken care of by using district average output measures. By using district wide averages, district wide outputs were regressed on district wide inputs. Since the explanitory power, R^2, of the regression was much higher using district

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sions were compared to results using all 865 observations. Since this observation could not be used in the district average tests, it was eliminated from both so the results of the two tests could be more readily compared.

averages, this form of the dependent variables was used for all additional testing.[12]

Test regressions using different functional forms were performed for each of the dependent variables.[13] This was done to make the secondary tests to see if the relationship between school inputs and outputs is non-linear. Four possible relationships were tested and compared: 1) a linear relationship, 2) a Log Y transformation, 3) a Log X transformation, and 4) a Log-Log transformation. Although several other relationships could be postulated, the results from these four were sufficient to indicate a conditional acceptance of the idea of non-linearity. The functional form with the best results, the highest R^2 and most significance indicated by the F-test, were used for the backwards stepwise regressions.[14] Linear relationships were used for further tests of the GPA, mathematics ACT, and natural science ACT output measures. Log Y

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[12]Backwards elimination regressions were performed using all observations to see if different district inputs effected the within school variation in test scores than effected between school variations.

[13]Similar test regressions were performed using all 865 of the output observations, and similar results were obtained.

[14]One exception to this rule was made. The Log-Log transformation did have slightly better results than the linear relationship for GPA but a linear relationship was used for hypothesis testing. Several problems came up using Log-Log, as well as Log X, transformations. Some of the budget input variables were zero dollars for many smaller schools (library salaries, principals' salaries and others). Log zero is undefined and cannot be performed on the computer. Several school variables had to be combined to avoid this problem. Since several variables were combined, part of the original hypothesis was no longer applicable. The school in-

transformations were performed on English ACT, social science ACT, and
composite ACT output measures for all further tests.

Before testing the hypothesis that school size effects student
performance, preliminary backwards elimination regressions were used to elim-
inate independent variables with very insignificant relationships to the
output measures. The backwards elimination regressions were continued until
all of the variables remaining were related to the output measures at
approximately the eighty-three percent significance level or higher.[15]
To test for differences in school effects on performance due to district
size differences, first the regression intercepts and then each of the
remaining independent variables were dummied for size. In each case, the
five district size classifications used for analysis of variance in the

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puts were not measured by a detailed budget breakdown. Administrative and
principals' salaries were combined into one variable, as were textbooks,
teaching supplies, other expenditures, and new equipment. The operation
and maintenance variable and student body and auxilary services were also
combined. Another problem involved socio-economic variables. The rural
population variable had to be eliminated because there were zero values
involved. There were negative values in the population change variable
and since the computer cannot take logs of negative numbers this variable
was also eliminated.

[15]The variables eliminated were adding almost nothing to the ex-
planitory power of the regressions and some regressions were insignif-
icant, using the F-tests as a criteria, with a large number of insignif-
icant variables. An eighty-three percent significance level was chosen
for two reasons. First, with the degrees of freedom for these regres-
sions, the T-test for the eighty-three percent level was 1.0. This was a
convenient cut off point from a computing standpoint. The second reason
for using eighty-three percent, or at least a relatively low significance
level, was that the remaining variables were to be dummied for size.
When variables are dummied the significance of the variable can change.
It was possible that insignificant (less than the ninety-five percent
level) variables might become significant when dummied. However, it was
highly unlikely that variables that were significant at less than eighty-
three percent would become significant when dummied.

preliminary analysis were employed, necessitating four dummy variables.

The first dummy variable indicated whether a school district had less

than 100 ANB, the second indicated whether the school district had be-

tween 101 and 200 ANB, or not, and third, whether the school district had

between 201 and 300 ANB, the fourth indicated if the district had between

301 and 600 ANB. It was not necessary to create a dummy variable for the

largest size classification, over 600 ANB, because variables were created

for the other four classifications.[16]

The intercept dummies were used to test the hypothesis that all

of the variables together had different effects on student performance

for students from different sized schools, i.e., to test the hypothesis

that the size of school districts effects performance. The purpose of

the independent variable dummies was to find out if each variable affected

performance differently for different sized school districts. All of the

individual variables remaining after the preliminary backwards stepwise

regressions were dummied for size. Several variables that had been elim-

inated were brought back into the regression equations and dummied as

well. There were two primary reasons for this. Some variables were elim-

inated from the regression on a particular output measure, even though the

variable was hypothesized to be highly related to that output measure.

It was possible that dummying the variable might bring out this hypothe-

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[16]Intercept dummies consisted of ones and zeros. If the dummy
variable applied to an output measure the variable was one. If the dummy
did not apply it was a zero. Dummy variables of independent variables
consisted of zeros and X's (where X was the value of the variable being
dummied). Again, if the dummy variable did not apply to a school dis-
tric (if the district did not fall in the size class represented by that
dummy) the dummy was zero. If the dummy did apply to the school district

sized significance. One striking example of this circumstance concerns the natural science ACT output measure. The number of classes in natural science per ANB had been eliminated using the eighty-three percent criteria, but it could be reasonably hypothesized that this variable should have been signficantly related to natural science ACT scores. Therefore, the variable was reconsidered, and dummy variables were applied to it. The second reason for bringing a variable back into consideration for an output measure had to do with the variable's relationship to the other five output measures. If a variable was significantly related to most of the outputs but had been eliminated from consideration for one output measure it was reconsidered. It was hypothesized that if a variable was significantly related to most of the outputs, it could be related to all of them and dummying the variable might bring out this relationship. Teachers' salaries per ANB had been eliminated from the social science regressions, but it was significantly related to the other five outputs. Therefore, teachers' salaries were dummied for social science ACT scores. The only variable that had been eliminated but became significant when dummied was principals' salaries per ANB for English ACT scores. This indicated that the eighty-three percent cut off was appropriate.

No size dummies were significant for intercepts or independent variables for the GPA, natural science ACT, or composite ACT output measures. The median value of homes variable had significant dummies associated with it for mathematics ACT scores. The change in population

it was equal to the value of the independent variable for that district.

variable and the number of classes in natural science per ANB had significant dummies associated with them for social science ACT scores. There were significant dummies for the intercept, as well as the female labor force, principals' salaries per ANB, new equipment per ANB, and natural science classes per ANB independant variables associated with English ACT scores.

