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Until litigation reaches the point where both sides are willing to listen to data, so much so that states actively monitor themselves and that plaintiffs concede when sophisticated data deny genuine differences, plaintiffs and states and children will suffer equally in lengthy and expensive litigation.

Resource Accessibility, Wealth Neutrality, and Tax Yield in Montana*

by David C. Thompson, R. Craig Wood, David S. Honeyman and M. David Miller

*This article was prepared from an earlier document entitled The Study of Resource Accessibility, Wealth Neutrality, and Tax Yield in Montana Rural Education Association v State[1] prepared on behalf of the Attorney General's Office, State of Montana. The earlier report was prepared under contract between the State of Montana and Wood, Thompson & Associates. These data were argued in the trial court and subsequently admitted into evidence.

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Introduction

In recent years, school finance litigation has dominated thought among theorists and researchers interested in the public policy dimensions of fiscal support for education. Nearly every state has experienced litigation, and in many instances repeated attacks on state funding methods for public elementary and secondary education have occurred. In some instances, litigation has represented emergence of more sophisticated thought about equal educational opportunity, while in other instances controversy has returned again and again as compliance litigation has sought to enforce earlier court rulings. Thoroughly illustrated in the literature, these complaints have followed a distinct pattern of argument as plaintiffs have alleged that states have not met their constitutional obligation to provide high quality educational opportunity to all children without regard to local wealth and school district boundaries.[2]

Although plaintiffs have argued with varying degrees of success in the many state courts, they repeatedly seek to test judicial sympathy in new settings and at new times in history. Although settings and conditions constantly change, the arguments are often the same, creating an unceasing challenge for defendants who must balance the delicate mix between the grim realities of limited state budgets and plaintiffs' successes in some states that have generally aided a climate of fiscal reform momentum. Such was recently the case in *Montana Rural Education Association v State*[3] where plaintiffs contended that the fiscal amounts allocated to the plaintiff school districts ". . . denies certain student equality of educational opportunity, . . . and equal protection of the laws."[4] Specifically, the plaintiffs contended that:

(a) The classifications and funding levels provided in the foundation program schedules are arbitrary, with no rational and educationally-related basis. Additionally, the amounts allocated through the foundation program have been, and continue to be, less than needed to fund public elementary and secondary education at the levels required by the State of Montana sufficient to provide equal educational opportunities;

(b) Because they are arbitrary and not based on educationally-related determinations of need, the foundation program schedules fail to reflect the costs of providing educational opportunities to students in rural elementary and secondary school districts in Montana;

(c) The eligibility formula for GTB aid is biased against smaller, rural school districts, and in favor of larger, non-rural districts. As a result, rural school districts are significantly less likely to qualify for Guaranteed Tax Base aid than are non-rural school districts;

(d) Additionally, the distribution formula for determining the amount of GTB aid for qualifying districts is biased against smaller rural districts, and favors larger, non-rural districts. As a result, even though a rural district may qualify for GTB aid, the amount it receives is disproportionately small compared to the amount that is distributed to a qualifying non-rural district;

(e) As a result of the funding inequities described, students in rural school districts are not afforded equal educational opportunities; and

(f) Montana's school finance system in general, and the foundation program classifications and funding inequities, in particular, adversely affect the quality of education afforded to students in the plaintiff school districts.[5]

These plaintiff claims are representative of and consistent with the broad context of school finance equity litigation that has characterized the last three decades in the fiscal policy arena. Although the facts were specific to one state, the broader questions of constitutional equity and sound finance theory were

again raised because the state of Montana was being challenged to show that its statutory scheme for financing public education did not violate equal opportunity as defined in constitutional and fiscal theory. As in every other state where challenges have arisen, the question for the court rested in whether the principle of equalized educational opportunity is uniformly operational, and whether equalization can be served when differential costs of educational delivery are only those related to enrollment and size of the district, rather than extended to include plaintiffs' claim of other attributable costs relating to economic and geographic factors affecting the actual price of education.[8] As such, the issue at bar became whether the Montana finance formula had achieved full equity, satisfactorily addressing the intent of equalization and equitable financing in the modern context of equal opportunity.

Often ignored in the modern frenzy of reform litigation, however, is the question of whether states are assumed guilty of inequitable treatment of children. The literature often trumpets the reform agenda as if such conclusion were naturally true, with little opportunity for defendants to offer their views in a reflective discourse. Since the root of controversy rests in disagreement about whether real harm has occurred or whether mere political theory is offended,[7] it becomes important to recognize that each side in a legal dispute views its claims as correct and justified. It is equally often unnoticed that plaintiffs and defendants effectively ask the same questions when they develop their arguments. Hence the literature generally attributes considerable detailing to plaintiff claims. Yet defendant claims deserve consideration in a democracy, particularly given that each party approaches the same legal and methodological questions.

Both plaintiffs and defendants in Montana addressed the same questions, but from radically different perspectives. In traditional form plaintiffs concluded that where disparity on fiscal variables could be found, such disparity was unacceptable on its face. Defendants likewise looked for disparity; however, the approach was quite different by extending the question beyond observation of phenomenon and linking these questions to legal theory of burden upon the state to redress both the *fact* and *root* of disparity. For defendants, the questions focused on the state-created aid formula on two dimensions:

> First, has the *formula* created wealth-related educational opportunity? If it has not, then legislative intent in enacting an equalization formula is by default met.
>
> Second, are there *formula*-based inequities which differentiate plaintiffs from nonplaintiffs? While absolute perfection may not be possible, any inequities should be rationally related to the aims of equalization. The question becomes: Are plaintiff districts differentially harmed by the formula? If not, then equity is by default met.[8]

Under these conditions, this analysis offers a significant contribution to the search for equal educational opportunity by tracing an actual data analysis for defendants in Montana and by offering the literature an analysis of the other side of a legal controversy.

The Challenged Statutory Scheme[9]

The state share of funding for public elementary and secondary schools in Montana is derived from a formula which includes both a foundation and guaranteed tax base component. The purpose of the formula,which took effect in the 1990–91 academic year in response to the declaration of the unconstitutionality of the former system of school finance in *Helena Elementary School District No. 1 v Montana Education Association,*[10] was to equalize per pupil educational expenditures among the 538 school districts across the state in order that each child may be provided a sufficient program of instruction regardless of the relative property wealth of the child's community. The rationale behind the foundation portion of the Montana public school funding formula is provided by statute:

> A uniform system of free public schools sufficient for the education of and open to all school age children of the state must be established and maintained throughout the state of Montana. The state shall aid in the support of its school districts on the basis of their financial need as measured by the foundation program and in the manner established in this title.[11]

The foundation program attempts to accomplish this goal through establishment of a dollar amount of the general fund of each district which is necessary to support a sufficient educational opportunity for each school child in the state.

The Montana formula is enrollment driven, with state funding based on pupil units expressed as *average number belonging* (ANB). The ANB, a modified form of average daily attendance, includes attendance for 180 instructional days per year plus up to seven instruction-related days. Elementary and high school districts are divided into fifteen funding categories based on ANB. The districts in each category are provided a certain general fund budget dollar amount through the foundation formula, with the per-pupil rate declining for each category as ANB increases. Each county government acts as fiscal agent for the school districts located within the county's borders. The Board of County Commissioners in each county is required by statute to fix and levy taxes necessary to finance the final budget of each school district. This includes levying taxes in support of the foundation program, as well as any permissive levies authorized by those districts that choose discretionary taxation for additional school spending.

The Montana foundation program includes statewide aid, as well as county equalization aid, to individual school districts. The state requires a 95 mill property tax rate to be levied by each county. The revenue resulting from the levy of the first 40 mills is deposited to the state special revenue account to be used as statewide equalization aid through the foundation program. The revenue derived from the remaining 55 mills is retained in each county, and is distributed as equalization aid among the districts in the county. The aggregate foundation program aid, including both state and county equalization funds, was $341 million for the 1990–91 school year.

County equalization aid money is distributed to the districts within each county's borders in an attempt to fund the general budget in accordance to the state schedule which bases general fund parameters on district ANB category. If the county is unable to fund districts at 100 percent of the foundation program general fund level, then districts in the county are eligible for state equalization aid. Funds from the state special revenue fund are used to provide foundation equalization aid to districts in counties unable to finance their general funds at 100 percent of the scheduled amount, as well as guaranteed tax base aid to qualified districts. If the special revenue fund is not sufficient to finance districts according to law, then the state commissioner of public education is authorized to request a special appropriation by the legislature to bring funding up to the total foundation program level.

The guaranteed tax base (GTB) component of the Montana public school funding formula is used to supplement statutory permissive levies of individual districts, as well as the levies passed by counties for teacher retirement funds. The purpose of the GTB is to assure that the levy resulting from a mill rate (either the permissive levy or the county retirement levy) is equivalent to the statewide average levy resulting from that same tax rate.

Permissive levies are statutorily available wherein individual school districts are authorized to pass mill rates above those prescribed in the foundation program. Such mill rate must be

passed by the district board of trustees and approved by district voters in a general election. The permissive levy which results from this mill rate by law may not exceed 35 percent of the foundation program levy of that district. In addition, no district may have an overall levy greater than 104 percent of the previous school year.

Calculation of the GTB for any given district is as follows: the mill value per ANB of the district is subtracted from the statewide mill value per ANB. This difference multiplied by the mill value passed by district voters in support of the general fund yields the amount of the guaranteed tax base. The GTB for a county in support of its teacher retirement fund for the districts within its borders is similarly calculated, i.e., the countywide mill value per ANB is subtracted from the statewide mill value per ANB. This difference is multiplied by the mills levied by the county to support the county teacher retirement fund. Although the formula is considerably more complex in its operation, the description here is sufficient to understand the fundamental aspects of the formula that were challenged by plaintiffs.

