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ABSTRACT

This study investigated school district size, the consolidation of small school districts to make larger ones, and the linear relationships of school district size to expense per average daily attendance (ADA), basic and composite scores on the MAT6 standard achievement test, and secondary school dropout rate. Correlational analysis revealed that the relationship among the above variables was slight. There is no evidence to suggest that the data from 330 Arkansas school districts proves that consolidating small school districts into larger ones will necessarily reduce expenditures per student, increase standardized test scores, or reduce dropout rates. (JAM)

SIZE, EXPENDITURES, MAT6 SCORES, AND DROPOUT RATES: A CORRELATIONAL STUDY OF ARKANSAS SCHOOL DISTRICTS

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Abstract

This study investigated school district size and its linear relationships to (1) expense per ADA, (2) basic and composite scores on the MAT6, and (3) secondary school dropout rates. Correlations between district size and expense per ADA, and expense per ADA including federal funds, -0.12 and -0.11, respectively, indicated that costs per student had a very slight tendency to be less in larger districts.

Correlations between district size and 4th grade MAT6 basic and composite scores were -0.03 and -0.04, which indicated that the 4th grade MAT6 scores had a very slight tendency to be higher in smaller districts. The 7th grade correlations, 0.06 for the basic scores, and 0.04 for the composite scores, and the 10th grade correlations, 0.12, basic, and 0.10, composite, indicated that those scores had a very slight tendency to be higher in larger districts.

The correlation between district size and secondary school dropout rate, 0.15, indicated that there was a very slight tendency for larger districts to have a higher dropout rate in the 7th through 12th grades.

In all cases, the relationships were very slight. In other words, for the approximately 330 school districts included in the analysis, there is no evidence to suggest that consolidation of small school districts into larger ones will necessarily reduce expenditures per student, increase standardized test scores, or reduce dropout rates.

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Billina Matthews entered the data and carefully proofread it for errors. Janice Boyd assisted in this effort.

Linda Coyle and Darrell Gentry shared their expertise by perusing and evaluating the paper with the same caring attention they apply to those of students enrolled in their graduate research classes. Joe Hundley, Selvin Royal, and Diane Wisdom read drafts of the paper at various stages of its development and offered helpful comments and suggestions.

Doug Buffalo willingly shared the results of a similar study and was also supportive of this effort.

Finally, but most importantly, the author thanks the reader for being interested.

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Introduction

Since the nation was proclaimed to be in a state of educational risk (National Commission on Excellence in Education, 1983), a great amount of attention has been focused on various elements in the educational arena. Among the more frequently investigated elements are economic efficiency in terms of school/district size, student performance in terms of test scores, and dropout rates (Ansingh, 1986; Center for Research and Public Policy, 1988; Forbes, 1985; Martellaro, 1984, Monk & Haller, 1986; Ramirez, 1987; Sher, 1986; Stevens, 1987; Vaughn, 1984; Walberg & Fowler, 1987; Yong, 1987). In Arkansas, a number of groups have studied educational issues since passage of the Quality Education Act in 1983, including A+ Arkansas, the Arkansas Business Council, and the Winthrop Rockefeller Foundation, not to mention the Department of Education and the State Legislature (Crownover, 1988; Fowler, 1989a; Shameer, 1988; Sissom, 1989). Recent articles and editorials in state newspapers indicate that these issues are still of considerable interest to the public, educators, businesspeople, and legislators (Bradburn, 1988; Charlton, 1988; Clements, 1988; Davies, 1988; Esser, 1988; Howell, 1988; and Isbell, 1988). Since the 77th Arkansas General Assembly convened January 9th, one of these issues, student test scores, has been closely associated with school consolidation (Barton, 1989; Fowler, 1989b,c; Oswald, 1989a,b). This possibility of school closure or merger has further increased interest in educational issues (Crommett, 1989; Davies, 1989).

Problem Statement

This increased awareness provides a potential opportunity for educational change wherever it may need to occur. Determining where it may need to occur, though, is a subject of considerable debate. This study investigates some possibilities: school district size and its linear relationships to (1) expense per average daily attendance (ADA), (2) basic and composite scores on the Metropolitan Achievement Tests, 6th Edition (MAT6), and (3) secondary school dropout rates.

Terminology

According to the *Annual Statistical Report of the Public Schools of Arkansas* (Merrill, 1988a), *ADA* is the average daily attendance of a school district including "those students who attend school outside the district on a tuition agreement between the respective districts". *Expense per ADA* is the "current expense, less the amount received from other districts, divided by the resident ADA, including kindergarten pupils and expenditures. It also includes "forest reserve, flood control, mineral leases, P.L. 874, revenue in lieu of taxes from Federal housing, wildlife refuge, and grazing rights". The figures used in this study are the actual counts for 1986-87 (333 districts) to correspond to the latest available district expenditures and dropout rates, and 1987-88 (329 districts) for the MAT6 scores.

The MAT6 is a standardized achievement test administered annually to students in grades 4, 7, and 10. According to the *MAT6 Norms Booklet* (Prescott, Balow, Hogan, and Farr, 1985), the *Total Basic Battery*

Score is the sum of the scores on the Reading, Mathematics, and Language tests. The *Total Complete Battery Score* includes these scores and those of the Science and Social Studies tests. The scores used in this study are from the Spring, 1988, administration, obtained through the Office of Student Assessment of the Department of Education (1988). They are district average scaled scores which are standard scores provided by the test publisher that make use of one continuous scale for all grades. In this study, 4th grade scores ranged from the upper 500's to the mid 600's; the 7th grade scores, from the lower 600's to the upper 600's; and the 10th, from the mid 600's to the low 700's. Scaled scores "have the advantage of providing approximately equal units throughout the scale" (Gronlund, 1985, p.355), making them better suited to statistical testing than nonscaled data.

Secondary school dropout rates are the quotients computed by dividing the number of dropouts per district in the 7th through 12th grades by the number of students per district in the 7th through 12th grades. The data was supplied through the Department of Education (Merrill, 1987, 1988b) and are for the 1986-87 school year.

Methodology

Commonly used methods for analyzing relationships among the types of data investigated in this study have been multiple correlation techniques (Borg & Gall, 1983; Cates, 1985; Martellaro, 1984; Ramirez, 1987; Stevens, 1987; Vaughn, 1984; Walberg & Fowler, 1987; Yong, 1987), of which simple linear correlation analysis was employed in this study. Calculations were performed using the NCSS statistical software

package written by Dr. Jerry L. Hintze of Kaysville, Utah, who has experience in teaching statistics at the university level and has served as a statistical consultant. The analyzed variables reported in this study included school district size in terms of ADA; 4th, 7th, and 10th grade MAT6 basic and composite scaled scores; and secondary school dropout rates. District size was compared with each of the other variables in the analysis.

Correlation vs. Causality

Relationship, or correlational, studies are often called *prestudies* or *pilot* studies, since correlations alone cannot be used to determine causality (Borg, 1987, p.175; Borg & Gall, 1983, p.575; Cates, 1985, p.87). For example, college entrance exam scores generally show a marked correlation with performance in college courses. However, it is unlikely that the high entrance exam scores themselves cause students to perform well. Rather, higher-scoring students are probably better prepared and perform well, both on the tests and in their classes, as a result of their academic backgrounds.

Correlational studies may suggest a relationship, however, and are frequently used by researchers to help provide a rationale for testing possible causal factors (Borg & Gall, 1983, p.575; Cates, 1985, p.86-87; Marascuilo & Serlin, 1983, p.79-81). However, to determine whether school district size causes differences in expenditures per pupil, MAT6 scores, or dropout rates would normally require more than mere evidence of a relationship. A theoretical or conceptual basis (for example, previous research findings) for attributing those

differences to district size, and consideration and rejection of other possible causes (for example, district wealth) are also necessary (Cates, 1985, p.86-89). Determining the strengths of the relationships, a first step, was the focus of this investigation.

Results

On page 6 is a table of the indicators related to school district size giving the strength of the relationship in terms of the correlation coefficient, and the level of statistical significance. It should be noted that smaller correlations, even if statistically significant, lack practical significance, especially in the case of large sample sizes (Borg & Gall, 1983, p.623-24; Cates, 1985, p.91-92). In this study, the sample size of school districts is over 300, which enhances the likelihood of statistical, but not necessarily practical, significance. Correlation coefficients between 0.00 and -0.20 or +0.20 are considered indicative of very slight relationships, regardless of statistical significance, and are of little use for predictive purposes (Borg & Gall, 1983, p.624; Cates, 1985, p.90).