Different dummy variables for size were tried for these independent variables. It was possible that the significance of the differences in performance related to size might be picked up with fewer dummies. This would facilitate further analysis since fewer variables would take less computer time and programming for the final hypothesis testing regressions would be less complicated. Therefore, the independent variables and intercept that had significant dummies were dummied using both two and three size classifications. The dummy variable for two size classes indicated whether a school district had less than 300 ANB, or more. The two dummy variables for three size classifications indicated that a school had less than 300 ANB, or 301 to 600 ANB. It was not necessary to dummy the largest size class, 601 or more ANB. None of these dummy variables added as much to the regressions as the original four dummies with five classifications, so four size dummies were used. However, more tests were made with four dummies. To get an idea of which size classification the independent variable being dummied affected differently, different size classes were not represented by dummy variables. Originally, the largest size class did not have a dummy variable representing it. Test regressions were made to see if more significant results, or more infor-

mative results could be obtained using the largest size class as a dummy. In this case, one of the other classifications was not represented by a dummy variables. For example, the new equipment variable had one significant dummy variable associated with it when English ACT scores was the dependent variable. The variable represented the third size classification, 201to 300 ANB. This indicated that the effect of new equipment on English scores was different for students from school districts with 201 to 300 ANB than for students from districts with over 600 ANB. The effect of new equipment of English scores did not differ significantly when the first, second, and fourth size classes were compared to the largest size classification. When the third group was not represented by a dummy variable, all four dummies, representing the first, second, fourth, and fifth size classes were significant at ninety-percent or higher, indicating that the effect of new equipment on English performance was different for students from schools with 201 to 300 ANB than for students from any others size school. Conclusions of this kind were drawn from manipulating the dummy variables. The dummies with the most explanitory power were retained for the final hypothesis testing.

One other dummy variable was tested. Most of the high school districts in Montana have only one school. However, there were three large districts that had two or more schools during the time period for which data was obtained. A large part of the sample came from these three school districts. If performance in these districts differed significant-

ly from performance in the other districts, it would indicate that add-
itional information about them should be obtained, such as individual
school budgets, rather than district budgets. Therefore, a dummy vari-
able indicating if a district had multiple schools, or not, was tested.[17]
No significant dummies resulted.

At this point, all preliminary testing was complete. Backwards
elimination regressions were used to test the hypothsis that school inputs
affect school outputs, GPA, and the five ACT scores. All variables not
previously eliminated, and all significant dummy variables were regressed
on the output measures.   The backwards elimination regressions were cont-
inued, eliminating one variable at a time until all remaining variables
were significant at the ninety-five percent level or higher. The only
exception to the elimination of one variable at a time came when an inde-
pendent variable was eliminated that had dummy variables associated with
it. In this case, the dummy variables were eliminated as well.

One final set of statistical tests were performed. Backwards
elimination regressions were used for each year of school data separately.
as well as the four year deflated average data. The social variables and
the number of classes variables were not used in these tests. For each
output measure, Log Y transformations and linear relationships were test-

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[17]This dummy variable could be viewed as a social measure as well
as a school district measure since the three multiple school districts
were also the three most urbanized districts. Therefore, it also tested
for a difference in performance between the three largest urban areas and
the rest of the state.

ed, since these two functional forms gave the best results when all the data was considered. The functional form with the best results, highest R^2 and F-test, was used for the various backwards elimination regressions. These regressions were continued until all remaining variables were significant at the ninety-five percent level or higher. These tests were performed to see if the use of four year deflated averages of budget data was a proper choice. If similar or better results came from the use of the average data than from the use of the individual years, the use of the average data would be justified. There was a second purpose for performing these tests as well. It can be hypothesized that certain school inputs may effect school outputs differently during different stages of a student's schooling. For example, it could be hypothesized that extra-curricular activities, measured by student body and auxilary services per ANB, may effect seniors more than freshmen, since senior participation in extra-curricular activities is more demanding. These tests should point out significant differences in the effect of school inputs of outputs for different school years. These tests generally supported the used of four year averages, since in almost every case regressions using the average data led to better results than regressions with yearly data, or at least similar results.

The results of the analysis and conclusions drawn from the results are discussed in the next chater.

CHAPTER VI

RESULTS AND CONCLUSIONS

All of the results and conclusions of this study can only be applied to schools and students represented by the data. The output measures were measures of student preparation for college. The ACT scores may be more general measures of educational output, but since the sample consisted of only college students any application of these results to Montana high school graduates who are not college bound can be made only with extreme caution and reservation. The results should not be applied to school districts with fewer than forty students nor should they be applied to school districts with more than 6,230 students because these were the bounds of this sample data. However, the results should be of interest to public education policy makers in Montana or similar states who consider preparation for higher education to be an important output of the secondary education system in this state.

The results of the backwards elimination regressions indicated that the hypothesis, school inputs, measured by budget components affect school outputs measured by ACT scores and college GPA, should be accepted. There were several school input measures significantly related to each output measure. The final regressions of the backwards stepwise regressions for district average GPA, English ACT, E, mathematics ACT, M,

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social science ACT, S, natural science ACT, N, and composite ACT, C, output measures attest to this. The variables in these regressions were all significant at ninety-five percent or higher and the regressions were all significant at the one percent level.[1] The final regressions, after starting with twenty-two social and school variables, were:

$$GPA = 2828.03 + 8.84182AS + 12.7375PS + 2.7824TS + (-13461.5)TE +$$
$$(-16166.2)NC$$

$$R^2 = 0.24419$$

$$E = 2.77618 + (4.94051E\text{-}3)PS + (8.87265E\text{-}4)TS + (-5.79539E\text{-}3)SA +$$
$$3.50749MC + (-6.60993)NC + (-7.60894E\text{-}3)D2PS + (-1.10014E\text{-}2)D4PS +$$
$$4.43863D2NC + 3.90329D3NC + 6.94186D4NC$$

$$R^2 = 0.360861$$

$$M = 19.8779 + (-5.28203E\text{-}2)CP + (5.87057E\text{-}4)MV + (-0.105318E\text{-}2)AS +$$
$$(3.0958E\text{-}2)TS + 0.615995LB + (-151.447)TE + 92.2887MC + (-117.295)$$
$$NC + (-2.21422E\text{-}4)D2MV + (-3.10872E\text{-}4)D4MV + (-4.00732E\text{-}4)D5MV$$

$$R^2 = 0.293279$$

$$S = 2.877 + (-1.10785E\text{-}2)NK + (-8.57353E\text{-}3)SU + (6.92762E\text{-}2)LB +$$
$$(6.5297E\text{-}3)NE + 3.45961MC + (-9.80786)NC + 7.43603D2NC + 9.3201D3NC$$
$$9.77561D4NC + 14.1769D5NC$$