Framework for Evaluating the Montana Formula[12]

Evaluation of fiscal equity in a state funding scheme for public education always requires measurement. Plaintiffs offer "proofs" of their complaints, and defendants are obliged to consider whether those proofs are accurate. As a general rule, measurement of selected aspects of the state aid formula and its impact on plaintiffs and nonplaintiffs follows wherein each side develops its own assessment of the formula for presentation to the court. While plaintiffs and nonplaintiffs have many strategic options, some framework to develop convincing data is always employed. Regardless of the level of analytical sophistication, measurement is implicit. Of critical importance is the selection of objects to be evaluated and the choice of methodologies by which measurement will occur. Generally plaintiffs and defendants will agree that the modern context of equity is to eliminate disparities over time and to disengage wealth from opportunity. Although there is general agreement to this end, there is less sophistication in the analyses that actually follow.

Despite absence of a single approach to measuring equity, three generally accepted principles of equity common across the research literature in education finance are *resource accessibility, wealth neutrality,* and *equal tax yield.* These broad standards seek answers to critical questions about equity that interest both plaintiffs and defendants. The resource accessibility standard asks whether students have access to resources to appropriately meet their educational needs. The wealth neutrality standard then asks whether those resources are unacceptably related to local wealth and residence. The tax yield standard finally seeks equity for taxpayers and asks whether equal tax effort results in equal yield. Although subject to varying degrees of emphasis in different analyses, these standards usually drive litigation data analysis. In the present instance, they again provide a useful framework to assess performance of the Montana statutory scheme for funding public education, both at the state level and within unique formula aspects relating to enrollment categories (ANB).

These equity standards must be further defined in order to be measurable, wherein a legislature's intent by enacting an aid formula must be considered. If the formula implies a heavy state responsibility for the education system, equity under the resource accessibility standard may be evaluated by looking critically at the degree of dispersion of wealth and expenditures per pupil. Measures that capture dispersion about some variable central to the formula are most useful in showing whether variance is too great at either end of the distribution. Generally analyses examine the relationship of school districts to variables such as median or mean budget or expenditure, wherein the critical question must finally be directed to whether their position is linked to local wealth, is related to choice, or is a function of some other political reality. If it can be determined that illegitimate relationships exist, then equity is seriously questioned. Less apparent, however, is that variability not explained by wrongful formula design should not be presumed the result of neglect. As a result, resource accessibility is the first key aspect of this evaluation of Montana's aid plan.

Whenever variability in resources is found, the question of formula flaw must be examined by measurement of the link between local wealth and resources. This second element of equity defines the wealth neutrality standard. If, in examining the dispersion of resources it were found that wealth and expenditures per pupil are positively correlated so that an increase or decrease in local wealth results in an increase or decrease in the budget per pupil, and if these differences were greater for a select group of school districts, then the wealth neutrality standard would be violated because opportunity becomes a function of local wealth. If, on the other hand, it were argued that variations are related to a legitimate educational purpose such as compensating for differences in certain costs, *i.e.*, sparsity or density or special educational needs, then tests for significant cost differentials between affected groups should reflect the concept that rational differences in fact exist. The test is more accurately between similarly situated groups: if differences are observed, then equity questions may be confirmed. However, if the formula creates differences based on justifiable differences in populations, then equity may in fact be served by variability.

If differences are significant and are unrelated to relevant attributable costs, both the resource accessibility and wealth neutrality standards must be measured. Such measures need to assess relationships between wealth and expenditure and should assess differences between affected groups (*e.g.*, plaintiffs, nonplaintiffs, and matched sets of nonplaintiff districts) to provide an effective means of evaluating wealth neutrality in a finance formula. When inequality as defined by differences in correlations between wealth and expenditure is present, or when there are demonstrable and significant differences between these groups unrelated to legitimate purposes, the formula may become suspect. Measuring wealth neutrality thus forms a central feature of this examination of Montana's school finance plan.

The final standard of taxpayer equity concludes the equity argument and seeks equal treatment by questioning the relationship between tax yield and equal tax effort. If one school district can produce higher tax yield with less tax effort than another school district which cannot reach that level without higher tax rates and therefore an unequal tax burden, the taxpayer equity standard is violated and access to educational opportunity is barrier-laden unless the state aid formula actively intervenes to nullify inequality. Consequently, observations regarding tax yield and tax effort are also instructive about resource accessibility and wealth neutrality. While many complex issues cloud the taxpayer equity standard and make it largely unmeasurable with the present level of sophistication in research, for rough consideration statistical assessment is still necessary. Because taxpayer equity can be considered as a *de facto* byproduct of the wealth neutrality standard, taxpayer equity is separately evaluated in this analysis of Montana's aid scheme only insofar as it enlightens discussion on resource accessibility and wealth neutrality.

Statistical measurement is therefore a necessary condition to determining equity in school finance litigation. By observing variations in the values of selected school finance measures, judgments can be made about formula effects on generally accepted equity standards for the affected groups. Although each side always believes its proofs to be accurate, measurement must show meaningful disparity if plaintiffs' contentions are to be valid, *i.e.*, there must be a substantively negative effect on

educational opportunity caused by statutory provisions. This analysis therefore uses measurement to examine performance of the Montana school aid formula generally, within, and between groups on the common standards of resource accessibility, wealth neutrality and taxpayer equity.

Measuring Resource Accessibility, Wealth Neutrality and Tax Yield

The standard measures of equity[13] used in this study to evaluate resource accessibility were the *mean, range, restricted range, variance, standard deviation, coefficient of variation*, and *analysis of variance*. These tests were applied, by group, to a number of variables which measured budget, expenditure, wealth (the dollar value generated by one mill), budget surplus, and tax millage for each district. The groups used in this analysis included: all districts, plaintiff districts, nonplaintiff districts, and a randomly selected group of nonplaintiff districts matched by enrollment (ANB). Likewise, the statistical measures used to determine wealth neutrality and equivalency of tax yield were *correlational analysis and regression*, the *McLoone Index*, and *Gini coefficient*. All data were for the 1991–1992 school year, except the percentage of budget surplus which was projected for the 1992–1993 school year, and were provided by the Montana Office of Public Instruction.

Mean

The mean is a measure of the central tendency of the distribution of observations. It represents the average value in a distribution of a variable The mean takes into account all observations in the distribution. The mean of each variable examined was calculated with the following formula:

$$\sum X_i / N$$

where $\sum$ is the sum of all districts, X_i is the value of a given variable in district *i*, and N is the number of districts.

Range

The range is the difference between the highest and lowest observations in a distribution. The smaller the value of the range, the smaller the variation in the distribution of a given variable. The smaller the variation, the better the assumed equity of a distribution. As a measure of equity, the usefulness of the range is limited. It is based on only two values, does not indicate the pattern of variation, nor is it sensitive to changes within the distribution. Nonetheless, the range is highly useful in assessing disparity. The range of selected variables in Montana was calculated with the following formula:

$$\text{Highest } X_i - \text{Lowest } X_i$$

where X_i is the variable considered in district *i*.

Restricted Range

The restricted range is the difference between the observation at the 95th percentile of the distribution and the 5th percentile. Due to the sensitivity of the range to extreme values, the restricted range eliminates values below the 5th percentile and above the 95th percentile. The smaller the value of the restricted range, the smaller the variation in the distribution of a given variable per district. The smaller the variation, the better the equity of the distribution. However, like the range, the restricted range is subject to the same limitations as a measure of equity. The restricted range was used in examining Montana's fiscal profile and was calculated with the following formula:

$$X_i \text{ at 95 percentile} - X_i \text{ at 5 percentile}$$

where X_i was the variable considered in district *i*.

Variance

The variance is the average of the squared deviations from the mean. The smaller the value of the variance, the smaller the variation in the distribution of a given variable. The smaller the variation, the better the equity of a distribution. The advantage of the variance over the measures previously discussed is that the variance takes into account all observations. However, the variance is not expressed in original units and is sensitive to outliers, i.e., extreme values at either end of a distribution. The variance was a fundamental tool in examining expenditures per pupil in Montana and was calculated with the following formula:

$$\sum P_i (X_p - X_i)^2 / \sum P_i$$

where $\sum$ is the sum of pupils in all districts, P_i is number of students in district *i*, X_p is the mean expenditure per pupil for all pupils, and X_i is the expenditure per pupil in district *i*.

Standard Deviation

The standard deviation is the square root of the variance. The smaller the value of the standard deviation, the smaller the variation in the distribution per pupil per district. The smaller the variation, the better the equity of a distribution. The advantage of the standard deviation is that all observations are included in the calculation and the units of measurement are in the original scale. However, it is sensitive to outliers. The standard deviation formed a central aspect of evaluating Montana's equity performance and was calculated as the square root of the variance as previously discussed using the following formula:

$$\sqrt{\sum P_i (X_p - X_i)^2 / \sum P_i}$$

Coefficient of Variation

The coefficient of variation is the standard deviation divided by the mean, or the square root of the variance divided by the mean. It is expressed as the ratio of the standard deviation of the distribution to the mean of the distribution. The smaller the value of the coefficient of variation, the smaller the variation in the distribution of some variable per pupil per district. The smaller the variation, the better the equity of the distribution. It is sensitive to outliers but not to changes in scale. The coefficient of variation was utilized in examining Montana's equity profile and was calculated with the following formula:

$$\sqrt{(\sum P_i (X_p - X_i)^2 / \sum P_i)}/X_p$$

where X_p is the mean expenditure per pupil for all districts.