To illustrate this point, an analogy may be helpful: A house located behind a softball field is more likely to have a window broken by a softball than one not located behind a softball field. Moreover, when games are played more frequently, the chance of a broken window increases. That is, there is a positive correlation between living near a softball field and having a window broken by a softball. A possible solution to this problem is to board up all the windows, but it is not practical for at least three reasons: First, unless the

house is located very close to the field (causing a high correlation), it is not likely that a window will be broken very often anyway; second, there are many other causes for broken windows besides softballs being knocked through them, and third, not ever being able to open the windows to let in sunlight and fresh air may be more of a problem than an occasional broken window. In other words, although it is definitely possible for a house located near a softball field to have a window broken by a softball, it is not practical to permanently close up all the windows to keep that from happening.

Borg & Gall (1983, p.624) and Cates (1985, p.90) suggest some guidelines concerning correlations: For crude predictions of group performance, correlation coefficients around 0.50 or larger are required. Marked relationships begin around 0.65 and generally reliable predictions require correlations around 0.85 or higher. These statements are similarly true for negative correlations. (Examples of various correlations are given in the Appendix.). In other words, the closer to +1.00 or -1.00 the correlation coefficient is, the more accurate are the predictions which may be made, while correlations close to 0.00 would be nearly useless for that purpose.

Educational Indicators and their Relationships to District Size

	Correlation Coefficient	Statistical Significance
Expense per ADA	-0.12	0.02
Expense per ADA, including federal funds	-0.11	0.04
4th grade basic MAT6 score	-0.03	0.53

Educational Indicators and their Relationships to District Size

	Correlation Coefficient	Statistical Significance
4th grade composite MAT6 score	-0.04	0.42
7th grade basic MAT6 score	0.06	0.28
7th grade composite MAT6 score	0.04	0.48
10th grade basic MAT6 score	0.12	0.02
10th grade composite MAT6 score	0.10	0.07
Secondary dropout rate	0.15	0.01

The following pages illustrate with the use of scattergrams the relationship of each of the indicators listed above and school district size. A *scattergram* is a graphical plot of the relationship between two variables (Best & Kahn, 1986, p.230), for instance school district size and expense per ADA. Each circle in the scattergram represents one school district. Since school districts vary so widely in size it was not possible to graph them all with adequate spacing without distorting the vertical scale. For that reason, most of the school districts appear close together toward the bottom of each graph. On each scattergram is also plotted a *least squares regression line.* This line is plotted so that the differences between it and the data points are minimized. The slope of this line is equal to the correlation coefficient which makes it useful for visualizing the strength of the relationship between the two variables plotted on the scattergram.

Limitations

The method of analysis in this study measures only the *linear* relationships among the variables. In other words, it addresses only the question of whether any of the variables steadily increase or decrease as school district size increases. It does not address the possibility of one or more reversals in direction as size increases. (Keppel, 1973, passim, p.113-14).

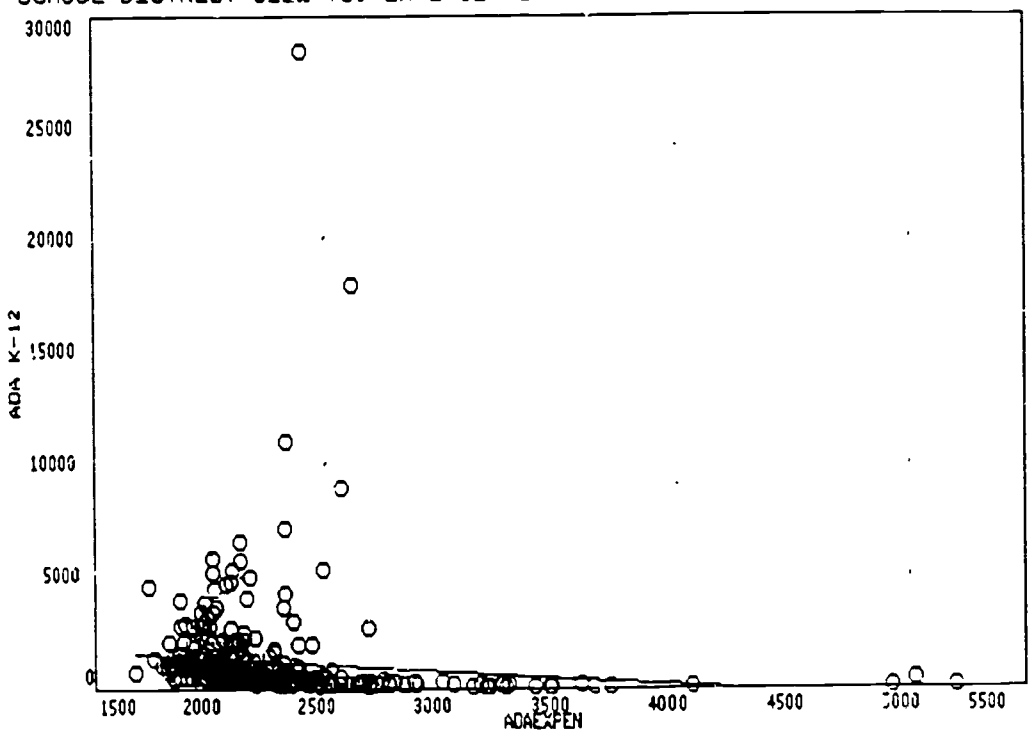
Scattergrams

School District Size vs. Expense per ADA

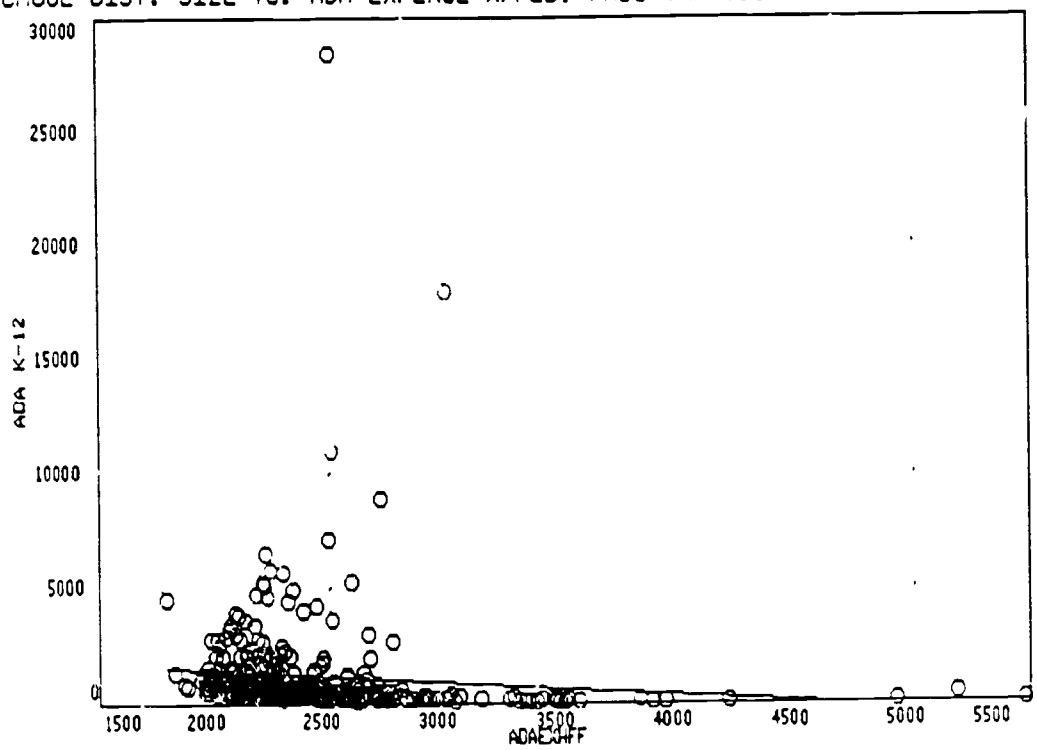
As with each of these scattergrams, it may be helpful to compare the graph to those in the Appendix to compare the strength of the measured relationship to a scale of correlations. In this case (See p.9), the correlation coefficient (R) was -0.12. This negative linear correlation means that, overall, the expense per student decreased very slightly as school district size increased. Again, a correlation of -0.12, even though statistically significant (0.02), is of little practical value for predictive purposes.