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[1]The codes for the independent variables are the same as the codes used in Chapter Five. Dummy variables were denoted by a D, followed by a number, one through five, indicating the size classification the dummy variable represented, and the code of the independent variable to which the dummy variable applied.

$$R^2 = 0.385549$$

$$N = 29.0583 + (-8.09371E-4)MY + 0.104626PS + (2.95013E-2)TS + (-0.110366)$$
$$SU + (-83.4007)TE + (-73.13)SC$$

$$R^2 = 0.249281$$

$$C = 3.1034 + (3.44842E-3)PS + (9.62851E-3)TS + (-5.61887E-3)SU +$$
$$(2.38468E-2)LB + (-5.23895)TE + 2.81712MC + (-3.76835)NC$$

$$R^2 = 0.255654$$

All of these regressions indicated significant school effects on educational outcome. In each case, several school inputs were related to the output measure. More weight was added to this conclusion by the regressions of the yearly budget data on the output measures. Again, several school inputs were related to outputs, and considering the exclusion of the socio-economic variables, the number of classes variables, and the dummy variables measuring the size influences, the R^2's of these regressions were fairly high. Before discussing the specific effects of school inputs on outputs the overall statistical results should be examined.

One noticeable statistical result was the relatively low explanatory power of the regressions, R^2. When these results were compared to studies using urban samples, the explanatory power of the results of this study was quite low. Several reasons for this difference can be hypothesized.

In urban studies, much of the explanatory power of the regressions came from measures of the socio-economic background of students. Studies

using rural samples, however, had similar results to this study in that little explanatory power was added by social variables. There are three possible explanations for this phenomena.[2] First, it is possible that the social variables did not accurately measure the background of the students in the sample or their school districts. It may be that the adjustments made in the census data were not sufficient to fit the school districts, or simply that the use of census data in this instance was not appropriate. In studies where census data was used with good results, the school districts tended to be more homogeneous within the district. There were ghetto districts and suburban districts in urban samples. In Montana, however, school districts were city wide and sometimes county wide. Students with a whole range of backgrounds went to one school. Students from wealthy, affluent white families were in the same school as students from poor, minority families.

When using census data, it was assumed that the background of the sample could be represented by the average background of the districts. However, the assumption may have been wrong. Montana, as well as the federal government, offers incentives for Indians to attend college, and the federal government offers incentives for students whose parents are classified as poor. There has been speculation in recent years that it is actually more difficult for middle income students to attend college

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[2]A fourth possible reason did exist for the lack of importance of the social variables. It was possible that the elimination process used for social variables was wrong and the use of other social input measures originally obtained would result in higher R^2. Test regressions were performed to check this possibility. The use of other social variables added nothing significant to the regressions.

because they do not get the financial assistance poorer students do, and
their parents cannot afford to send them as wealthier parents can.
It may be that students from wealthier backgrounds are under represented
at the University of Montana as well. More affluent families may send
their children to more pretentious colleges. In this case, the sample
could tend to be from lower than middle economic strata, and the social
data would not accurately fit its background.

A third hypothesis explaining the lack of explanatory power of
social measures could be that social background was not as important an
influence on rural students as it was on urban students, as postulated in
Chapter Two. Students' background may have a concentrating effect in
urban areas. Students from poor minority families live in ghetto type
areas and attend school with poor, predominantly minority peers. Middle
class students live in middle class suburbs and go to middle class sub-
urban schools. However, in Montana students attend school with students
from the whole range of social strata and live in small communities made
up of a wide range of social backgrounds. This may have a broadening
rather than concentrating influence.

The lack of explanatory power of the social measures was not the
only reason for low R^2's. No measure of the inherited, or innate ability
of students was available for this study. When such measures were used
in educational input-output studies they proved to be very important. For
example, Jencks reported that if genetic inheritance could be equalized
inequality in test scores would fall between thirty-three and fifty per-

cent.[3]

Another potential reason for the low R^2's was that school effects existed that were not measured. Other possible school inputs include the experience and educational attainment of teachers, principals, and administrators, as well as measures of teachers' ability. Quality measures of textbooks, libraries, and laboratories might add to the explanatory power of the regressions. Since the age of school buildings was significantly related to output in some studies, this or some other measure of the general study atmosphere may be useful.

A potential problem, which might have decreased the effectiveness of this analysis has to do with the sample. This sample consisted of students who entered the University of Montana for the first time during the fall of 1972. The budget data was obtained for the four school years previous to that. There were probably students in the sample who did not fit the budget period. They may have graduated earlier than 1972 but not entered college right away. For example, there are over 1,000 military veterans attending the University of Montana. It is quite possible that a number of these students spent from two to four years in the military immediately after high school. There may be students in the sample who transfered from other colleges as well. Transfer students with forty-five or more credits from another college were eliminated, but there may be transfer students with less than forty-five credits in the sample. However, deflated school inputs did not vary significantly over time for the data gathered. If this is true for other budget periods this problem

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[3]Jencks, p. 109.

should not be significant.

One other problem may exist because of the sample used. This sample consisted of college students only. However, the school inputs affected all of the students in school. Perhaps if budget components could have been disaggregated so component expenditures on the college preparatory courses could have been regressed on the output measures of this sample, better results would have been obtained. Alternatively, if output measures of all graduating seniors could have been obtained, the inputs used in this analysis might have explained more of the variance in output.

The explanatory power of the regressions was much higher using district average output measures than it was when all 865 output observations were regressed on inputs. When using averages, the within school variation was removed, and the between school variation was tested. Since all the data used as independent variables was district wide data, it follows that these variables would have a more significant effect on the between school variations. Both between and within school variations were present in school outputs using all of the obervations but there were no independent variables which measured within school differences in the effect of school on students. When district average outputs were used the within school variation was eliminated so between school variations in school outputs were related to between school differences in inputs. The results should have been better using the district average output measures.

This leads to a suggestion for further study. If the total effect

of schools on students is to be estimated, measures of the effect of each school on each of its students must be found. Possible variables might measure the effect of tracking, such as college preparatory or vocational. In Montana, a student can generally take chemistry or vocational agriculture, algebra or business mathematics, and so on. The classes a student takes may have a significant effect on how well a student performs. Other possible within school effects might be a student's participation, or lack of participation, in sports, speech, drama, music, student government, or other extra-curricular activities. The distance, or travel time to and from school may be important in rural school districts. Other measures of within school effects of school on students could be hypothesized as well.