McLoone Index

The McLoone Index is the ratio of the sum of expenditures per district for all districts below the median to the sum of expenditures that would be required if all districts below the median were brought up to the median level of expenditure. The larger the value of the McLoone Index, the closer the lower half of the distribution is to the median of the distribution. Usually this index has a value between 0 and 1; however, if the group of districts (e.g., a selected subgroup as opposed to the entire distribution) being compared were to have a mean value close to the median, this value can be greater than 1. The McLoone Index formed a central aspect of evaluating the wealth neutrality standard and was calculated with the following formula:

$$\sum(1. . .j)\ P_i X_i / M_p \sum (1. . .j)\ P_i$$

where districts 1 through *j* are below the median, $\sum$ is the sum of pupils in all districts 1 through *j*, P_i is the number pupils in district *i*, X_i is the expenditure per pupil in district *i*, and M_p is the median expenditure per pupil for all districts.

Gini Coefficient

The Gini coefficient indicates how far the distribution of expenditures is from providing each percentage of students with the same percentage of expenditures. The smaller the value of the Gini coefficient, the more equitable the distribution of expenditures in providing a specified percentage of students with the same percentage of expenditures. Values range from

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Table 1. Descriptive Statistics for the Entire State

Category	N	ANB MEAN	ANB ST. DEV.	BUDGET MEAN	BUDGET ST. DEV.	EXPEND MEAN	EXPEND ST. DEV.	PPEXP MEAN	PPEXP ST. DEV.	PPMILVAL MEAN	PPMILVAL ST. DEV.
1	45	6.58	1.88	$32,644.91	$8,040.86	$28,523.44	$7,481.19	$4,620.44	$1,478.81	$101.41	$103.76
2	30	11.27	1.01	$43,142.63	$18,876.74	$37,657.65	$14,627.38	$3,315.38	$1,090.59	$94.94	$161.32
3	10	17.00	15.50	$61,196.00	$17,563.22	$51,000.66	$13,817.72	$3,284.92	$813.02	$42.40	$33.49
4	1	20.00	—	$51,014.00	—	$44,619.05	—	$2,230.95	—	$10.50	—
5	49	24.90	5.69	$86,161.47	$44,062.38	$72,028.38	$24,999.55	$2,912.32	$657.78	$36.43	$28.47
6	72	69.46	17.37	$326,197.68	$132,629.90	$294,559.93	$126,018.70	$4,211.38	$1,366.82	$39.05	$70.87
7	87	179.08	53.34	$657,639.17	$235,121.51	$625,167.78	$23,078.13	$3,535.52	$931.61	$19.30	$31.16
8	70	1185.47	1696.32	$3,887,630.87	$5,380,191.83	$3,831,718.84	$5,362,217.30	$3,275.07	$603.66	$15.85	$27.84
9	6	20.50	3.51	$357,440.50	$70,518.03	$208,012.60	$37,195.77	$10,273.73	$1,670.92	$77.58	$29.75
10	24	34.38	4.24	$361,328.67	$85,947.51	$326,084.99	$94,959.40	$9,495.23	$2,467.89	$78.94	$46.20
11	53	65.21	19.60	$487,246.83	$119,344.06	$452,750.31	$103,153.56	$7,315.30	$2,074.85	$49.81	$31.08
12	36	149.83	28.75	$827,608.17	$259,746.64	$798,615.62	$226,866.47	$5,294.33	$1,261.13	$46.65	$36.69
13	15	237.47	30.87	$1,163,770.60	$363,776.86	$1,095,864.07	$236,682.66	$4,665.93	$1,143.99	$39.74	$14.88
14	18	433.28	76.28	$2,129,535.17	$853,555.89	$1,981,557.42	$552,246.45	$4,643.00	$1,359.37	$45.40	$80.33
15	11	1931.64	1345.77	$7,888,533.55	$5,437,399.65	$784,935.57	$5,456,326.61	$4,048.49	$311.42	$27.86	$4.45
Overall	527	280.83	784.12	$1,079,468.23	$26,282,710.31	$1,044,072.98	$2,613,356.00	$4,537.31	$2,178.45	$44.84	$67.78

zero to 1. The coefficient compares expenditures at each level with expenditures at every other level and is sensitive to changes throughout the distribution, though not to extreme outliers. The Gini coefficient formed a central aspect of evaluating the wealth neutrality standard and was calculated with the following formula:

$$\Sigma_i \Sigma_j P_i P_j [X_i - X_j] / 2(\Sigma_i P_i)^2 X_p$$

where Σ is the sum for all pupils in districts *i* and district *j*, P_i is the number of pupils in district *i*, P_j is the number of pupils in district *j*, X_i is the expenditure per pupil in district *i*, X_j is the expenditure per pupil in district *j*, and X_p is the mean expenditure per pupil for all districts.

The foregoing measures were useful in assessing both the resource accessibility and wealth neutrality standards by dealing with the dispersion or variation of single variables. Other measures were also used, however, to describe relationships between two variables and were regression-based measures. Correlations and slopes were two such regression-based measures used to examine Montana's aid formula.

Simple Correlation

Simple correlation describes the degree to which two variables are associated. In the present study the two main variables were wealth (mill value) in each school district and the corresponding expenditure per pupil. In the study of school finance, these two variables are often used to describe the fiscal neutrality of a state school finance system. A system that is fiscally neutral is generally able to show very low relationship between wealth and pupil revenue/expenditure.

The correlation coefficient has values that range from -1.0 to +1.0. When two variables are positively associated, larger values of one tend to be accompanied by larger values of the other. Conversely, when two variables are negatively related, larger values in one tend to be accompanied by smaller values of the other. A value of +1.0 indicates a perfect positive linear relationship and a value of -1.0 a perfect negative linear relationship. A value of 0 indicates no linear relationship between the two variables. As a measure of fiscal neutrality, a correlation coefficient of 0 would indicate no linear relationship between the two variables. In assessing Montana's aid scheme, the simple correlation was found by the Pearson correlation coefficient and was calculated using the following formula:

$$\Sigma P_i(X_i - X)(W_i - W) / [\sqrt{\Sigma P_i(X_i - X)^2}][\sqrt{\Sigma P_i(W_i - W)^2}]$$

where Σ is the sum of pupils in all districts, P_i is the number of pupils in district *i*, X_i is the expenditures per pupil in district *i*, X is the mean expenditures per pupil for all districts, W_i is the wealth per pupil in district *i*, and W is the mean wealth per pupil for all districts.

These fundamental tools formed the basis for assessing resource accessibility, wealth neutrality, and by inference tax yield in Montana. The results of the analysis were reviewed by the court in the record wherein defendants were able to respond to plaintiffs' claims of formula-based inequity.

Results of the Analysis[14]

Resource Accessibility

Table 1 shows the derived values for school district budgets, expenditures, and mill rates for the 527 school districts in Montana. The funding categories included eight (1–8) elementary school district categories and seven (9–15) secondary school district categories. The primary method of defining funding category at both the elementary and secondary levels was the ANB. Thus, many of the discrepancies in operating schools for fewer students can be seen simply by examining the funding categories with their differences in ANB. As the funding categories increased in ANB, there was a concomitant increase in district budgets and expenditures for both elementary and secondary categories. However, expenditures per pupil, as well as mill values per pupil, did not follow the same trend. At the secondary level, per pupil expenditures decreased with increases in ANB, while the pattern was less clear at the elementary level. While there were exceptions, per pupil mill values were higher given fewer students.

Plaintiffs in this cause were 146 school districts comprising some of the smaller and more rural districts in Montana. Because the state of Montana has greater diversity in district sizes (*i.e.*, ANBs) than was represented by plaintiff school districts bringing this action, comparisons between plaintiffs and the rest of the state in funding and expenditures should be interpreted with caution. Nevertheless, Tables 2 and 3 show descriptively the budgets and expenditures of all plaintiffs and all nonplaintiffs in the state respectively, thereby giving some preliminary indication of the relative position of plaintiffs to the remainder of the state's districts.