The presence of outliers should be noted. *Outliers* are data points which differ markedly from the rest (Borg & Gall, 1983, p.391). In this scattergram, several circles representing districts can be seen in the lower right corner while others seem to float toward the top. The three rightmost districts are small districts with high district wealth while the upper districts have very large enrollments. The effect

SCHOOL DISTRICT SIZE VS. EXPENSE PER ADA (R=-0.12)



SCHOOL DIST. SIZE VS. ADA EXPENSE W/FED. FNDS (R=-0.11)



these outliers had on this correlation coefficient is that the smaller, wealthy districts tended to move the coefficient away from zero in the negative direction while the larger districts tended to move the coefficient away from zero in the positive direction.

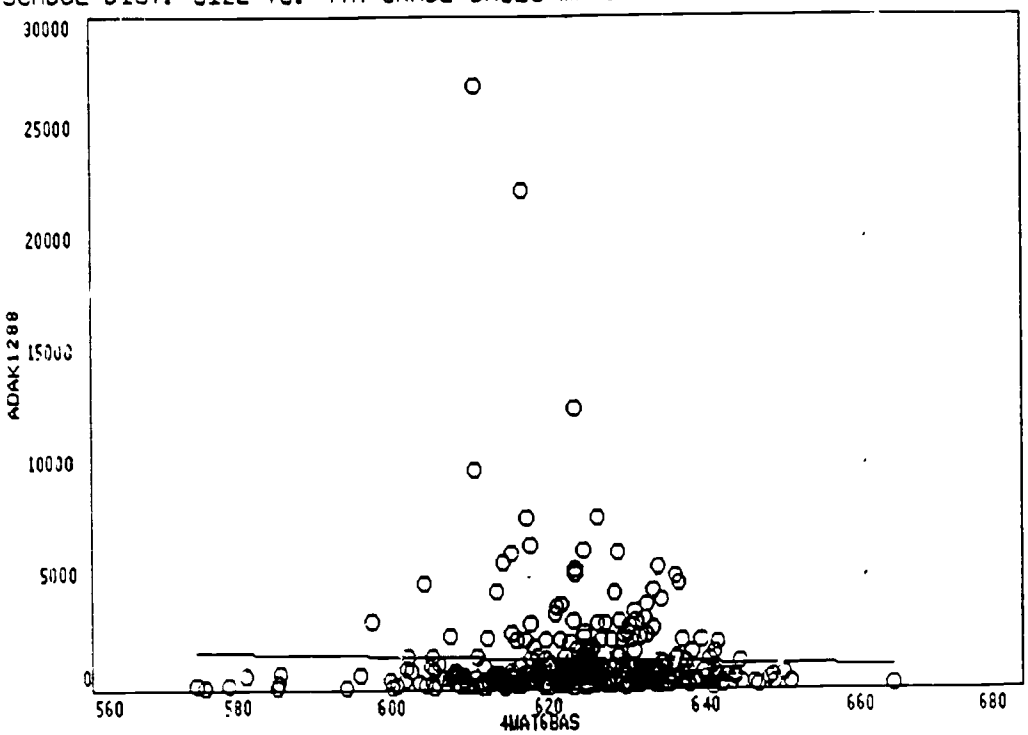
School District Size vs. Expense per ADA, including Federal Funds

The correlation coefficient (R) was -0.11. Similar to the previous scattergram, this negative linear correlation means that, overall, the expense per student, including federal funds, decreased very slightly as school district size increased. The outliers also had an effect similar to the previous graph in that the smaller, wealthy districts tended to move the coefficient away from zero in the negative direction while the larger districts tended to move the coefficient away from zero in the positive direction.

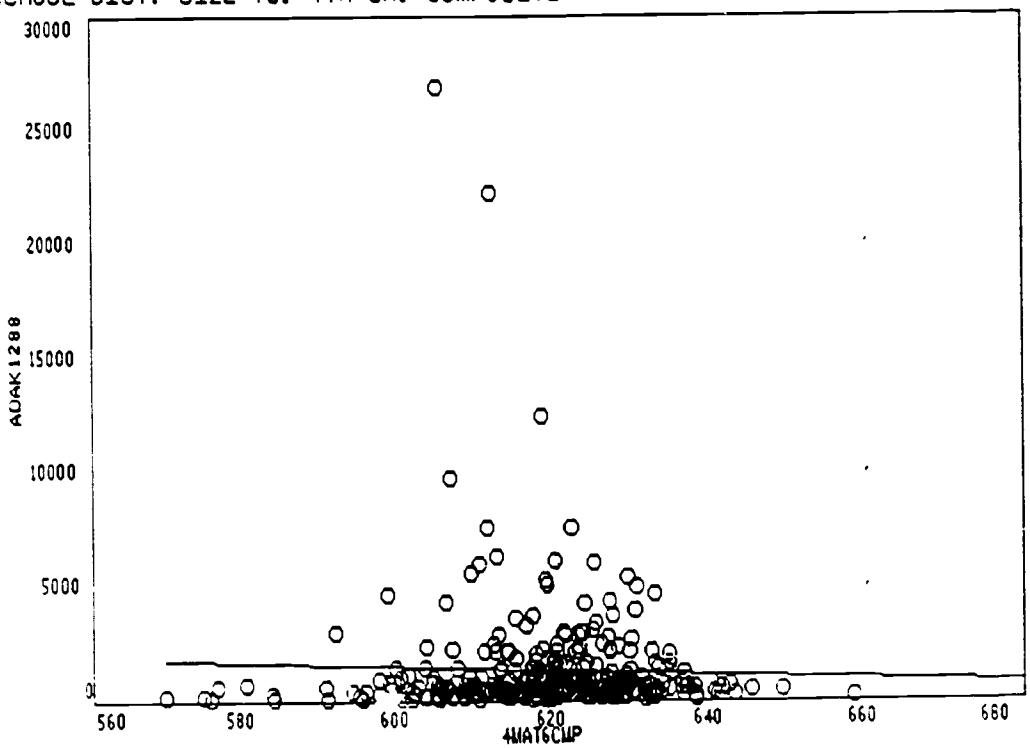
School District Size vs. 4th Grade Basic MAT6 Scores

In this case, the correlation coefficient (R) was -0.03. This negative linear correlation means that, overall, the 4th grade basic MAT6 scores decreased very slightly as school district size increased. The outliers in the lower right and lower left are not far enough away from the body of the data to have had much of an effect. The upper outliers would have had a slight tendency to move the correlation coefficient away from zero in a negative direction. The reason the tendency would have been slight is that the outliers are fairly closely aligned vertically with the body of the data.

SCHOOL DIST. SIZE VS. 4TH GRADE BASIC MAT6 (R=-0.03)



SCHOOL DIST. SIZE VS. 4TH GR. COMPOSITE MAT6 (R=-0.04)



School District Size vs. 4th Grade Composite MAT6 Scores

The correlation coefficient (R) was -0.04. As with the previous scattergram the negative linear correlation means that, overall, the 4th grade composite MAT6 scores decreased very slightly as school district size increased. The outliers would have had much the same effect as before.

School District Size vs. 7th Grade Basic MAT6 Scores

The correlation coefficient (R) was 0.06. This positive linear correlation means that, overall, the 7th grade basic MAT6 scores increased very slightly as school district size increased. The outliers, again, would have had only a minor impact.