The secondary tests to see if the relationship between school inputs, and outputs was non-linear was conditionally accepted. Tests indicated that school inputs affected different outputs in different ways. For some output measures, the relationship may be linear. The best results for mathematics ACT, and natural science ACT output measures were obtained using linear relationships. However, this was not conclusive, since only four functional relationships were tested. Some other functional form may indicate even more significant relationships. The results do indicate that an assumption of linearity is not necessarily a correct assumption. Other studies may have found more significant relationships if tests for non-linear relationships had been made. Another suggestion for furture study was drawn from this conclusion. If the true effect of school inputs on educational outputs is to be found, various functional

relationships should be tested.

Another conclusion was indicated by the results of these tests. It appears as though the relationship between school inputs and outputs differs for different output measures. This conclusion was further substantiated by other statistical results discussed below. For example, it appears that economies of scale exist for English, ACT output, but no economies of scale are evident for the GPA, natural science ACT, or composite ACT outputs.

In addition to the conclusions concerning the hypothesis there were other overall conclusions. As previously mentioned, it appears that school inputs variously affect the output measures. This conclusion was drawn from results of most of the final tests. Three different functional relationships were most effective with different output measures. The explanatory power of the data, when related to the different output measures, varied from .24419 to .385549. The size of the school district appears to have an important effect on English performance, and some effect on mathematics and natural science performance, but no size effects were observed for the GPA, social science, and composite ACT output measures. Also, input measures were related to different outputs in different ways. Some inputs were similarly related to all or most outputs but some were not. One striking example concerns administrative salaries per ANB. Administrative salaries were positively and significantly related to the GPA output measure, but they were negatively and significantly related to the mathematics ACT output. Administrative salaries were not related significantly to the other four outputs. Library books and

periodicals had a significant effect on the mathematics, social science, and composite outputs, but this variable was not significantly related to any other output measure. Such findings indicate that one general budgeting policy will not effect all outputs the same. To improve educational output, priorities will have to be established by school policy makers. The educational outputs that school policy makers feel are the most important probably should be examined carefully so that school inputs effecting those outputs can be recognized. General budget increases may not improve some outputs, but increased spending on some inputs and decreased spending on others will.

The results did indicate that the best way to improve overall educational output would be to concentrate on instructional personnel. The teacher variables and principals' salaries per ANB were the most consistently significant variables, looking at the results for all of the output measures. This finding is consistent with the findings of almost every econometric study done concerning educational inputs and outputs.

One other overall conclusion was drawn. When the district average output measures were used, some variables were significant that were not when all 865 observations were used as output measures, and visa-versa. For example, social variables seem to be more significant using all observations than when average data was used. It follows that social variables had a more significant effect on the within school variation in GPA and test scores, than on the between school variation. It appears, then, that school inputs may have more effect on between school variation in educational outputs, and socio-economic background may have more effect

on the within school variation. More tests would have to be made to sub-
stantiate this hypothesis, since there were no within school differences
in either social or school variables available for this study.

The following conclusions apply to the hypotheses made concerning
the relationships between the individual inputs and the output measures.
These conclusions should be of some interest to Montana educational
policy makers and will, therefore, be discussed from a policy point of
view. The results of the regressions using district average output mea-
sures were emphasized when drawing these conclusions. Since only between
school district differences in input measures were used, the tests using
the district average outputs should be the most conclusive. Other than
the general conclusions that some district wide input measures effect
within school variations in outputs more than other inputs, no strong
conclusions could be drawn from the regressions using all 865 observa-
tions, because of the extremely low explanatory power of these regres-
sions. The R^2's range from .016 to .064. The significant inputs in
these regressions were related to the combined within and between school
variations in outputs, but they explained such a small part of the vari-
ation that they were almost trivial.

Before discussing the school inputs' relationships to the output
measures, the social measures can be discussed in total. For the possible
reasons sighted earlier, the social measures added almost nothing to
these regressions. Social measures were significantly related to only
three output measures. The percentage change in population and median
value of owner occupied homes variables were significantly related to

mathematics ACT scores. The population change variable was negatively related to mathematics performance, and the housing variable had a positive relationship. The kitchen variable was significantly and negatively related to social science scores. Median family income was negatively and significantly related to natural science scores. Little can be drawn from these results except that the social measures used here added little to the analysis. Judging from the negative relationship for the population variable, it probably was not a measure of the economic well being of school districts, since the relationship should have been positive if it was. The relationships for the two housing variables were hypothesized. Higher valued homes should be associated with better performance. The kitchen variable was hypothesized to be a measure of poor housing so the higher the percentage of poor housing the poorer the students from the districts should perform. The results for median family income go against the findings of several other studies. It appears that median family income was a proxy for a different socio-economic causal force for this sample than for the samples used in the other studies.

However, no strong conclusions can be drawn concerning socio-economic background because no consistent results were found. The variables that were significant, were significant for only one output measure, and three output measures had no significant social variables associated with them.

Tests for the influence of school district size on outputs were made with dummy variables. These test indicated that the size of school

districts had no effect on school outputs measured by college GPA, and the natural science, and composite ACT output measures. However, size appeared to be the most important school factor effecting English performance. English ACT was the only output measure that had significant intercept dummies associated with it. There were several size dummies of independent variables associated with English performance as well. The significant intercept dummies indicated that the relationship of all of the inputs to English differed for different sized school districts. The dummies associates with principals' salaries and natural science classes per ANB detracted from the significance of the intercept dummies so much, that the intercept dummies were eliminated during the final backwards stepwise regressions. This indicated that most of the size influences were associated with the difference in the effect of these two variables on students from school districts of various sizes. More evidence supporting the hypothesis that school district size was the most important influence for English performance was obtained from the regressions of district average English scores on the four year deflated average budget variables alone. The social variables, and number of classes variables were not used in this backwards stepwise regression, and no size dummies were used. All of the school variables were eliminated since none were related to English scores at the ninety-five percent level. When size was included several variables were significantly related to English, but when size was ignored there were no significant relationships.

The size dummies significantly related to English did not indicate true economies of scale, however. Rather they indicated that students

from school districts in the smallest size classification performed similarly to students from the largest size classifications. Students from districts in the largest size class and the smallest size class performed better than students from the middle three size classes. In other words, when English performance was being considered, students performed better if they attended school in districts with fewer than 100 ANB, or more than 600 ANB. If students attended school in districts with 101 to 600 ANB their English performance was poorer, on the average. These differences were primarily associated with the school inputs measured by principals' salaries and natural science classes per ANB. These variables will be discussed below.