As expected, total budgets and expenditures of nonplaintiff school districts were much higher (means) and more variable (higher standard deviations) when considered on a statewide basis. This finding was expected on the basis of observed differences in ANBs for plaintiffs and nonplaintiffs where the average ANB for nonplaintiffs was almost three times the average ANB for plaintiffs. In addition, the plaintiffs did not represent any districts in the two largest secondary funding categories (14 and 15), and represented only smaller districts in the largest ele-

Table 2. Descriptive Statistics for Plaintiff Districts

Category	N	ANB MEAN	ANB ST. DEV.	BUDGET MEAN	BUDGET ST. DEV.	EXPEND MEAN	EXPEND ST. DEV.	PPEXP MEAN	PPEXP ST. DEV.	PPMILVAL MEAN	PPMILVAL ST. DEV.
1	8	6.50	2.39	$36,495.75	$10,480.17	$30,780.90	$9,776.66	$5,172.30	$1,918.56	$150.46	$92.80
2	4	11.75	0.96	$46,991.25	$13,209.20	$39,761.81	$9,331.20	$3,368.64	$664.23	$77.00	$48.77
3	2	15.00	1.41	$75,925.00	$23,753.13	$56,619.34	$3,217.28	$3,718.32	$142.02	$46.58	$37.86
4	1	20.00		$51,014.00		$44,619.05		$2,230.95		$10.50	
5	13	25.31	5.06	$85,060.46	$24,730.58	$70,396.23	$12,082.12	$2,857.79	$644.49	$53.66	$45.22
6	26	67.35	19.26	$356,890.50	$120,577.15	$313,541.12	$121,298.41	$4,617.28	$1,141.55	$60.84	$111.73
7	27	181.15	52.00	$701,778.33	$200,491.20	$637,949.22	$179,075.19	$3,610.79	$897.83	$29.61	$53.09
8	9	482.78	122.45	$1,631,249.22	$474,924.84	$1,579,681.58	$438,716.19	$3,267.41	$310.01	$33.25	$52.86
9	3	22.33	2.08	$270,147.67	$66,015.16	$224,343.41	$51,524.87	$9,975.42	$1,497.90	$85.46	$44.55
10	16	34.63	4.40	$387,900.56	$90,581.12	$347,895.55	$109,538.75	$10,030.57	$2,810.05	$88.80	$51.72
11	20	67.75	20.52	$521,854.60	$122,583.05	$472,625.25	$97,126.35	$7,258.59	$1,278.81	$57.66	$25.76
12	12	152.08	31.50	$897,837.92	$269,446.99	$824,135.07	$253,938.85	$5,387.25	$992.29	$62.08	$55.20
13	5	226.40	26.42	$1,221,979.60	$359,809.77	$1,155,752.73	$255,154.58	$5,067.35	$639.16	$45.46	$17.00
14	0										
15	0										
Overall	146	112.32	121.43	$541,334.86	$439,981.26	$496,112.22	$420,325.52	$5,303.53	$2,608.40	$60.25	$69.99

Table 3. Descriptive Statistics for Non-Plaintiff Districts

Category	N	ANB MEAN	ANB ST. DEV.	BUDGET MEAN	BUDGET ST. DEV.	EXPEND MEAN	EXPEND ST. DEV.	PPEXP MEAN	PPEXP ST. DEV.	PPMILVAL MEAN	PPMILVAL ST. DEV.
1	37	6.59	1.79	$31,812.30	$7,325.22	$28,035.34	$6,960.08	$4,501.12	$1,369.24	$90.81	$104.08
2	26	11.19	1.02	$42,550.54	$19,740.10	$37,333.93	$15,392.46	$3,307.18	$1,151.62	$97.70	$172.75
3	8	15.63	0.92	$57,513.75	$15,444.05	$49,595.99	$15,255.40	$3,160.82	$871.19	$41.36	$35.09
4											
5	36	24.75	5.97	$86,559.06	$49,520.86	$72,617.77	$28,385.13	$2,932.01	$670.42	$30.21	$16.15
6	46	70.65	16.31	$308,849.57	$137,204.67	$283,831.43	$128,671.50	$3,981.96	$1,440.36	$26.73	$23.67
7	60	178.15	54.33	$637,776.55	$248,141.20	$619,416.12	$251,709.02	$3,501.66	$951.88	$14.66	$10.14
8	61	1289.15	1795.03	$4,220,539.64	$5,690,518.60	$4,163,986.63	$5,671,659.80	$3,276.20	$637.37	$13.29	$21.61
9	3	18.67	4.04	$244,733.33	$87,118.11	$191,681.80	$1,978.85	$10,572.02	$2,114.07	$69.69	$6.45
10	8	33.88	4.16	$308,184.88	$42,986.98	$282,463.87	$25,587.12	$8,424.54	$1,060.94	$59.23	$24.78
11	33	63.67	19.17	$466,272.42	$114,107.84	$440,704.90	$106,270.41	$7,349.67	$2,453.85	$45.05	$33.37
12	24	148.71	27.92	$792,493.29	$253,153.39	$770,855.90	$215,623.48	$5,247.86	$1,393.76	$38.93	$20.11
13	10	243.00	32.72	$1,134,666.10	$381,430.93	$1,065,919.75	$234,981.37	$4,465.22	$1,311.46	$36.88	$13.74
14	18	433.28	76.28	$2,129,535.17	$853,555.89	$1,981,557.42	$552,246.45	$4,643.00	$1,359.37	$45.40	$80.33
15	11	1931.64	1345.77	$7,888,533.55	$5,437,399.65	$7,849,535.57	$5,456,326.61	$4,048.49	$311.42	$27.86	$4.45
Overall	381	345.41	911.24	$1,285,682.07	$3,055,174.32	$1,254,052.69	$3,037,541.66	$4,243.69	$1,913.32	$38.94	$66.06

mentary category (8). Thus, larger budgets and expenditures for nonplaintiffs were expected from their larger ANBs. Also, the larger ANBs for nonplaintiffs led to lower average per pupil expenditures. These findings were consistent with the pattern expected on the basis of relationships of these variables to ANB in the overall state summary as seen previously in Table 1. Deeper examination, however, revealed that differences between plaintiffs and nonplaintiffs were not necessarily predictable by normal expectations of equity critics in school finance litigation. Differences between plaintiffs and nonplaintiffs were in fact negligible, even when cursorily taking into account the funding category, or ANB. When comparing plaintiffs and nonplaintiffs within the categories of ANB comparability in Tables 2 and 3 (Categories 1, 2, 3, 5, 6, 7, 9, 10, 11, 12 and 13), it could readily be seen that budgets and expenditures were higher for plaintiff school districts with only one exception (category 5) and that per pupil plaintiff expenditures were higher in 11 of the 13 categories (not 9 or 11). In addition to plaintiffs having higher per pupil expenditures, wealth as shown by per pupil mill values was higher for plaintiffs. Thus, plaintiffs were wealthier districts with higher per pupil expenditures.

Although rough statewide comparison showed absence of gross disparity after recognizing the impact of district size, these data on budget, expenditure, and per pupil expenditure were still nonetheless comparing two groups (plaintiffs versus nonplaintiffs) that were not perfectly comparable. This lack of comparability can be seen in ANBs. To more fairly examine such phenomena, actual plaintiffs needed to be compared with comparable nonplaintiff districts. For purposes of this study, comparability was defined as matching the two groups in terms of their individual funding categories and their individual ANBs. To accomplish this, a matched nonplaintiff counterpart was selected for each plaintiff school district. The matched district was derived from the same funding category and with the same (or as nearly possible) ANB. Whenever multiple districts qualified on the criteria, the matched district was randomly selected by appropriate statistical procedure. Table 4 shows descriptively these data for the matched school districts. Note first that the number of districts in each funding category was the same for plaintiff and the nonplaintiff matched pair.[15] In addition, the means and standard deviations for ANBs were approximately the same for the two groups within each funding category as well. Thus, comparisons between Table 2 (all plaintiffs) and Table 4 (matched nonplaintiffs) provided a better basis for examining whether plaintiffs materially differed from other districts in the state.

When comparing plaintiffs with comparable nonplaintiffs, differences in budgets, expenditures and mill value still existed, generally for the same reasons observed earlier. Because budgets and expenditures overall were still higher for plaintiffs, higher overall budgets and expenditures seen in Table 3 were simply a result of including larger noncomparable school dis-

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Table 4. Descriptive Statistics for Comparison Non-Plaintiff Districts

Category	N	ANB MEAN	ANB ST. DEV.	BUDGET MEAN	BUDGET ST. DEV.	EXPEND MEAN	EXPEND ST. DEV.	PPEXP MEAN	PPEXP ST. DEV.	PPMILVAL MEAN	PPMILVAL ST. DEV.
1	37	6.59	1.79	$31,812.30	$7,325.22	$28,035.34	$6,960.08	$4,501.12	$1,369.24	$90.81	$104.08
2	26	11.19	1.02	$42,550.54	$19,740.10	$37,333.93	$15,392.46	$3,307.18	$1,151.62	$97.70	$172.75
3	8	15.63	0.92	$57,513.75	$15,444.05	$49,595.99	$15,255.40	$3,160.82	$871.19	$41.36	$35.09
4											
5	36	24.75	5.97	$86,559.06	$49,520.86	$72,617.77	$28,385.13	$2,932.01	$670.42	$30.21	$16.15
6	46	70.65	16.31	$308,849.57	$137,204.67	$283,831.43	$128,671.50	$3,981.96	$1,440.36	$26.73	$23.67
7	60	178.15	54.33	$637,776.55	$248,141.20	$619,416.12	$251,709.02	$3,501.66	$951.88	$14.66	$10.13
8	32	475.53	124.94	$1,616,274.75	$587,125.40	$1,581,576.97	$529,106.35	$3,323.52	$688.58	$11.07	$4.51
9	3	18.67	4.04	$244,733.33	$87,118.11	$191,681.80	$1,978.85	$10,572.02	$2,114.07	$69.69	$6.45
10	8	33.88	4.16	$308,184.88	$42,986.98	$282,463.87	$25,587.12	$8,424.54	$1,060.94	$59.23	$24.78
11	33	63.67	19.17	$466,272.42	$114,107.84	$440,704.90	$106,270.41	$7,349.67	$2,453.85	$45.05	$33.37
12	24	148.71	27.92	$792,493.29	$253,153.39	$770,855.90	$215,623.48	$5,247.86	$1,393.76	$38.93	$20.11
13	10	243.00	32.72	$1,134,666.10	$381,430.93	$1,065,919.75	$234,981.37	$4,465.22	$1,311.46	$36.88	$13.74
14											
15											
Overall	323	121.16	143.53	$492,282.47	$525,876.91	$471,790.81	$507,895.52	$4,319.63	$2,020.00	$41.04	$68.30