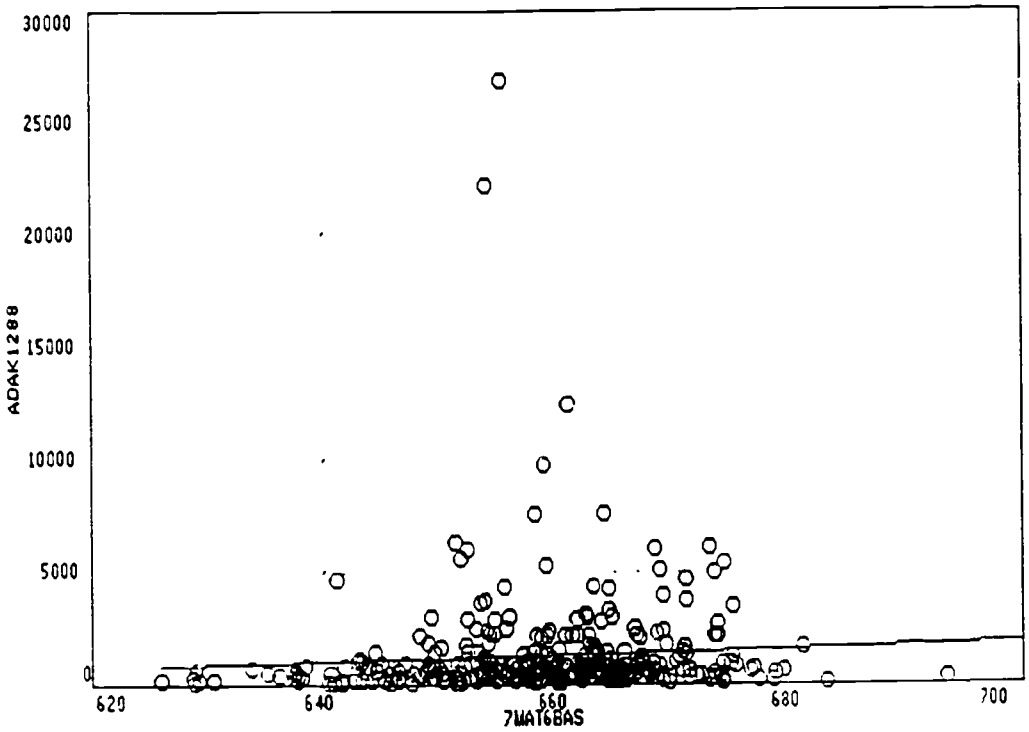
School District Size vs. 7th Grade Composite MAT6 Scores

The correlation coefficient (R) was 0.04. This correlation means that, overall, the 7th grade composite MAT6 scores increased very slightly as school district size increased. The outlier's impact would have been minor.

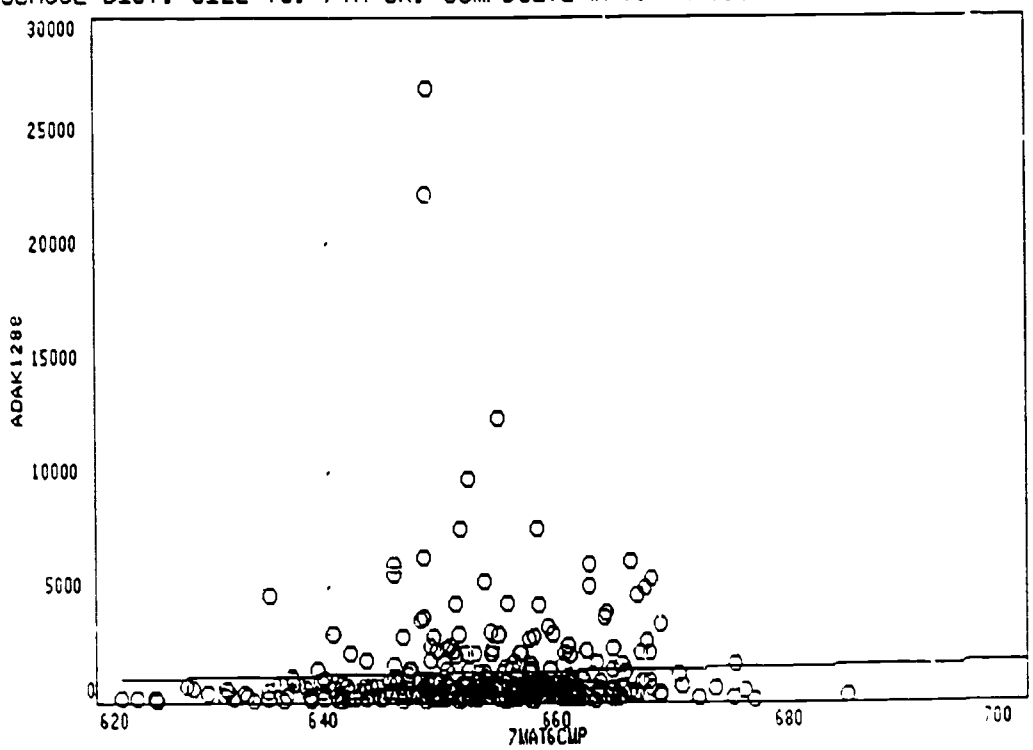
School District Size vs. 10th Grade Basic MAT6 Scores

The correlation coefficient (R) was 0.12. This positive linear correlation means that, overall, the 10th grade basic MAT6 scores increased very slightly as school district size increased. The outliers, again, would have had only a minor impact.

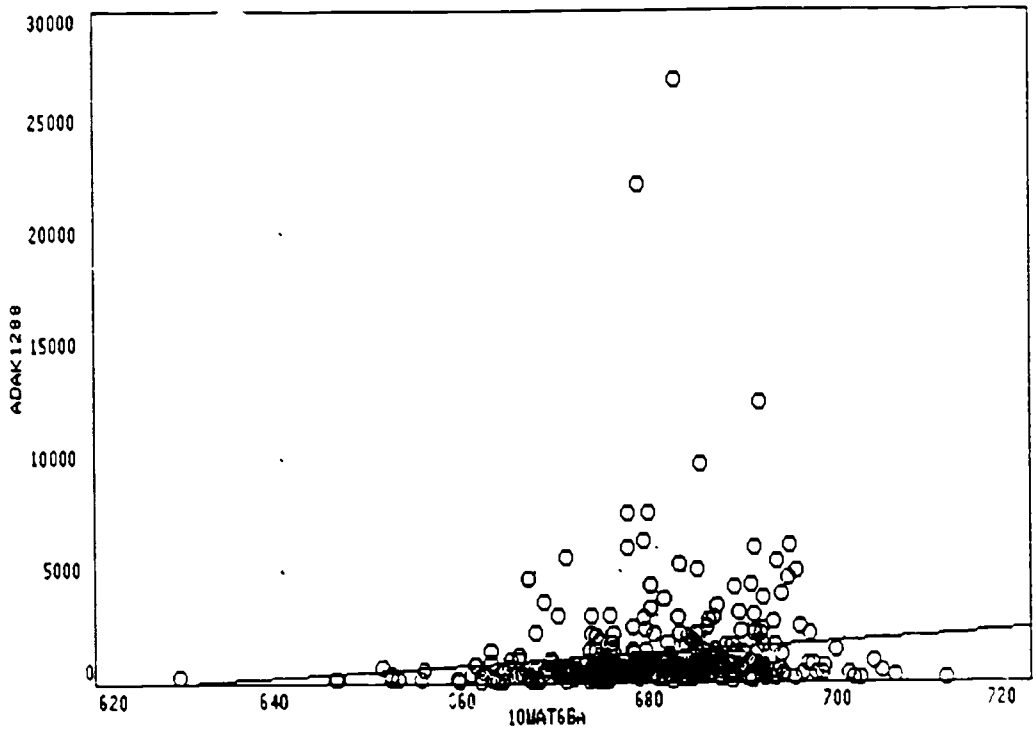
SCHOOL DIST. SIZE VS. 7TH GRADE BASIC MAT6 (R=0.06)



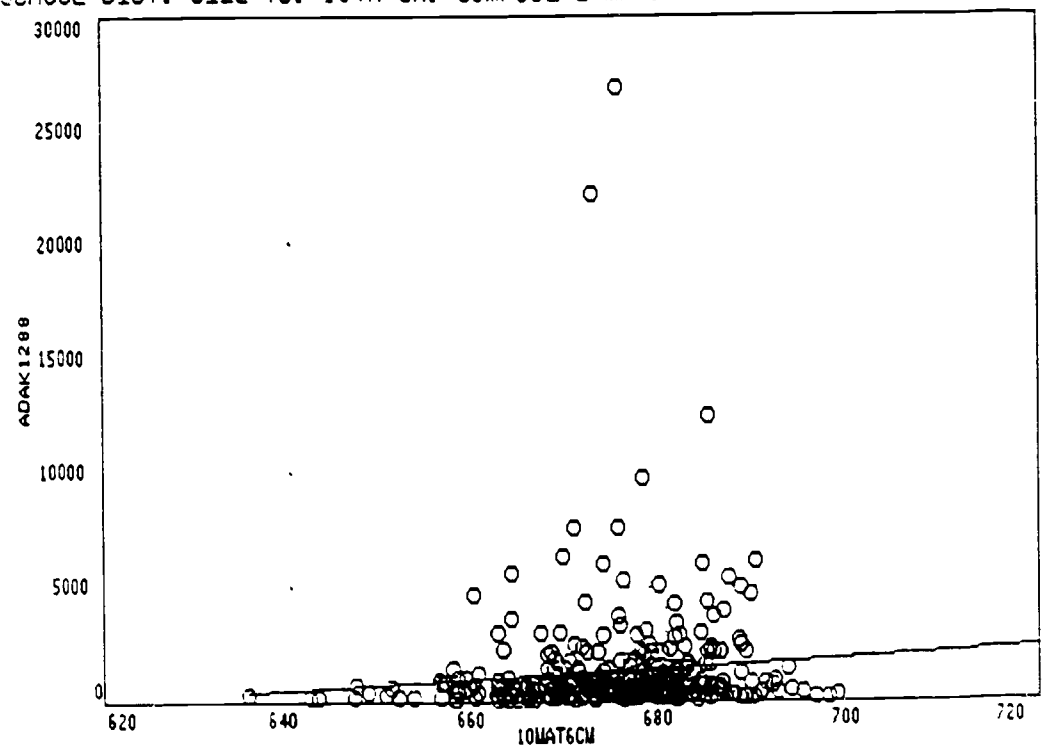
SCHOOL DIST. SIZE VS. 7TH GR. COMPOSITE MAT6 (R=0.04)