Economies of scale probably existed for larger school districts, 100 ANB or more, for English performance. Larger schools with more than 600 ANB did have higher performance students than schools with 100 to 600 ANB. Economies of scale have been indicated in other econometric studies of education. However, for very small school districts scale economies did not apply. One difference between small and larger schools is the variety of course work offered. It may be that small schools offered only the courses necessary to fulfill the basic English needs of students, and that these courses covered the material needed to perform well on English ACT tests. However, larger schools offered a variety of courses to fulfill English requirements. Many of these courses may have pertained to subjects not tested by ACT. Because of scale economies, only the very large schools may be able to improve English performance, because of a large and interesting variety of course work offered. This is one hy-

pothetical explanation of these findings, concerning the important effect of school size on English performance. Another possibility might be that in small, and large schools there was more personal contact between students and teachers. In small schools a student may have had the same English teacher for more than one year and developed a more personal relationship. In large schools with larger varieties of specialized classes, teachers may have developed closer relationships with students that specialized in their field. Such personal contacts may not develope in the middle range of school sizes.

A similar size influence appears to have had an effect on mathematics ACT scores. Again, size effects on performance for the smallest and largest school districts were not significantly different, but dummy variables of the median value of homes measure indicated that this variable was affecting student performance differently for the middle three district size classifications. Students tended to perform better in the largest and smallest school districts, than in the districts with 100 to 600 ANB. In this case, the reason for the difference may have been the socio-economic strata of school districts. Economies of scale probably could not explain these size influences. It appears as though students from the most rural and from the most urban school districts out performed students from school districts that fall inbetween them in degree of urbanization. However, the social variables and size influences together did not add a great deal to the explanatory power of the mathematics ACT regression. Size influences were not nearly as important for mathematics performance as they were for English. The size influences on mathematics

were probably working outside of school. It may be that median value of homes was an appropriate measure of housing quality for the larger school districts, with over 100 ANB. The most urbanized school districts had the highest median values of homes. If this variable was a proxy for housing quality, the most urbanized school districts should have had more high performance students. However, in the most rural areas the housing value variable may not have been a proxy for housing quality. Perhaps a total property value measure would be a better proxy for home environment in rural areas, where the house is generally only a small portion of property in Montana's agricultural regions.

True scale economies may have existed over the full range of schools when social science performance was the output measure. All of the larger school district size classifications performed better than the smallest classification, due to the influences of the school input measured by natural science classes per ANB. Again, the size influences were not nearly as strong for social science performance as they were for English performance. The district size influences were associated with the school, rather than the social background of students for social science performance.

The size of school districts was associated with school output in a manner depending upon the output measure. District size was the most important school influence on English performance. District size also influenced school output measured by social science performance. The size of school districts influenced mathematics performance as well, but the influence was associated with the socio-economic background of the students, rather than school influences.

The results for the number of classes per ANB variables were difficult to interpret. Only one, the number of classes in mathematics per ANB, had expected results. Mathematics classes per ANB was positively and significantly related to mathematics performance, and the composite ACT, English, and social science performance. It appeared as though the amount of contact a student had with mathematics teachers effected student performance in mathematics, as well as overall performance. However, contact with English teachers had no signficant effect on performance. The confusion came from the results for social science, and natural science classes per ANB. The number of social science classes per ANB were significantly but negatively associated with college GPA, and natural science ACT outputs. Natural science classes per ANB were significantly and negatively associated with mathematics, composite, English, and social science ACT scores. There were significant size dummies associated with natural science classes per ANB, for the English and social science outputs as well.

Some conclusions can be drawn from these results however. The number of classes in social, and natural science per student were probably proxies for some more important input. For example, the number of classes in a subject per ANB may be a proxy for a lack of variety in classes. The number of classes per ANB variables were generally larger for the smallest schools, because ANB was small. These small schools did not have a large variety of classes in each curriculum. Generally then, more classes per ANB meant less variety in classes available. These results would mean that a negative relationship for classes per ANB would

indicate a positive relationship for variety of classes available. It may have been the significance of the variety of classes in natural and social science or some other related input that was being measured. District size dummies were associated with natural science classes per ANB. This suggests that the variable was a proxy for some input that varied with school district size, such as variety of classes offered. Another possible reason for these negative relationships was that schools with more classes per ANB were hiring more low salary teachers, rather than fewer high quality, high salary teachers. The importance of this possibility can be seen in the following discussion of instructional personnel inputs.

This project was primarily concerned with the school budget inputs. The budget variables signficantly related to most outputs were the instructional personnel variables, teachers' salaries, and principals' salaries per ANB. The variables were significantly related to five of six output measures. The only output that did not appear to be significantly effected by instructional personnel inputs was social science performance. However, the significance of personnel inputs does not indicate that more teachers should be hired to improve educational output. The number of teachers per ANB was significantly but negatively related to outputs. This may indicate that higher paid teachers, with more experience or education, should be hired rather than more teachers. School policy makers in Montana probably have been forced to choose between a large number of inexperienced, low salary teachers, or relatively fewer experienced or highly educated, high salary teachers. This hypothesis was supported by

other research done concerning Montana schools. School budgets have
been fairly stable, and spending has not increased to improve inputs.
Spending per pupil has been highly correlated with the state foundation
schedule, so the actual expenditures have probably reflected the require-
ments of the state foundation program.[4] Steven Barkley reported that the
electorate in Montana "is willing to raise expenditures only to provide
for additional students, and not to increase real expenditures for
students already in the system," in an econometric study to investigate
the factors influencing demand for educational expenditures in Montana.[5]
If school spending in Montana has been simply a reflection of the state
foundation schedule and spending has not increased unless enrollment
increased it follows that expenditures for teachers' salaries were fixed,
since teachers' salaries is the largest portion of total school expen-
ditures. Therefore, school administrators had to choose between two
alternatives. They had a choice between more teachers or better qualified
teachers. Teachers with little or no experience and only a bachelor's
degree have been available for relatively low wages. More of these
teachers could be hired than experienced, or better educated teachers, who
demand higher salaries. If this reasoning is true, schools should hire
more qualified teachers, even though they have fewer teachers as a result.

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[4] John H. Wicks, <u>Alternative School Finance Programs for Montana</u>
(Helena, Montana: Montana Legislative Council, 1972), p. 6.

[5] Steven Barkley, "The Determinants of Public School Financing in
Montana" (M. A. thesis, University of Montana, 1975), p. 54.

The results for teachers' salaries per ANB and teachers per ANB clarified the results of test regressions using average teachers' salaries. The average teachers' salaries variables was not significantly related to any output measure. If teachers' salaries per ANB is divided by teachers per ANB, the result is average teachers' salaries. Since teachers' salaries per ANB was positively related to outputs and teachers per ANB had a negative relationship the two would cancel each others' effect using average teachers' salaries.