Table 5. Descriptive Measures Including Range Calculations for Expenditures Per Pupil and Millvalue Per Pupil By Group

Group		Mean	St. Dev.	Minimum	Maximum	Range	Res. Range**
All Districts	Exp/Pupil*	4537.31	2178.50	1832.78	16570.70	14737.00	6570.50
	Millvalue/Pupil *	44.84	67.80	0.26	911.45	911.20	129.50
Plaintiffs	Exp/Pupil	5303.54	2608.40	1922.58	16570.69	14648.17	7148.83
	Millvalue/Pupil	60.25	69.99	5.45	599.43	593.99	162.85
Non-Plaintiffs	Exp/Pupil	4243.69	1913.32	1832.78	14344.35	12511.57	5463.38
	Millvalue/Pupil	38.94	66.05	0.264	911.45	911.20	88.09
Comparison Non-Plaintiffs	Exp/Pupil	4319.64	2020.00	1832.78	14344.35	12511.57	6071.48
	Millvalue/Pupil	41.04	68.29	0.26	911.45	911.20	95.79

* All data are reported in Dollars
** The Restricted Range

tricts. Even after removing those districts (see Table 4), plaintiffs still budgeted more money for schools and plaintiffs still spent more per pupil. In addition to overall differences in budgets and expenditures, per pupil expenditure remained about $1,000 higher in plaintiff districts. Significantly, higher expenditures of plaintiff districts were accompanied by higher wealth, as can be seen in the per pupil mill values. Finally, variability for comparison sets and plaintiffs also showed some other differences. Standard deviations of budgets and expenditures were higher for the nonplaintiff comparison group, while standard deviations for per pupil expenditures were higher for plaintiffs, showing less homogeneity within groups. Finally, per pupil mill values were about equally variable in the plaintiff group and the nonplaintiff comparison group.

For the remaining analyses examining resource accessibility, districts were analyzed across funding categories. Except as a basic description of the populations, the number of districts within any single funding category was too small to confidently draw conclusions. Consequently, analyses were run for each of the groups as a whole (*i.e.,* the state as a whole, plaintiffs, nonplaintiffs, and matched nonplaintiffs). The results are reported in Tables 5–7.

Results of range measures examining wealth (mill value per pupil) and expenditures per pupil are reported in Table 5. As analysis by these data showed, unrestricted ranges of these variables were noteworthy. Plaintiff districts had greater average wealth per pupil ($60.25) than was true for either the state ($44.84), non-plaintiffs ($38.94), or for the comparison nonplaintiff group ($41.04). The range of wealth expressed as mill value per pupil was in fact dramatic, as wealth varied by $911.20 per mill per pupil between the highest ($911.45) and lowest ($0.26) wealth districts in the state. This relationship was also true for the nonplaintiff group and for the comparison group as well. For plaintiffs, however, the range was considerably narrower at $593.99 (from $5.45 to $599.43).

The restricted range measure was also applied to the mill value per pupil, offering both a more conservative view of wealth disparity and an estimate of where wealth inequality was concentrated. By ignoring those districts at the extreme top 5 percent and bottom 5 percent of the scale of mill value per pupil, the restricted range at the state level revealed that mill value range dropped from $911.20 to $129.50 for the state (-14.2%). The decrease in restricted range was more variable for the other two groups, as the nonplaintiff group dropped from $911.20 to $88.90 (-9.7%), and the comparison group dropped from $911.20 to $95.79 (-10.5%). Further, the decrease in restricted range was less dramatic for plaintiffs, moving from $593.99 to $162.85, showing a 27.4% difference between the unrestricted and restricted ranges. These data indicated that disparity in mill values per pupil at the 5th–95th percentile was greatly reduced. Such a result was meaningful, indicating that there were several districts in the state that accounted for the apparent wide variations in wealth. At the same time, plaintiff districts appeared to be more homogeneous in the distribution of wealth as evidenced by a larger restricted range percentage. Such a result was significant because, although the state's unrestricted range in wealth per pupil appeared low compared to plaintiffs, this variation was reason-

Table 6. Analysis of Variance for Millvalue Comparing Plaintiffs with Non-Plaintiffs

ANOVA Table of MILVALUE/ANB

	DF	Sum of Squares	Mean Square	F-Value	P-Value
P-NP	1	47942.704	47942.704	10.628	.0012
Residual	525	2368224.122	4510.903		

Model II estimate of between component variance: 205.736.

Means Table for MILVALUE/ANB
Effect: P-NP

	Count	Mean	Std. Dev.	Std. Err.
1	146	60.248	69.987	5.792
2	381	38.936	66.054	3.384

Scheffe for MILVALUE/ANB
Effect: P-NP
Significance Level: 5%

	Mean D...	Crit. Diff.	P-Value	
1, 2	21.312	12.842	.0012	S

Table 7. Analysis of Variance for Expenditures per Pupil Comparing Plaintiffs with Non-Plaintiffs

ANOVA Table for EXP/P

	DF	Sum of Squares	Mean Square	F-Value	P-Value
P-NP	1	118564207.732	118564207.732	26.180	<.0001
Residual	525	2377651181.924	4528859.394		

Model II estimate of between component variance: 540184.703

Means Table for EXP/P
Effect: P-NP

	Count	Mean	Std. Dev.	Std. Err.
1	146	5303.535	2608.404	218.873
2	381	4243.688	1913.322	98.022

Scheffe for EXP/P
Effect: P-NP
Significance Level: 5%

	Mean Diff.	Crit. Diff.	P-Value	
1, 2	1059.847	406.922	<.0001	S

ably explained by a few extremely wealthy and extremely poor districts. Likewise, the greater restricted range of plaintiffs indicated that they were generally wealthier than the state as a whole. Thus, nonplaintiff and comparison groups did not differ dramatically from the restricted range calculations and percentage changes calculated for the entire state.

That plaintiffs were wealthier per pupil than either nonplaintiffs or the state as a whole was especially apparent when looking at comparison groups by category. Both the expenditure per pupil and mill value per pupil differentials were found to be located in only a few districts holding extremely high or low wealth. As seen in Table 6, these differences were statistically significant. The *p* value of 0.0012 indicated that there was a statistically significant difference of $21.31 in the mill value per pupil between plaintiff and nonplaintiff districts. In other words, the bulk of districts came closer together in wealth as indicated by the reduction in the restricted range, while the plaintiff districts were significantly higher in wealth per pupil as measured by dollars generated by each mill levied. While these observations were insufficient to conclude that wealth inequality was not an identifiable issue with impact on educational opportunity in Montana, they did indicate that the issue of wealth disparity between the plaintiff districts, their matched counterparts, and the state as a whole was not totally accurate because, as a group, plaintiff districts were wealthier than other districts in the state.

Wealth measures are important, however, only insofar as they relate to expenditures per pupil by either facilitating or hindering the ability of districts to fund expenditures and by indicating the relative position of districts to one another on the resource accessibility standard. Because it is difficult to interpret wealth measures alone, it was necessary to compare the range of wealth per pupil to equivalent measures of expenditure per pupil in order to make informed and valid assessment of the resource accessibility standard.

As may be seen from the analysis in Table 7, plaintiff districts also had greater mean expenditures per pupil ($5,303.54) than was true for any other group. As seen earlier in discussion of ranges of wealth, plaintiffs had a slightly lower range of expenditures per pupil than the state as a whole ($14,648.17 to $14,737.00). However, plaintiffs had a greater restricted range for all groups ($7,148.83) when compared to the state ($6,570.50), to nonplaintiffs ($5,463.38), and to the matched group ($6,071.48). These data indicated that plaintiffs spent more per pupil than any other group—a difference in mean expenditure per pupil that was statistically significant when plaintiffs were compared to nonplaintiffs. As seen in Table 7, the *p* level of significance at 0.0001 yielded a difference in means of plaintiffs compared to the means of nonplaintiff groups of $1,059.85. Investigation showed that it was thus possible to assert that higher wealth per pupil did not necessarily drive higher expenditures per pupil since several plaintiff districts had lower wealth and higher expenditures, and vice versa, than was true for several of their counterparts. Although plaintiff districts and the categories represented thereby appeared to have higher expenditure levels and higher wealth, it was thus observable that this was not the result of membership in an ANB category. The relationship between wealth and expenditures per pupil across the state ameliorated equity concerns related to any district's position in the distribution because it was not provable that higher wealth districts had increased per pupil expenditures faster than low wealth districts as there was no statistical evidence to suggest such a situation that could be causally related to the state funding mechanism.

Examination of resource accessibility in the framework of this analysis therefore yielded the overall conclusion that range and restricted range measures of mill value and expenditures per pupil, measures comparing the performance of variables within and across ANB categories and groups, and tests for significant differences had not supported plaintiffs' claims of inequitable performance on the resource accessibility standard in Montana.

Wealth Neutrality

As stated earlier, three conditions of equity had to be met in this analysis if the state aid formula were to be judged equitable. The formula passed the first standard of resource accessibility in that expenditures were based on a scheme of enrollment categories that did not result in an unacceptable variation of funds. The second standard of wealth neutrality followed closely, requiring that the relationship between wealth and expenditure be at least a neutral, if not inverse, covariant. As a somewhat natural byproduct of wealth neutrality, taxpayer equity can also be determined. While it should be clearly stated that the successful achievement of any one standard is often

sufficient to cast shadows on plaintiff arguments concerning the operation of a formula and its credibility, it was nonetheless desirable to continue in this analysis by assessing wealth neutrality in order to more fully judge the relationship between wealth (mill value) and expenditures available to each student, *i.e.*, a measure of educational opportunity.