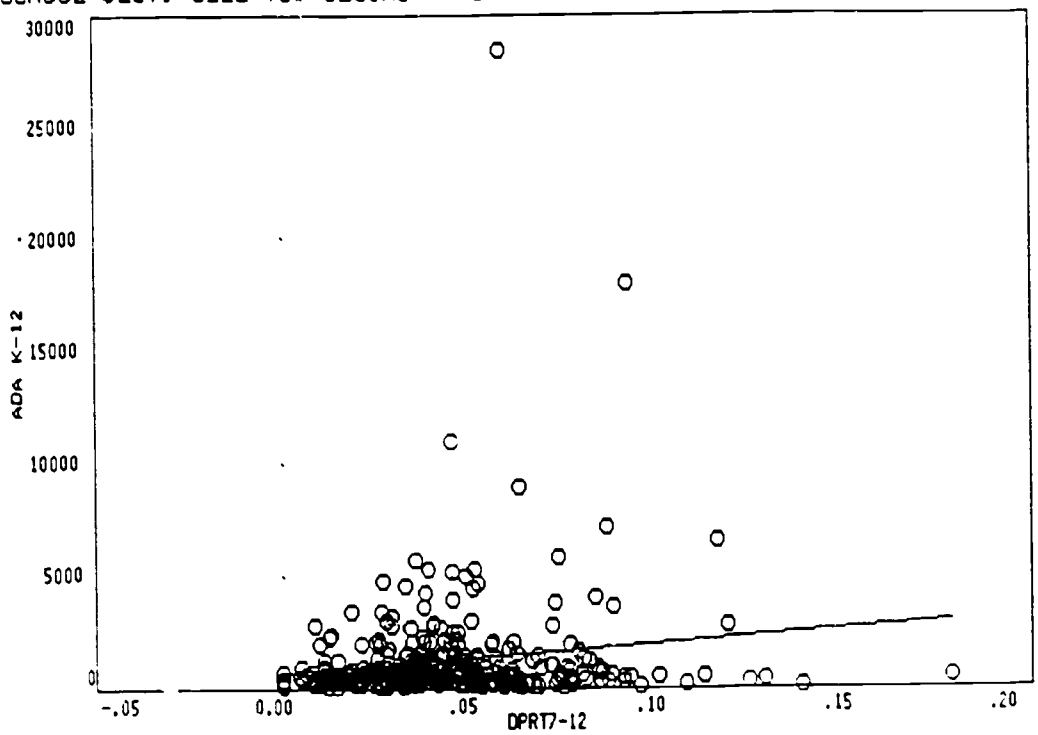
SCHOOL DIST. SIZE VS. 10TH GRADE BASIC MAT6 (R=0.12)



SCHOOL DIST. SIZE VS. 10TH GR. COMPOSITE MAT6 (R=0.10)



SCHOOL DIST. SIZE VS. SECONDARY DROPOUT RATE (R=0.15)



School District Size vs. 10th Grade Composite MAT6 Scores

The correlation coefficient (R) was 0.10. This correlation means that, overall, the 10th grade composite MAT6 scores increased very slightly as school district size increased. The impact of the outliers would have been minor.

School District Size vs. Secondary School Dropout Rate

The correlation coefficient (R) was 0.15. This correlation means that, overall, the dropout rate increased very slightly as school district size increased. The impact of the upper outliers would have been to slightly increase the correlation while the far right outlier would have caused it to slightly decrease.

Summary and Conclusions

This study investigated school district size and its linear relationships to (1) expense per ADA, (2) basic and composite scores on the MAT6, and (3) secondary school dropout rates. The correlations between district size and expense per ADA, and expense per ADA including federal funds, were -0.12 and -0.11, respectively. These figures indicate that expenditures were very slightly less per student as district size increased, that is, that costs per student had a very slight tendency to be less in larger districts. The correlations were statistically significant (0.02 and 0.04) primarily because of the large sample size, but not practically significant (See discussion on p.5.).

The correlations between district size and 4th grade MAT6 basic and composite scores were also negative, -0.03 and -0.04, respectively. These correlations indicate that the scores increased very slightly as district size decreased, that is, that the scores had a very slight tendency to be higher in smaller districts. The 7th grade correlations were positive, 0.06 for the basic scores, and 0.04 for the composite scores These figures indicate that the scores increased very slightly as district size increased, that is, that the scores had a very slight tendency to be higher in larger districts. Similarly, the 10th grade correlations, 0.12, basic, and 0.10, composite, indicated a very slight increase in scores as district size increased. The significance levels were 0.02 and 0.07, respectively, but again, were not practically significant.

The correlation between district size and secondary school dropout rate, 0.15, was the strongest in the study, but still relatively small. This positive correlation indicated that the dropout rate increased very slightly as district size increased. That is, there was a very slight tendency for larger districts to have a higher dropout rate for the 7th through 12th grades.

In all cases, the relationships were very slight. In other words, for the approximately 330 school districts included in the analysis, there is no evidence to suggest that consolidation of small school districts into larger ones will necessarily reduce expenditures per student, increase standardized test scores, or reduce dropout rates.

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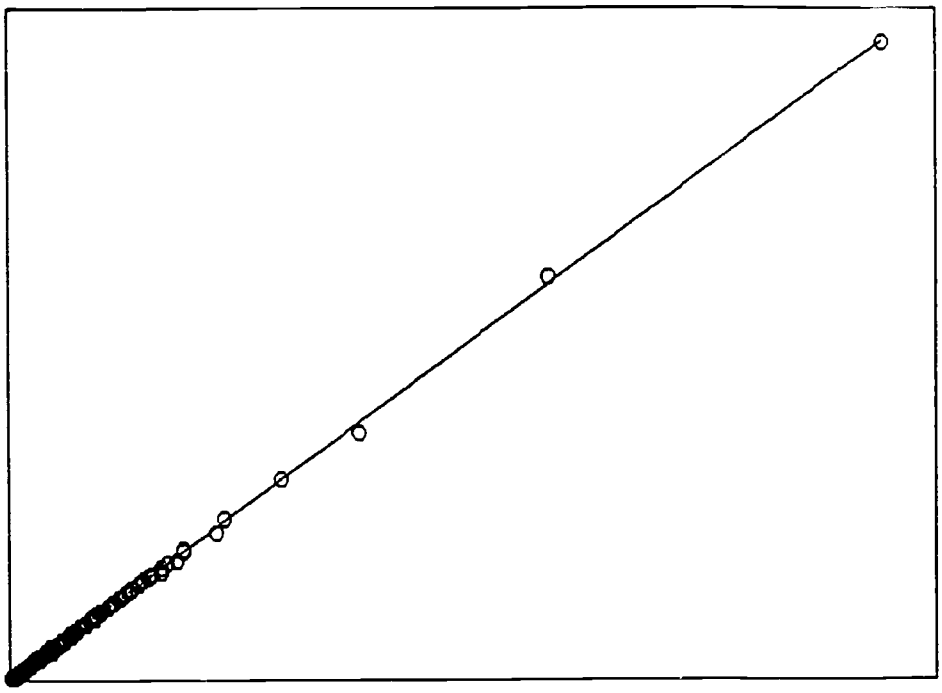
Appendix