No other school input was as consistently significant for most outputs as the instructional personnel variables. Expenditures on library books and periodicals per ANB was significant and positively related to three output measures however. It was hypothesized that schools with better libraries should have better performing students, and these results varify the hypothesis. Library salaries was not significant however. What relationship there was between outputs and library salaries was negative. Just looking at the budget data, it appeared as though schools that had relatively high library salaries did not have relatively high expenditures on books and periodicals. It may be that school library expenditures were generally fixed. If more library staff was hired, relatively fewer books and periodicals were purchases. Since books and periodicals were positively related to outputs, it follows that library salaries would be negatively related or insignificant.

Expenditures for new equipment per ANB also had a significantly positive effect on educational output, measured by social science performance. New equipment was not significantly related to any other output

measure. It may be that the instructional aids, such as audio-visual equipment, included in the new equipment budget component were more intensly used for social science classes. English and mathematics courses would probably have little use for such equipment.

Along with the library salaries variable, textbooks, other instructional expenditures, and operation and maintenance of plant had no significant relationships with any output measure. The other instructional expenditures variable was relatively small compared to other budget components. It appeared to be a category for expenditures that did not fit other component headings, so the results were not surprising. The operation and maintenance variable may have been measuring a combination of school effects. Two alternative hypotheses were postulated for this variable. It seemed possible that more expenditures for upkeep would mean a better study environment and therefore better performance. This may have been true for some schools. Alternatively, more expenditures for upkeep could indicate that the school building was old and rundown. This would mean a poor study environment and poorer performance. The two effects would cancel one another resulting in an insignificant relationship to outputs. The insignificance of the textbook variables was more difficult to interpret. It was possible that expenditures for textbooks per ANB did not proxy the quality of textbooks. Quality texts seldom cost more than poor texts. Another possibility was that ACT tests apply to general knowledge that can be gained from most textbooks. Therefore, the quality of textbooks would not effect performance on ACT tests.

Some budget components improved output, and some did not. There

were budget components that detracted from performance as well. Student body and auxiliary services were significantly and negatively related to English performance. It was hypothesized that extra-curricular activities might take students away from study and therefore cause poorer performance. This may have been the case. It also seemed that extra-curricular activities may set up an alternative goal for students. Rather than trying to excel scholastically, students may try to excel in some extra-curricular activity. This also would detract from performance.

Teaching supplies per ANB was significantly and negatively related to three output measures. If school budgets were relatively fixed as suggested, higher expenditures for teaching supplies and student body and auxilary services would mean lower expenditures for other budget components. Teaching supplies are in the instructional expenditures categories of school budgets. If higher expenditures for supplies meant lower expenditures for other instructional expenditures, such as the important personnel components, this would result in a negative relationship for the teaching supplies variable.

The most surprising findings were the results for administrative salaries per ANB. This variable was significant and positively related to the GPA output measure, significant and negatively related to mathematics ACT scores, and insignificant for the other four output measures. It may be that quality administrators did have a positive effect on student performance as hypothesized. However, if school budgets were relatively fixed, increased expenditures for quality administrators may have meant decreased expenditures for the more important instructional personnel

budget components. This appeared to be the case, especially in smaller school districts. When many small schools budgeted more for administration they budgeted less for principals' salaries. Therefore, higher administrative salaries would also have a negative effect on output. For most output measures, the positive and negative effects cancelled each other resulting in an insignificant relationship. However, for GPA the positive effects on performance out weighed the negative effects, and for mathematics the negative effects out weighed the positive. There may be another reason for these results but with the information available none could be hypothesized.

One other set of econometric tests was performed. Each year of school data was regressed on the output measures. The first year of data, 1968-69, probably should not be compared to the other three years, since the number of teachers per ANB was not available for that year. This variable was included in the regressions for the other three years. These regressions indicated that most of the effect of schools on educational output occured during the early years of high school. Except for natural science performance, the explanatory power of the regressions for the sample's senior year in high school was smaller than for sophomore and junior years. This should not be surprising. Most of the basic English, mathematics, and social science classes were taken in the first three years of school, The senior year may have included course work in these areas, but the courses probably were optional and may not have added much to students' understanding of the basic knowledge in these curriculums. The material tested by ACT was probably taught in the required

courses that students took in the first three years of school. Natural science classes, on the other hand, are often taken during the last years of school after students have obtained a background in mathematics. It follows then that school's effect on mathematics, social studies, and English performance should have been stronger during the first three years of school, and the strongest school effects on natural science performance should have occured during the final years of high school. These tests supported this hypothesis.

In summary then, schools did effect student performance as measured by GPA and ACT test scores. This effect varied from output to output however. School inputs affected different educational outputs in different ways. Economies of scale did exist for some educational outputs, but advantages in the smallest school districts out weighed these economies of scale in most cases and made them insignificant. If educational policy makers wish to improve educational output, simply increasing total expenditures may or may not accomplish this goal. It would depend on how the funds are spent. For best results schools should:

1. hire experienced, quality teachers even if the higher salaries demanded by these teachers necessitate reducing the total number of teachers

2. hire experienced, quality principals

3. buy more library books and periodicals even though this may necessitate a reduction in library staff

4. purchase instructional aids such as audio-visual equipment

5. reduce expenditures on teaching supplies and divert these funds

to hiring quality instructional personnel

    6. reduce expenditures for student body and auxiliary services and divert these funds to hiring quality instructional personnel

    7. increase expenditures for quality administration only if the funds are not taken from the more important instructional personnel budget components.

If these seven policy moves are made the students graduating from high school in Montana could be better prepared for college and their performance in college could improve.

APPENDIX I

COMPUTER PROGRAMS

Appendix I contains the most important programs used for the statistical analysis of this study. The programs were written in the basic computing language to handle the data stored in separate files. Each type of data, output measures, social measures, and school input measures, was stored in different files on computer tape.

The programs listed were used for:

1. analysis of variance

2. two way analysis of variance

3. multiple regression

4. creation of dummy variables.