It was observable on its face that expenditures per pupil in Montana were positively related to local wealth such that poorer districts sometimes had lower expenditure levels. In fact, as seen in Figure 1 the correlation between expenditure per pupil and mill value per pupil was 0.25 statewide, 0.289 for plaintiff districts, 0.194 for nonplaintiff districts, and 0.178 for the matched comparison group. While it was correct to observe that these relationships were positive in direction and implied that greater wealth per pupil correlates unfavorably with greater expenditures per pupil, these relationships were very small, particularly given the unevenness of such phenomena as judged under the resource accessibility standard. As seen in Figure 1, the R squared value indicated the amount of variability of expenditure per pupil statistically explainable by the wealth of a district. For example, despite a positive correlation between wealth and expenditure for the state as a whole, only 6.2% (R^2 = 0.062) of variation in expenditure per pupil could be explained by wealth in any given district. It then followed that 94% of this difference was explained by other factors. Even the slightly higher level of explained variance for plaintiffs (8.4%) was very low. Importantly, for nonplaintiff districts (3.5%) and matched groups (2.9%) the effect of wealth on the level of per pupil expenditure was almost negligible. As a classic measure of wealth neutrality, these correlations and variance in expenditure explained by wealth (as mill value per pupil) indicated a relatively wealth-neutral situation.

However, tests for wealth neutrality should also be interested not only in access to wealth by district based on the number of students, but also based on the amount of revenue a local district could generate in support for its educational program. In order to address this issue, it was necessary to consider the strength of linkages between wealth and expenditures per pupil in the state as a whole and within each of the individual groups to more fully judge the level of wealth neutrality. If

Figure 1. Correlation between Wealth per Pupil and Mill Value per Pupil for all Districts in the State, Plaintiff Districts, and Non-Plaintiff Districts

All Districts in the State

Regression Summary
EXP/P vs. MILVALUE/ANB

Count	527
Num. Missing	0
R	250
R Squared	.062
Adjusted R Squared	.060
RMS Residual	2111.561

Non-Plaintiff Districts

Regression Summary
EXP/P vs. MILVALUE/ANB

Count	381
Num. Missing	0
R	.194
R Squared	.038
Adjusted R Squared	.035
RMS Residual	1879.261

Comparison Districts

Regression Summary
EXP/P vs. MILVALUE/ANB

Count	323
Num. Missing	0
R	.178
R Squared	.032
Adjusted R Squared	.029
RMS Residual	1990.975

Plaintiff Districts

Regression Summary
EXP/P vs. MILVALUE/ANB

Count	146
Num. Missing	0
R	.289
R Squared	.084
Adjusted R Squared	.077
RMS Residual	2505.677

Table 8. Correlation and Regression Analysis for the State

Regression Summary
EXP/P vs. MILVAL

Count	527
Num. Missing	0
R	.034
R Squared	.001
Adjusted R Squared	.
RMS Residual	2179.263

Regression Coefficients
EXP/P vs. MILVAL

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	4565.890	101.753	4565.890	44.872	<.001
MILVAL	-.005	.006	-.034	-.780	.4356

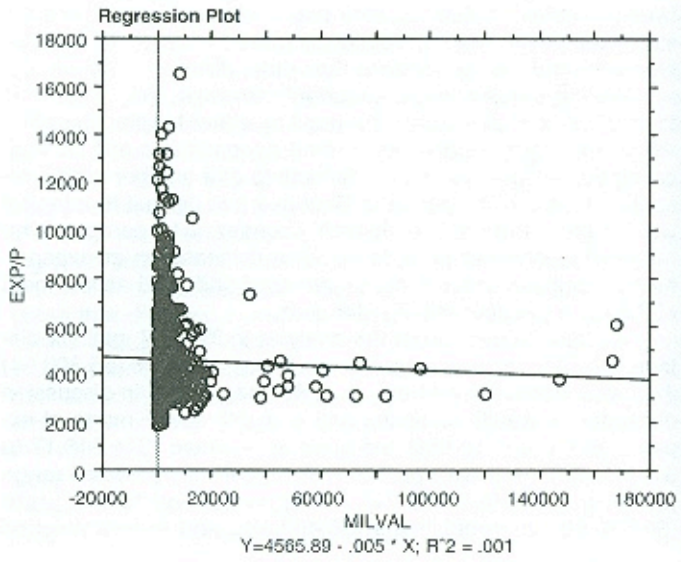


Table 9. Correlation and Regression Analysis for the Plaintiff Districts

Regression Summary
EXP/P vs. MILVAL

Count	146
Num. Missing	0
R	.046
R Squared	.002
Adjusted R Squared	•
RMS Residual	2614.691

Regression Coefficients
EXP/P vs. MILVAL

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	5366.564	244.773	5366.564	21.925	<.0001
MILVAL	-.013	.023	-.046	-.551	.5825

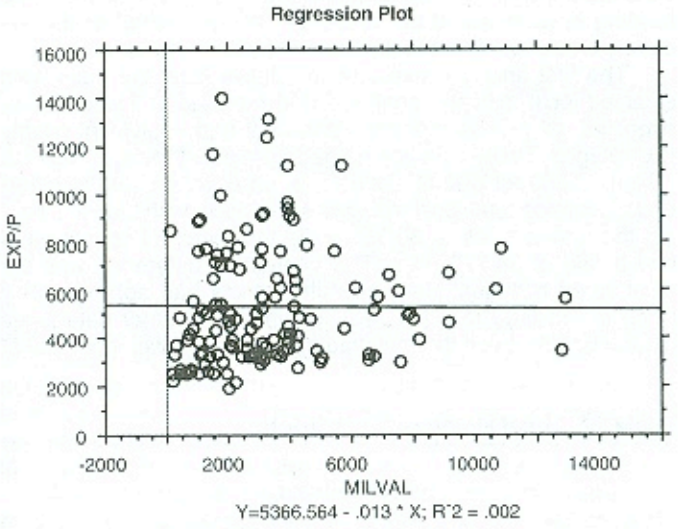


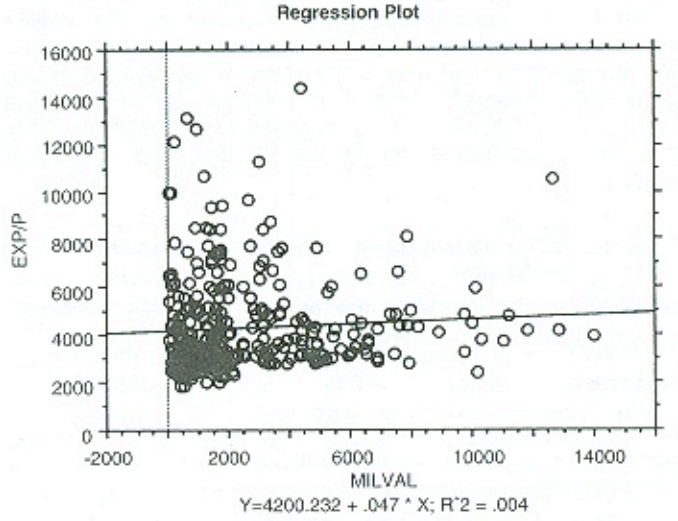
Table 10. Correlation and Regression Analysis for the Comparison Districts

Regression Summary
EXP/P vs. MILVAL

Count	323
Num. Missing	0
R	.061
R Squared	.004
Adjusted R Squared	.001
RMS Residual	2019.317

Regression Coefficients
EXP/P vs. MILVAL

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	4200.232	155.978	4200.232	26.928	<.0001
MILVAL	.047	.043	.061	1.104	.2706



the formula had successfully eliminated residence-related educational opportunity, the link between expenditures and local wealth (mill value for the district) should be noticeably absent throughout the distribution. If the formula had failed to break the link, the presence of statistically significant relationships between expenditures and wealth at any level would indicate that the wealth neutrality standard (and consequently the taxpayer equity standard) was violated. As such, this portion of the analysis was designed to further test and confirm the initial findings that wealth neutrality was adequately operative within the state.

For purposes of this study, two procedures were utilized to assess wealth neutrality in the state and in each enrollment category on the variables of expenditure per pupil and mill value of property reported for every district in the state. The first tests for wealth neutrality were run to develop correlation coefficients and regression equations to assess the relationship between variables and to predict the contribution of each variable to observed variance. All measures cited were correlated and also included in the regression equations. The results are shown in the tables and graphs which follow.

Data reported in Table 8 show correlations and variability for relationships between expenditures and wealth for all districts in the state. It is important to note that the relationship between expenditure per pupil and wealth per mill was very small (r=0.034) and was negatively directed. Such a relationship indicated that the link between expenditure per pupil and wealth was weak and inversely directed. Wealthier school districts did not exhibit higher expenditure levels. This is shown graphically as a slightly downward slope to the regression line. This pattern of association generally held true within and across all groups and enrollment categories with the exception of the matched group. Table 9 contains the regression analysis for plaintiff districts, and Table 10 contains similar information for the matched set of districts.

As expected, regression analysis for plaintiff districts in Table 9 indicated a strong similarity in lack of strength and negative direction of the correlation between expenditure per pupil and wealth. The R value of 0.046 and an R^2 of 0.002 indicated that the relationship was weak at best and negatively directed. The shape of the graph showed this relationship visually. As seen in Table 9, for plaintiff districts there was virtually no relationship between expenditure and wealth. The regression equation developed to help explain the relationship between wealth and expenditures for the districts selected as matches for plaintiff districts, however, showed a slightly different relationship as seen in Table 10. The correlation coefficient was stronger and positively directed, which would indicate that there was a positive relationship between the two variables such that, as wealth increased, so did expenditures per pupil in these districts.