Examples of Correlations

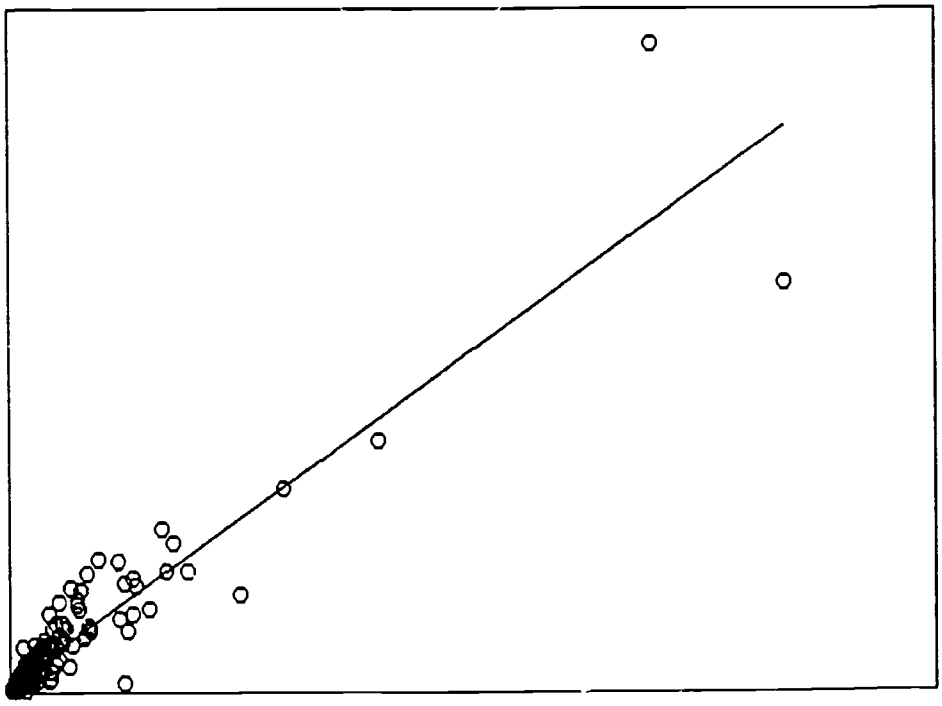
Examples of Correlations

The scattergrams which follow are examples of a range of correlations, from strong positive to very slight positive to zero, or no relationship, to very slight negative to strong negative. The stronger positive a relationship is, the higher the regression line will be on the *right* side. The stronger negative the relationship is, the higher the regression line will be on the *left* side. The more near horizontal the line is, the less of a relationship there is. A horizontal line indicates no relationship at all. All of the correlation coefficients have been rounded to two decimal places.

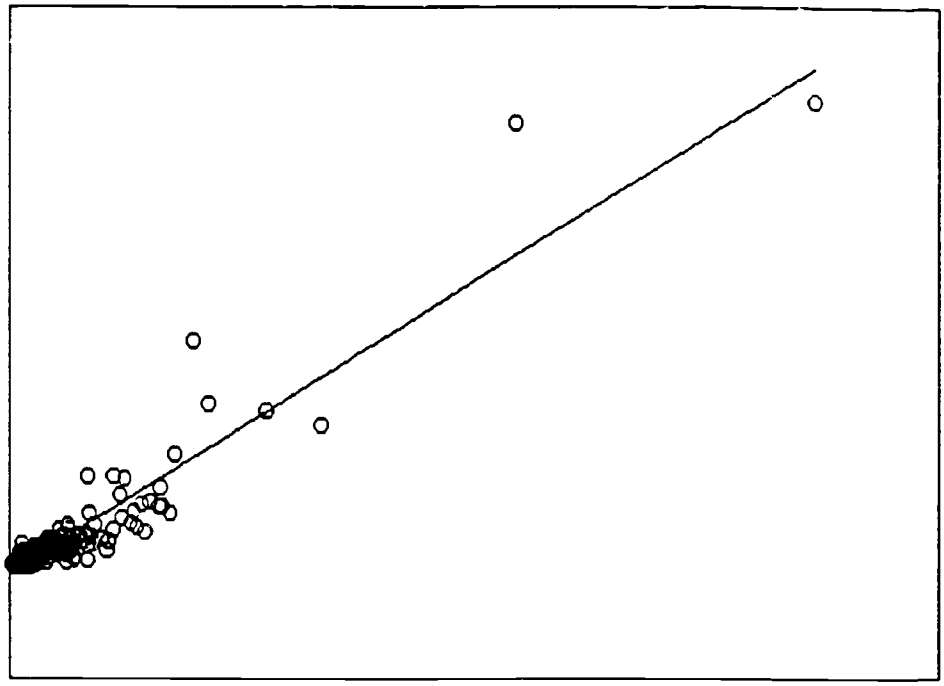
EXAMPLE OF A STRONG POSITIVE RELATIONSHIP (R=1.00)



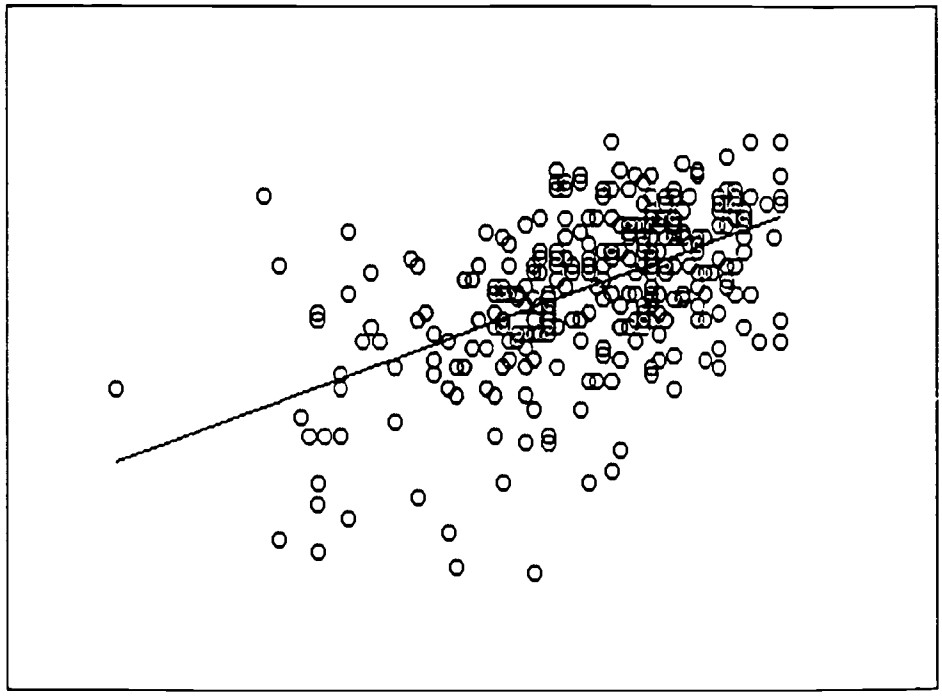
EXAMPLE OF A VERY HIGH POSITIVE RELATIONSHIP (R=0.93)



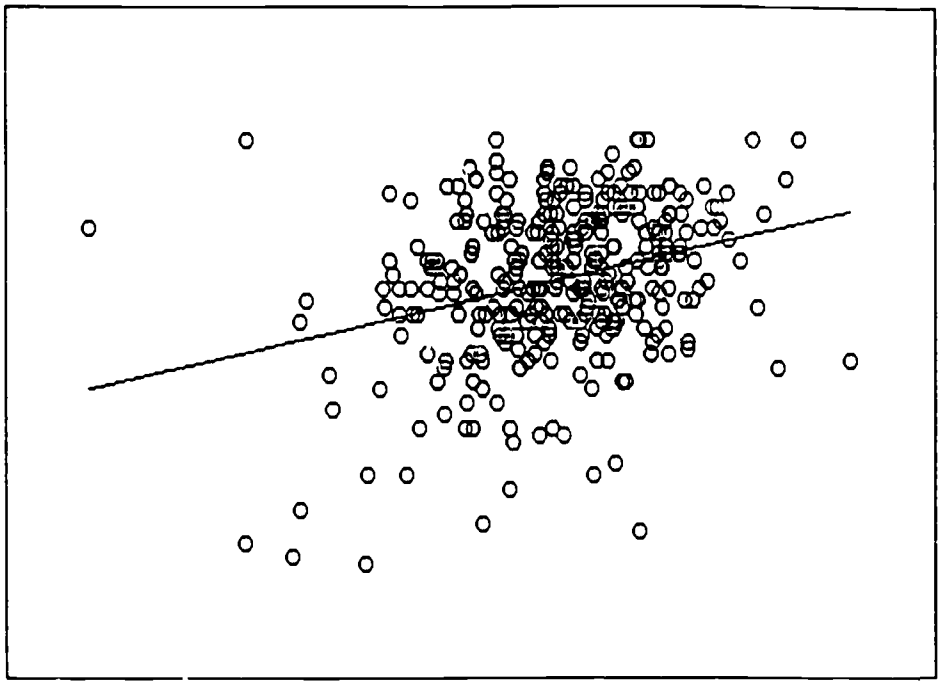
EXAMPLE OF A MARKED POSITIVE RELATIONSHIP (R=0.73)