These are examples of the major programs. Variations of these programs were used for all statistical analysis.

```
001 'ANALYSIS OF VARIANCE PROGRAM
002 '5 SIZE CLASSIFICATIONS
010 FILES INDEX.DTA,ANB72.DTA
020 RESTORE #1,#2
030 X1=X2=M=S5=0
035 FOR J=1 TO 107
040 READ #1,C,N
050 I(C)=I(C)+1
060 M=107
080 READ #2,Y1,Y2,Y3,Y4,Y5,Y6
081 READ #2,Y7,Y8,Y9,Z1,Z2,Z3
082 READ #2,Z4,Z5,Z6,Z7,Z8
085 X=Y1
090 X1=X1+X
100 X2=X2+X**2
110 T(C)=T(C)+X
180 NEXT J
190 S1=X2-(X1**2)/M
195 PRINT "INPUT NUMBER OF CLASSES"
196 INPUT K
200 FOR C=1 TO K
210 S2=(T(C)**2)/I(C)
212 S5=S5+S2
220 NEXT C
230 S3=S5-(X1**2)/M
240 S4=S1-S3
260 K1=K-1
265 K2=M-K
270 K3=M-1
280 M1=S3/K1
290 M2=S4/K2
300 M3=M1/M2
310 PRINT "K="K
320 PRINT "N FOR CLASSES="
330 MAT PRINT I(C)
340 PRINT "K*N="M
350 PRINT
360 PRINT
370 PRINT "SOURSE=TREATMENTS, RESIDUALS,TOTAL"
380 PRINT "D OF F ARE:"K1,","K2,","K3
390 PRINT "MEAN EQUARES ARE:"M1,","M2
400 PRINT "F TEST IS"M3
410 END
```

TWO WAY ANALYSIS OF VARIANCE

```
001 '2 WAY ANALYSIS OF VARIANCE PROGRAM
002 '5 SIZE CLASSES AND 4 YEARS OF TIME CLASSES
003 'DEFLATED BY STATE AND LOCAL GOV PURCHASES OF GOODS AND SERVICES
010 FILES AND72.DTA,ANB71.DTA,ANB70.DAT,ANB69.DAT,INDEX.DTA
020 RESTORE #1,#2,#3,#4,#5
030 X1=X2=S5=0
031 S7=0
035 FOR J=1 TO 107
040 READ #1,Y1,Y2,Y3,Y4,Y5,Y6
041 READ #1,Y7,Y8,Y9,Z1,Z2,Z3
042 READ #1,Z4,Z5,Z6,Z7,Z8
045 READ #2,A1,A2,A3,A4,A5,A6,A7
046 READ #2,A8,A9,B1,B2,B3,B4
050 READ #3,C1,C2,C3,C4,C5,C6,C7
051 READ #3,C8,C9,D1,D2,D3,D4
055 READ #4,E1,E2,E3,E4,E5,E6
056 READ #4,E7,E8,E9,F1,F2
057 READ #5,D,N
058 I(D)=I(D)+4
060 Z=Y1
061 Y=Z/1.454
065 B=A1
066 A=B/1.414
070 D=C1
071 C=D/1.343
075 F=E1
076 E=F/1.273
080 X1=X1+Y+A+C+E
085 X2=X2+Y**2+A**2+C**2+E**2
090 T(1)=T(2)+Y
095 T(2)=T(2)+A
100 T93)=T(3)+C
105 T(4)=T(4)+E
106 IF D=1 THEN 111
107 IF D=2 THEN 113
108 IF D=3 THEN 115
109 IF D=4 THEN 117
110 IF D=5 THEN 119
111 S(1)=S(1)+Y+A+C+E
112 GO TO 125
113 S(2)=S(2)+Y+A+C+E
114 GO TO 125
115 S(3)=S(3)+Y+A+C+E
116 GO TO 125
117 S(4)=S(4)+Y+A+C+E
118 GO TO 125
119 S(5)=S(5)+Y+A+C+E
```

Continued

```
125 NEXT J
195 PRINT "INPUT # OF TIME CLASSIFICATIONS"
196 INPUT K
197 M=107*K
198 S1=X2-(X1**2)/M
200 FOR G=1 TO K
210 S2=(T(G)**2)/107
212 S5=S5+S2
220 NEXT G
230 S3=S5-(X1**2)/M
245 PRINT "INPUT # OF SIZE CLASSIFICATIONS"
246 INPUT R
247 FOR D=1 TO R
248 S6=(S(D)**2)/I(D)
249 S7=S7+S6
250 NEXT D
251 S8=S7-(X1**2)/M
252 S9=S1-S3-S8
260 K1=K-1
261 K2=R-1
265 K3=M-K-R+1
270 K4=M-1
280 M1=S3/K1
285 M2=S8/K2
290 M3=S9/K3
295 F1=M1/M3
300 F2=M2/M3
310 PRINT "TOTAL OBSERVATIONS =";M
320 PRINT "OBSERVATIONS IN EACH TIME CLASSIFICATION IS 107"
330 PRINT "OBSERVATIONS IN EACH SIZE CLASSIFICATION ARE:"
350 MAT PRINT I(D)
360 PRINT
370 PRINT "SOURSE=TREATMENTS,BLOCKS,RESIDUALS,TOTAL"
375 PRINT "D OF F ARE:";K1",";K2",";K3",";K4
380 PRINT "MEAN SQUARES ARE:";M1",";M2",";M3
390 PRINT "F TESTS ARE:";F1",";F2
410 END
```