However, it was noted that the relationship was still minimal as reported by an R^2 of .004, less than 0.4% of the differences in expenditures per pupil explained by the wealth of the district (see Table 10). Despite its greater strength, these observations indicated the presence of strong and widespread wealth neutrality across the state. With the slight exception noted for the comparison group, this observation found wealth neutrality across all enrollment categories.

Nonetheless, two additional tests for wealth neutrality were conducted to further explore relationships between wealth and expenditures due to some evidence of positive association. These tests were the McLoone Index and the Gini coefficient. As noted earlier, the McLoone Index is the ratio of the sum of expenditures per district for all districts below the median to the sum of expenditures that would be required if all districts below the median were brought up to the median level of expenditure. The larger the value of the McLoone Index, the closer the lower half of the distribution is to the median of the distribution and the greater the equity of the distribution. Usually this index has a value between 0 and 1. However, if the group of districts being compared were in fact a selected subgroup of a mean value close to the median, the McLoone value could be greater than 1. The second measure, the Gini coefficient, indicates how far the distribution of expenditures is from providing each percentage of students with the same percentage of expenditures. The smaller the value of the Gini coefficient, the more equitable the distribution of expenditures in providing a specified percentage of students with the same percentage of expenditures. Values range from zero to 1. Results of the calculations for the McLoone Index and the Gini coefficients for each of the groups is reported in Table 11.

Table 11. McLoone's Index and the Gini Coefficients for All Groups

Group	McLoone Index	Gini Coefficient
All Districts	0.6598	0.034
Plaintiffs	1.004	0.019
Non-Plaintiffs	0.5484	0.024
Comparison Non-Plaintiffs	0.5513	0.018

As expected from the earlier tests showing strong wealth neutrality, the values for the McLoone and Gini were similar for all groups. The larger values for the McLoone Index reported for plaintiffs was explained by their relatively higher expenditures per pupil. As explained previously, if the group of districts being compared were to have a mean value close to the median, this value can be greater than one. Likewise, the favorable value and consistency across groups of the Gini coefficient was indicative of a situation where wealth neutrality did not vary much according to membership in any of the groups being tested. The conclusion held that for the state as a whole and for both the plaintiff and matched groups and the enrollment categories, measures of resource accessibility and wealth neutrality were similar and consistent and continued to favor the defendant state.

Tax Yield

The final area of examination sought answers to questions raised earlier regarding tax yield equity. The analysis of tax yield for districts in Montana was driven by two basic questions:

- Are taxpayers living in a given school district or group of school districts paying higher tax rates than others for support of public schools; and
- If in fact taxpayers do pay at some differential rate, does the revenue generated help or harm these districts under expectations of the resource accessibility and wealth neutrality standards?

In order to address the first issue of taxpayer effort it was necessary to investigate the relative tax loads imposed on taxpayers. The second issue was in fact a marketplace evaluation which would consider the relative efficiency of school districts and consider the budget surplus carried by each district or group of districts. The assumption was that surplus, or cash carryover, is sensitive to revenue excess or shortfall during any given financial period. If one group were to suffer from lack of adequate revenue or experienced consistent economic hardship, such adversity should be reflected in reduced surplus. These factors could then be used to compare surplus levels with tax effort to determine if the yield of a local tax had a relationship to the amount of surplus. For example, if a district was conserving or increasing its surplus at a higher rate than its neighbors, and if tax effort was significantly lower than in neighboring wealthy districts, then the argument of potential inequity would be strengthened. If on the other hand all districts, even though there were extreme differences in wealth, exerted consistent and equivalent tax rates while maintaining similar and consistent surpluses, the challenge to the equity of the state funding system would be suspect—*i.e.*, no district or its taxpayers would be differentially harmed by the formula.

The first analysis investigated relative local tax rates, with selected local millages analyzed and reported in Table 12. As expected, all groups reported consistent and equivalent county tax millages. These millages ranged from 59.36 for all districts to a high 60.353 for plaintiff districts, or an approximate 2% difference. Likewise total local millages were close, with plaintiffs having the lowest rates at 30.961 while the matched counterparts had a rate of 34.772 mills. The interesting difference was the local voted millages. Here plaintiff districts had approximately twice the millage rate (11.793), compared to other categories (state= 6.975). Even the matched group had a lower local rate at

Table 12. Local Millages for Districts

All Districts

Plaintiff Districts

	Mean	Std. Dev.	Std. Error	Count
Total County	60.353	12.940	1.071	146
Local Perm.	8.979	13.192	1.092	146
Local Voted	11.793	15.395	1.274	146
Total Local	30.961	21.001	1.738	146

Non-Plaintiff Districts

	Mean	Std. Dev.	Std. Error	Count
Total County	58.980	9.992	.512	381
Local Perm.	16.430	16.278	.834	381
Local Voted	5.129	12.278	.629	381
Total Local	36.192	29.122	1.492	381

Comparison Non-Plaintiffs

	Mean	Std. Dev.	Std. Error	Count
Total County	59.525	10.010	.557	323
Local Perm.	15.832	16.892	.940	323
Local Voted	4.558	12.074	.672	323
Total Local	34.772	30.234	1.682	323

Table 13. Comparison Between Plaintiff and Non-Plaintiff Districts on the Variable Total Tax Rate

ANOVA Table for TOTAL MILLAGE

	DF	Sum of Squares	Mean Square	F-Value	P-Value
P-NP	1	1571.364	1571.364	1.701	.1927
Residual	525	485030.239	923.867		

Model II estimate of between component variance: 3.067.

Means Table for TOTAL MILLAGE
Effect: P-NP

	Count	Mean	Std. Dev.	Std. Err.
1	146	91.314	24.110	1.995
2	381	95.173	32.474	1.664

Scheffe for TOTAL MILLAGE
Effect: P-NP
Significance Level: 5%

	Mean Diff.	Crit. Diff.	P-Value
1, 2	-3.858	5.812	.1927

Table 15. Comparison Between Plaintiff and Non-Plaintiff Districts on the Variable Net Local Tax Rate

ANOVA Table for Net Local Millage

	DF	Sum of Squares	Mean Square	F-Value	P-Value
P-NP	1	520.257	520.257	1.163	.2813
Residual	525	234831.259	447.298		

Model II estimate of between component variance: .346.

Means Table for Net Local Millage
Effect: P-NP

	Count	Mean	Std. Dev.	Std. Err.
1	146	21.982	18.170	1.504
2	381	19.762	22.181	1.136

Scheffe for TOTAL MILLAGE
Effect: P-NP
Significance Level: 5%

	Mean Diff.	Crit. Diff.	P-Value
1, 2	2.220	4.044	.2813

4.558 mills. However, the reverse was true for local permanent millage rates. Plaintiffs had a rate approximately one-half of the rate for the remaining groups (8.976) compared to nonplaintiffs (16.43). At first analysis it appeared that taxpayers in plaintiff districts in fact did exert greater effort at the local voted level than did other districts in the state. This result would be expected in districts with significantly higher expenditures and significantly lower wealth. However, this was not the case in Montana since there was no statistically significant difference between total millage paid by taxpayers in plaintiff districts compared to nonplaintiff districts. As seen in Table 13, the *p* value was 0.1927 and even though plaintiffs had an average 3.858 greater mill levy than nonplaintiffs, this level was small and was not statistically significant. As a result, it could be confidently said that taxpayers in all districts paid similar taxes for the support of schools.

Although the second issue of differential tax rates was meaningfully addressed while answering the first question, additional analysis was conducted as seen in Tables 14 and 15. From these data, several observations were made. Most importantly, within the general fund the total tax efforts (voted and permissive) of the various groups could be seen to be quite similar. As shown in Table 14, the difference between plaintiff districts (20.722 mills) and the state (21.341 mills) was only 0.619 mills, with plaintiffs exerting the lower general fund tax effort. Similarly, the difference between plaintiffs (20.772 mills) and nonplaintiffs (21.559 mills) was only 0.787 mills. In fact, the greatest difference in total general fund tax effort (1.169 mills) was found between nonplaintiff districts (21.559 mills) and the matched comparison group of districts (20.39 mills). As a result, both plaintiffs and the matched comparison group had a lower effort for general fund millage than either the state as a whole or the group of nonplaintiff districts. Equally important was the observation in Table 15 where it can be seen that any difference in tax effort for general fund between plaintiffs and nonplaintiffs was not statistically significant, with a *p* value of 0.2813.

Notwithstanding tests showing uniformity of revenue or expenditure and notwithstanding policy questions impacting on equity such as locally voted millages, a persistent equity question has always troubled scholars about whether fiscal differences may be assumed to create differential effects. Although the question is vastly complex and has never been successfully disentangled, it was necessary and possible in this instance to determine whether the small differences did have a negative effect on expenditure levels of plaintiff districts which subsequently could influence the effectiveness of their operation. One analysis which can be used to determine whether these differences had a substantial effect on expenditure patterns for local school districts is to investigate respective levels of budget surplus for plaintiff and nonplaintiff groups. For purposes of satisfying this nagging question in Montana, the 1992 budget surplus was calculated as a percentage of total budget for each district and reported as a percentage of total general fund budget. The results of the comparison are reported in Tables 16 and 17.