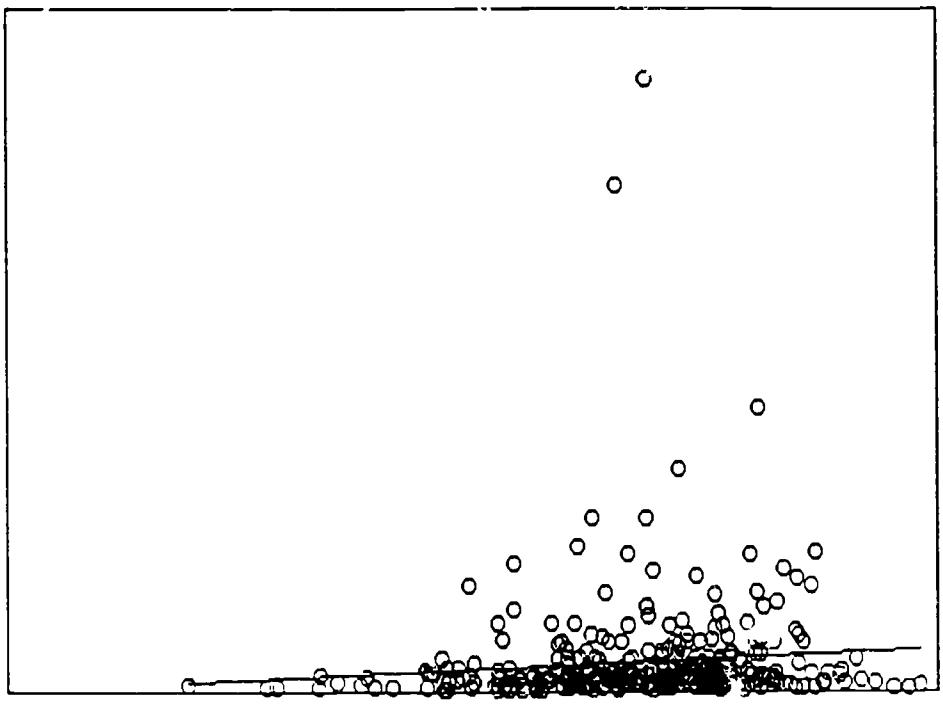
EXAMPLE OF A MODEST POSITIVE RELATIONSHIP (R=0.53)



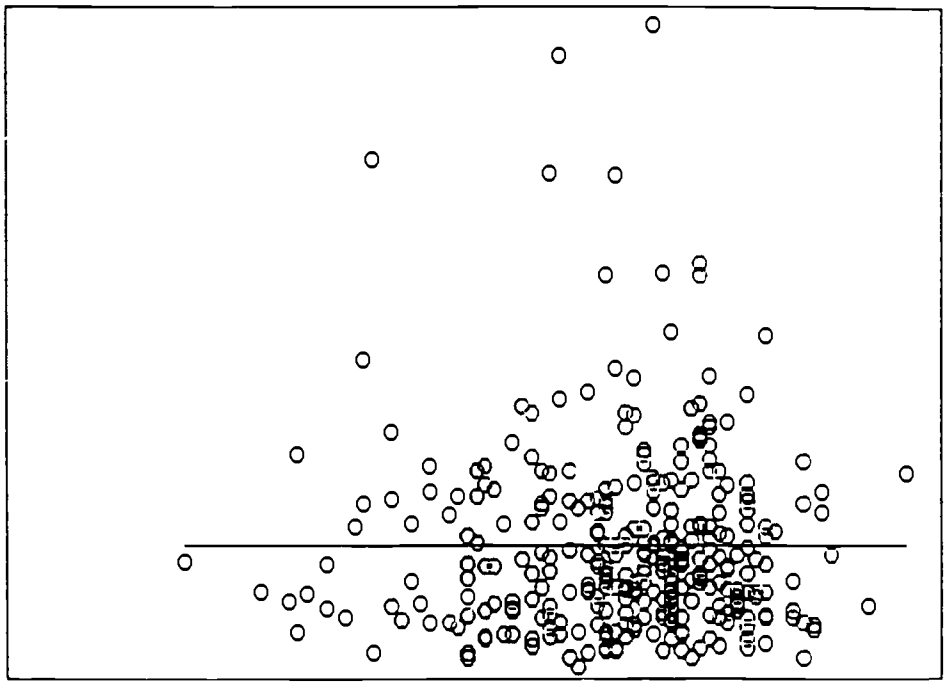
EXAMPLE OF A SLIGHT POSITIVE RELATIONSHIP (R=0.30)



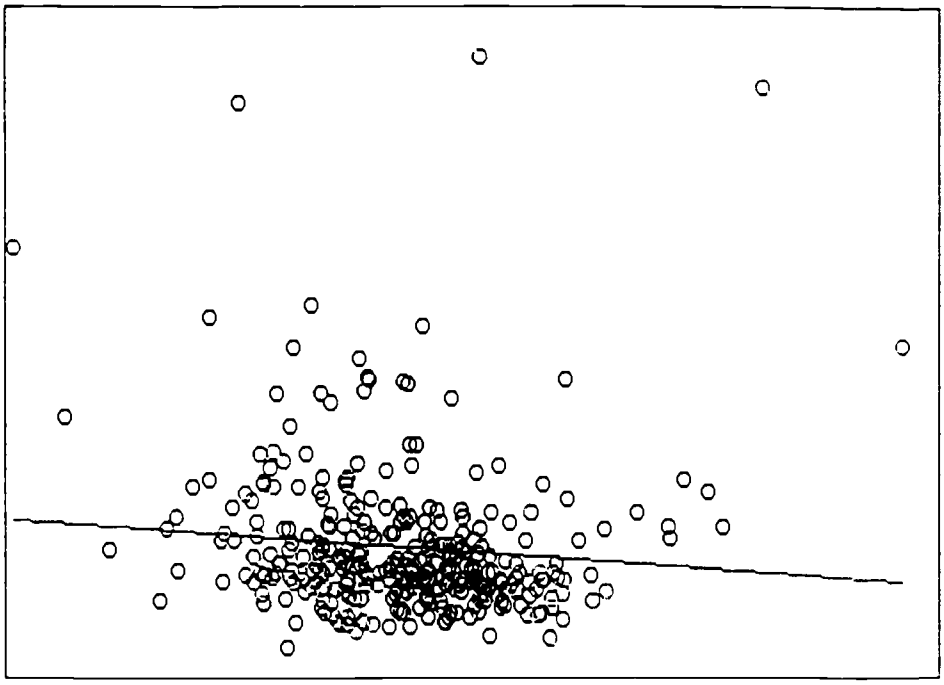
EXAMPLE OF A VERY SLIGHT POSITIVE RELATIONSHIP (R=0.10)