MULTIPLE REGRESSION

```
001 'MULTIPLE REGRESSION PROGRAM
002 '865 OUTPUTS ON INPUTS AND DUMMIES
100 DIM S(35,35),M(35,35)
101 DIM Y(866,1)
105 DIM X(1,35)
110 DIM B(35,1),B1(1,35)
115 DIM D(1,35)
120 DIM O(1,1)
125 DIM P(866,1)
126 DIM E(866,1),E1(1,866),E2(1,1)
128 DIM C(35,1),T(35)
500 FILES AVERAG.DTA,DUMDTA.DTA
510 RESTORE #1,#2
520 PRINT "INPUT N AND THE NUMBER OF VARIABLES IN INDEPENDENT FILE"
525 INPUT N,L
530 PRINT "INPUT K"
535 INPUT K
540 MAT S=ZER(K+1,K+1)
545 MAT C=ZER(K+1,1)
546 MAT P=ZER(N,1)
547 MAT Y=ZER(N,1)
550 S(1,1)=N
580 PRINT "INPUT SUBSCRIPTS OF INDEPENDENT VARIABLES"
590 FOR I=1 TO K
600 INPUT D(I)
610 NEXT I
615 Y2=0
620 FOR IO=1 TO N
625 READ #1,D1,D2,D3,D4,D5,D6
626 Y=D1
630 FOR I=1 TO L
640 READ #2,X(I)
650 NEXT I
655 Y(IO,1)=Y(IO,1)+Y
660 Y2=Y2+Y**2
670 c(1,1)=C(1,1)+Y
680 FOR I=2 TO K+1
690 J=D(I-1)
700 S(1,I)=S(1,I)+X(J)
710 C(I,1)=C(I,1)+X(J)*Y
720 NEXT I
730 FOR I=2 TO K+1
740 FOR I2=T TO K+1
750 J=D(I-1)
760 J2=D(I2-1)
770 S(I,I2)=S(I,I2)+X(J)*X(J2)
780 NEXT I2
```

```
790 NEXT I
800 NEXT IO
803 FOR J=1 TO K+1
804 FOR I=J TO K+1
805 S(I,J)=S(J,I)
806 NEXT I
807 NEXT J
810 MAT M=INV(S)
820 MAT B=M*C
830 MAT B1=TRN(B)
840 MAT O=B1*C
841 PRINT "INPUT 1 IF WANT QUICK E2,IF NOT THEN INPUT O"
842 INPUT Q
843 IF Q=1 THEN 865
844 RESTORE #2
845 FOR IO=1 TO N
846 FOR I=1 TO L
847 READ #2,X(I)
848 NEXT I
849 P(IO,1)=B(1,1)
850 FOR I=2 TO K+1
851 J=D(I-1)
852 P(IO,1)=P(IO,1)+B(I,1)*X(J)
853 NEXT I
854 NEXT IO
855 MAT E=Y-P
856 MAT E1=TRN(E)
857 MAT E2=E1*E
860 Z2=E2(1,1)/(N-K-1)
864 GO TO 870
865 E2=Y2-O(1,1)
866 Z2=E2/(N-K-1)
870 Z=SQR(Z2)
880 FOR I=1 TO K+1
890 T(I)=B(I,1)/Z*SQR(M(I,I)))
900 NEXT I
910 R2=(O(1,1)-(C(1,1)**2)/N)/(Y2-(C(1,1)**2)/N)
920 F=(R2*(N-K-1))/((1-R2)*K)
924 PRINT "B MATRIX ="
925 MAT PRINT B
930 PRINT "R2=";R2
940 PRINT "F=";F
950 PRINT "Z=";Z,"Z2=";Z2
960 PRINT "E2=";E2(1,1),"OR";E2
```

```
970 PRINT "T TESTS FOR B(I)=0:"
980 FOR I=1 TO K+1
990 PRINT "B(";I;"):";T(I)
995 NEXT I
1000 END
```

CREATION OF DUMMY VARIABLES

```
001 'PROGRAM TO CREATE DUMMY VARIABLES BY SIZE CLASSIFICATIONS
002 'ALSO CREATES A NEW INDEPENDENT DATA FILE-DUMDT2.DTA
010 FILES INDEX.DTA,DUMDTA.DTA,DUMDT2.DTA
020 RESTORE #1,#2
030 SCRATCH #3
040 FOR I=1 TO 103
050 READ #1,C,D
060 READ #2,A1,A2,A3,A4,A5,A6,A7,A8,A9
070 READ #2,B1,B2,B3,B4,B5,B6,B7,B8,B9
080 READ #2,C1,C2,C3,C4,C5,C6,C7,C8
085 X=A7
090 IF C=1 THEN 140
100 IF C=2 THEN 150
110 IF C=3 THEN 160
120 IF C=4 THEN 170
130 IF C=5 THEN 180
140 C5=X
141 C6=0
142 C7=0
143 C8=0
144 GO TO 190
150 C5=0
151 C6=X
152 C7=0
153 C8=0
154 GO TO 190
160 C5=0
161 C6=0
162 C7=X
163 C8=0
164 GO TO 190
170 C5=0
171 C6=0
172 C7=0
173 C8=X
174 GO TO 190
180 C5=0
181 C6=0
182 C7=0
183 C8=0
190 WRITE #3,A1,A2,A3,A4,A5,A6,A7,A8,A9
200 WRITE #3,B1,B2,B3,B4,B5,B6,B7,B8,B9
210 WRITE #3,C1,C2,C3,C4,C5,C6,C7,C8
220 NEXT I
230 END
```

APPENDIX II

BUDGET FORM

Appendix II contains a copy of the general fund section of the Budget and Application for Tax Levies from which the budget variables were obtained. The budget categories were the same as the categories for the Trustees' Report. The information obtained from these forms are marked by X. The number of teachers, total ANB, and special education ANB were also on the form, in another section.

PART 1. GENERAL FUND BUDGET	Actual Expenditure, Last Completed School Year 1971-72	Approved Expenditure, Current Year 1972-73	Ensuing School Year Expenditures	
			Estimated 1973-74	Approved 1973-74
EXPENDITURES				
Administration				
01-00-0110 Salaries	X			
01-00-0130 Supplies				
01-00-0150 Other expenses				
Total—Administration				
Instruction				
01-00-0211 Principals' salaries	X			
01-00-0212 Teachers' salaries	X			
01-00-0213 Clerical salaries	X			
01-00-0241 Textbooks	X			
01-00-0232 Teaching supplies	X			
01-00-0250 Other expenses	X			
Total—Instruction				
Library Services				
01-00-0310 Salaries	X			
01-00-0342 Books and periodicals	X			
01-00-0350 Other expenses				
Total—Library Services				
Supportive Services				
01-00-0410 Salaries, Prof.				
01-00-0413 Salaries, Clerical				
01-00-0450 Other expenses				
Operation of Plant				
01-00-0610 Salaries				
01-00-0641 Heat for buildings				
01-00-0642 Utilities, except heating				

01-00-0650 Other supplies & expenses				
Total—Operation of Plant	X			
Maintenance of Plant				
01-00-0710 Salaries				
01-00-0780 Contracted services				
01-00-0734 Replacements & parts				
01-00-0750 Other supplies & expenses				
Total—Maintenance of Plant	X			
School Food Services Program (01-00-0800)				
Student Body & Auxilary Services (01-00-0900)	X			
Other Current Charges				
01-00-1057 Rental of land & buildings				
01-00-1056 Insurance				
01-00-1059 Other expenses				
01-00-1072 Interest on warrants				
Total—Other Current Charges				
Capital Outlay (from General Fund, not Bonds)				
01-00-1161 Sites				
01-00-1162 Buildings				
01-00-1163 Remodeling, Improvements				
01-00-1164 New equipment	X			
01-00-1165 Other (identify)				
Total—Capital Outlay				
TOTAL GENERAL FUND EXPENDITURES				
New Cash ADDED to Reserve (Not Cash Balance Retained as Reserve)				
TOTAL AUTHORIZED GENERAL FUND BUDGET				

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