As seen in Table 16, the statewide average for budget surplus was 20.7% (0.207) and the surplus calculation for plaintiff districts was 23.3%. The surpluses reported for comparison districts and nonplaintiff districts were approximately 19% each. Again, it would appear that plaintiff districts were not sufficiently harmed so as to affect their budget surplus which, as a group, was the highest in the state. As seen in Table 17, the average difference between plaintiff and nonplaintiff surpluses was in fact statistically significant. Statistical significance, however, augured against plaintiffs since that group carried higher mean budget surpluses. Consequently while differences in wealth, expenditure, tax effort and budget surplus did in fact exist, it was apparent that no identifiable harm fell to members of the plaintiff group. In a situation where plaintiffs had higher wealth, higher expenditures per pupil, and similar tax effort while maintaining larger budget surpluses, it was entirely reasonable to conclude that the Montana school finance formula had protected local taxpayers from the need for excessive tax rates to support quality educational programs and services.

Table 14. The Total Local Millage less the Required Local Millage

District	Total Local Millage	Local Permanent Millage	Net Local Effort
State	34.743	14.366	20.377
Plaintiff	30.988	8.959	21.98
Non-Plaintiff	36.142	16.380	19.762
Comparison Group	34.726	15.778	18.940

Table 16. Budget Surplus Calculations

All Districts

	Mean	Std. Dev.	Std. Error	Count
% Surplus 92	.207	.164	.007	525

Plaintiff Districts

	Mean	Std. Dev.	Std. Error	Count
% Surplus 92	.233	.203	.017	146

Non-Plaintiff Districts

	Mean	Std. Dev.	Std. Error	Count
% Surplus 92	.196	.145	.007	379

Comparison Group

	Mean	Std. Dev.	Std. Error	Count
% Surplus 92	.196	.146	.008	321

Table 17. Comparison of Budget Surplus for Plaintiff and Non-Plaintiff groups

ANOVA Table for % Surplus 92

	DF	Sum of Squares	Mean Square	F-Value	P-Value
P-NP	1	.143	.143	5.384	.0207
Residual	523	13.904	.027.		

Means Table for % Surplus 92
Effect: P-NP

	Count	Mean	Std. Dev.	Std. Err.
1	146	.233	.203	.017
2	379	.196	.145	.007

Scheffe for % Surplus 92
Effect: P-NP
Significance Level: 5%

	Mean Diff.	Crit. Diff.	P-Value	
1, 2	.037	.031	.0207	S

Summary and Conclusions

This analysis performed on behalf of the defendant state of Montana led to final summary of observations and impressions about fiscal equity generally and about the context of modern school finance litigation. One such observation is that data arguments are often lengthy and complex. Another such observation is that each side will present data arguments that contest the validity of any contrary opinion. From the data presented in this paper, an apparent further observation is that proving the plaintiffs' cause can be difficult because these data show with considerable elaboration that plaintiffs were not differentially harmed by the Montana aid formula. The analysis detailed here showed that it is difficult to substantiate that the formula failed to provide a mechanism for equitable distribution of funds to schools. Increasingly, plaintiffs may expect to encounter such analyses because states are increasingly seeking data-driven arguments.[16]

A critically important observation also rests in recognition that recent school finance litigation has generally taken a tack arguing no need for specificity of harm to plaintiffs. Instead plaintiffs have argued that raw horizontal disparity in numbers, uncluttered by the complex adjustments of vertical equity, is sufficient to cast a pall over the manner in which states fund education. While there can be no doubt that many states have been reluctant and even unwilling to appropriately fund education, it is equally without doubt that this strategy may have limited utility in the future because states are now beginning to understand that the historic presumption that states are derelict in their constitutional obligation is refutable only when convincing data are available to show that plaintiffs' claims of illegitimate variability may not be well grounded. Until recently, only plaintiffs have understood the important role of data in litigation. Until litigation reaches the point where both sides are willing to listen to data, so much so that states actively monitor themselves and that plaintiffs concede when sophisticated data deny genuine differences, plaintiffs and states and children will suffer equally in lengthy and expensive litigation. It should be recognized by both sides that in some instances the culprit is not the formula or the ability of local districts to pay which must be questioned. Rather it is sometimes the willingness of taxpayers in local districts to assume responsibility for funding, rather than furthering a victim psychology. Such seems the case in Montana where the statistical analysis led to a collective view concluding that the plaintiff school districts exhibited high expenditures (expenditure per pupil) and low wealth (mill value) while claiming that the statutory scheme for funding public schools is unfair when there was evidence to support the view that they also maintained consistent budget surpluses and experienced consistent and moderate tax rates. In states where such data exist, plaintiffs may not depend on a climate of reform to adequately secure their claims.

Footnotes

1. The original document citation was David Honeyman, M. David Miller, R. Craig Wood, and David C. Thompson, *The Study of Resource Accessibility, Wealth Neutrality, and Tax Yield in Montana Rural Education Association v State* (Gainesville: Wood, Thompson & Associates, 1992). Attribution is as follows: conceptualization by Wood, data design and analysis by Miller and Honeyman, further analysis and rewrite for publication by Thompson.
2. For a thorough discussion of these concepts and historical developments, see Chapter 5 in David C. Thompson, R. Craig Wood, and David Honeyman, *Fiscal Leadership for Schools: Concepts and Practices.* New York: Longman (1994); see also R. Craig Wood and David C. Thompson, *Educational Finance Law: Constitutional Challenges to State Aid Plans—An Analysis of Strategies.* Topeka: NOLPE (1993); see also David C. Thompson, Julie K. Underwood, William E. Camp, Equal Protection Under Law: Reanalysis and New Directions in School Finance Litigation. In Spheres of Justice in American Education. *1990 American Education Finance Association Yearbook.* New York: Harper (1990); see also David C. Thompson, School Finance and the Courts: A Reanalysis of Progress. *West's Education Law Reporter,* v59 n4 (1990); see also R. Craig Wood, "Adequacy in Education Finance Litigation," Washington, DC: Office of Educational Research and Improvement, Center for Education Statistics (in press); see also numerous expert studies on behalf of plaintiffs or defendants by Thompson and Wood that have been developed for court testimony.
3. Montana Rural Education Association v State No. BDV-91-2065.
4. Id at 2.
5. Id at 5-8.
6. Price differential effects are developed elsewhere in detail in this issue of *Educational Considerations*; see later R. Craig Wood and David C. Thompson, *Funding Public Education in Montana Based on the Concept of*

Cost of Living Indices in Montana Rural Education Association v State. The general concepts of uniform operation and limited cost inclusion were first raised in David C. Thompson, R. Craig Wood, and M. David Miller, *Findings of Fact and Opinion on the Equity and Fiscal Neutrality of Kansas' New State Aid Formula to Public Schools: Expert Analysis on Behalf of Plaintiffs in Newton USD 373 et al v State of Kansas et al* (1993).

7. For a full development and discussion of harm versus offense to political reform theories, see Chapter 3, Thompson et. al., FISCAL LEADERSHIP FOR SCHOOLS (New York: Longman, 1994), pp208–264.
8. These two concepts, developed repeatedly by Thompson and Wood in expert studies in various states for both plaintiffs and defendants, represent significant forward movement in litigation data strategy. Studies have historically ignored whether the formula itself caused the problem or whether problems were phenomena rooted in some peripheral area: *e.g.,* an aid formula may appear inequitable because property assessments are wrong—an issue that should not indict the school aid formula. Likewise, the concept of direct comparison of interested parties is often conveniently ignored—yet if plaintiffs can demonstrate no actual harm, there is serious *prima facie* doubt about their claims if they must rely on noncaptioned parties to prove their claims.
9. Subsequent to this litigation, the Montana Legislature changed the distribution formula, rendering moot plaintiff claims. The trial court maintained jurisdiction regarding selected aspects of the new formula. The scheme as described here is the challenged statutory scheme grieved by plaintiffs and examined by this analysis for its equity performance.
10. 769 P.2d 684.
11. *Montana Code,*§ 20-9-301.
12. The framework used here has been employed repeatedly by Thompson and Wood in expert studies. See, for example, Chapter 3, Thompson et. al., FISCAL LEADERSHIP FOR SCHOOLS (Longman, 1994), pp. 208–264 and more than a dozen state studies. This section has been adapted from standard language incorporated in those studies.
13. Various excellent sources for deeper discussion of equity measures are available. See Thompson et. al., FISCAL LEADERSHIP FOR SCHOOLS (New York: Longman, 1994); see various expert reports by Thompson and Wood for plaintiffs and defendants on state-specific application of measurement; for extended theoretical discussion, see Robert Berne and Leanna Stiefel, *The Measurement of Equity in School Finance* (Baltimore: Johns Hopkins, 1984). This discussion here is nearly verbatim of sections from Thompson et. al. (1994).
14. The general methodology was developed elsewhere in Thompson, et al, FISCAL LEADERSHIP FOR SCHOOLS (New York: Longman, 1994) based on earlier studies by Wood and Thompson and completed for plaintiffs or defendants in other states. Specific research design and analysis in Montana were conducted by Miller and Honeyman. Original text in this portion of the analysis was prepared by Wood and developed further by Thompson for publication.
15. Comparison districts were selected by eliminating the large ANB school districts from the nonplaintiffs. For secondary school districts, this was accomplished by dropping school districts in categories 14 and 15. For elementary schools, all districts with ANB greater than 750 were eliminated.
16. Similarly complex arguments have been offered or are now being developed by Wood, Thompson & Associates in more than a dozen states.