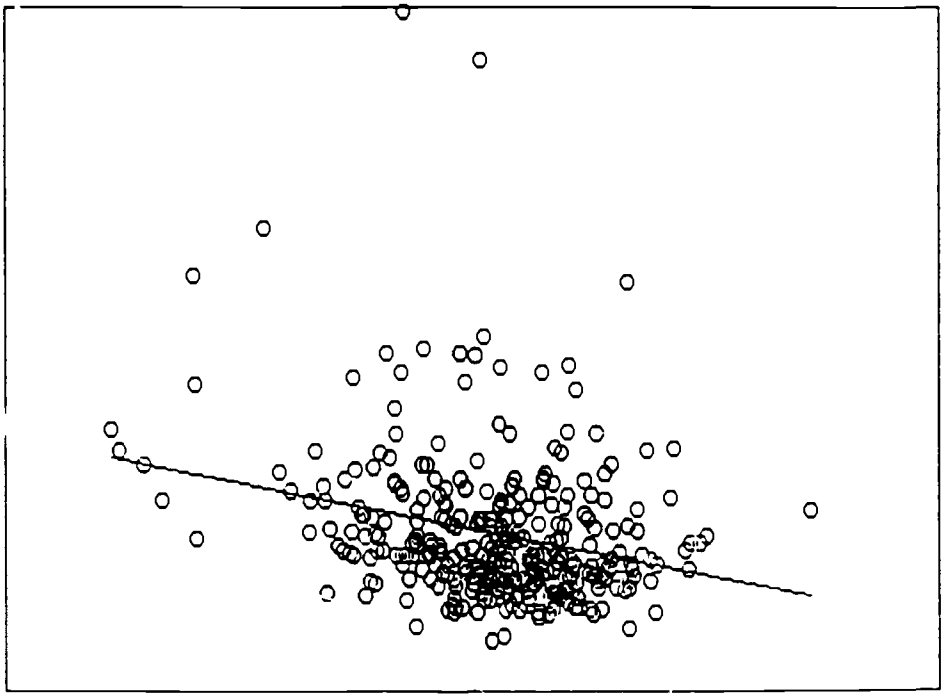
EXAMPLE OF NO RELATIONSHIP (R=0.00)



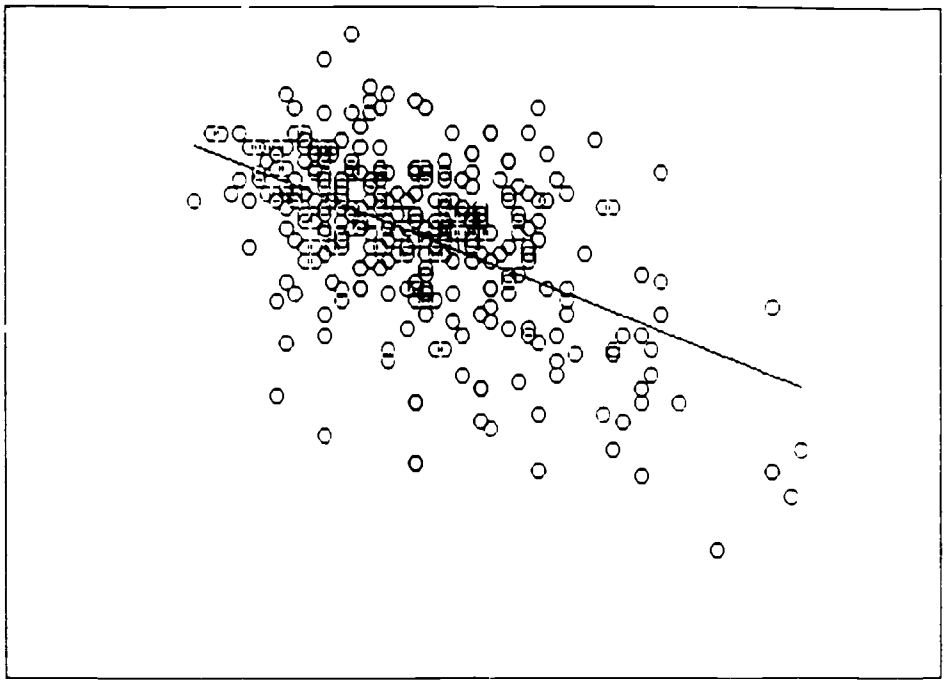
EXAMPLE OF A VERY SLIGHT NEGATIVE RELATION. (R=-0.10)



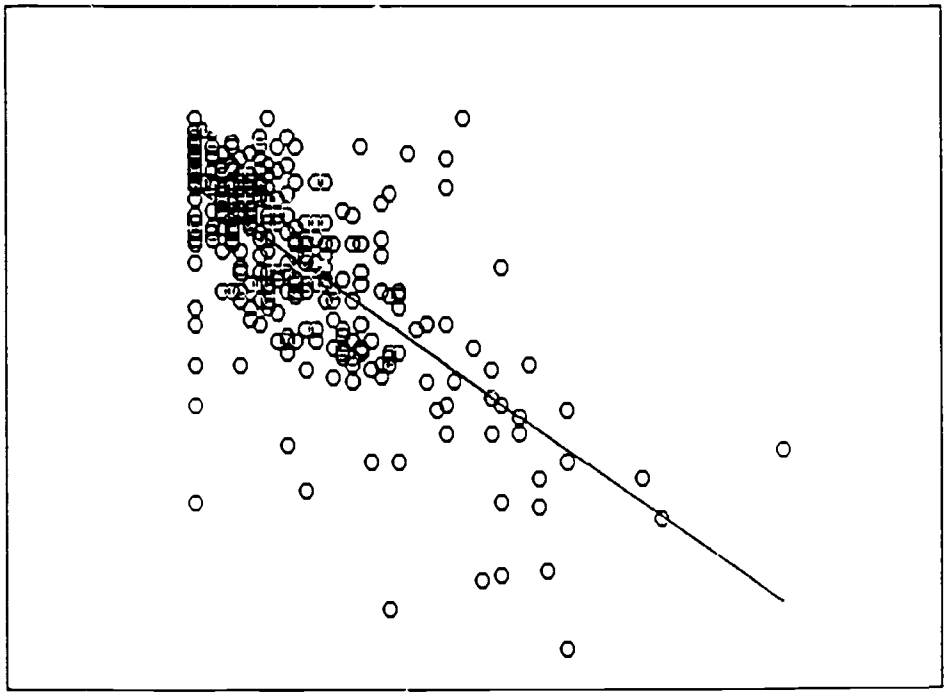
EXAMPLE OF A SLIGHT NEGATIVE RELATIONSHIP (R=-0.27)



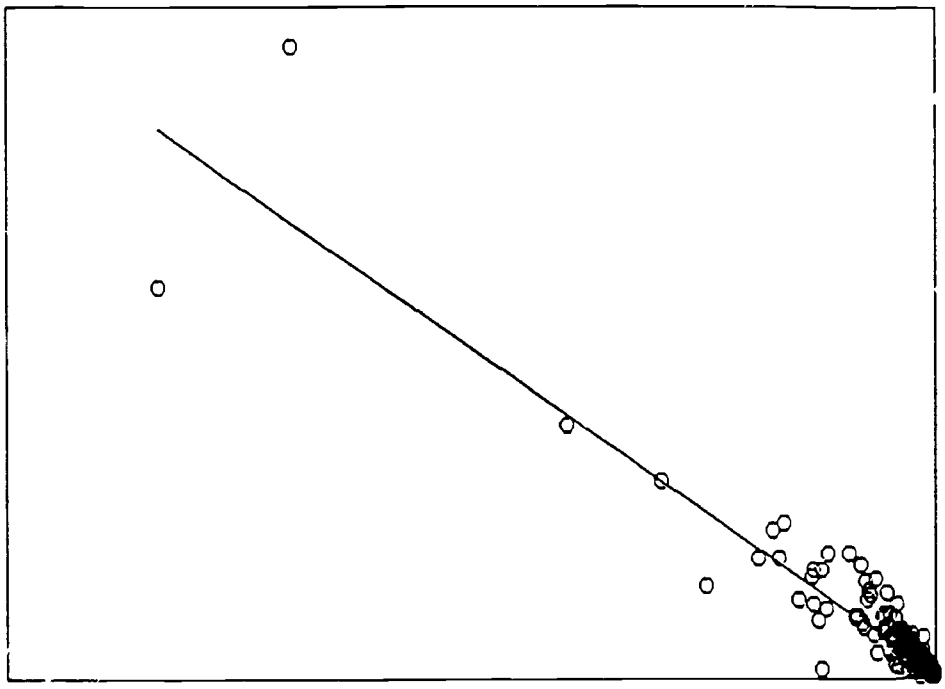
EXAMPLE OF A MODEST NEGATIVE RELATIONSHIP (R=-0.54)



EXAMPLE OF A MARKED NEGATIVE RELATIONSHIP (R=-0.70)



EXAMPLE OF A VERY HIGH NEGATIVE RELATIONSHIP (R=-0.93)



EXAMPLE OF A STRONG NEGATIVE RELATIONSHIP (R=-1.00)