Examination of Efficiency and Achievement Gaps in Arkansas School Districts:
Case Studies and Statistical Analyses

Prepared by
the Bureau of Legislative Research for

The House Interim Committee on Education and
The Senate Interim Committee on Education

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EXECUTIVE SUMMARY

This report examines Arkansas School Districts from three different perspectives. Multi-method approaches to studying characteristics, processes, and outcomes offer a distinct advantage of greater breadth and depth of information than any single approach. After providing a brief historical context for the concept of educational adequacy underlying most current state policies and practices in this country, an argument is made that analyzing the efficiency of school districts is a systematic empirical approach to evaluating adequacy.

Presently, educational adequacy has been evaluated by making professional judgments that rely on impressions and preferences. Even with the so-called "evidence-based" method of evaluation, judgments must be made about the applicability and comparability of model school districts in other states noted in the research literature. However, statewide educational adequacy implies that school districts are operating at an efficient level. Efficiency, based on achievement, is a key aspect of adequacy.

The current report presents details of efficiency analyses conducted on the 244 school districts (FY 2010) in Arkansas. Maximum efficiency assumes that there is a linear relationship between costs and desired outcomes, such as student performance on the state Benchmark exams. The linear relationship between per pupil total expenses and student performance is examined for 4th grade and 8th grade literacy and math. This performance outcome is measured by the districts' percentages of students at or above proficiency. Proficiency on the Benchmark is an indicator of performing at grade level in Arkansas.

Efficiency analyses of 4th and 8th grade literacy and math outcomes in 2007 and 2010 indicated that approximately one third of the school districts are efficient, with low per pupil costs and high student performance on these outcomes. About a quarter of the districts had high per pupil cost and high student achievement. In contrast, about 20% of these districts had high costs and low student achievement. Further analyses indicated that these inefficient districts are characterized by significantly higher NSLA (National School Lunch Administration) rates, lower ADM (Average Daily Membership), and much higher per pupil total expenses than efficient districts. Moreover, the inefficient districts had more weeks of tutoring, extended school, and summer school. While there were shifts in efficiency among schools districts between 2007 and 2010, the majority of districts either did not show significant change or they improved.

A second approach to examining school districts' outcomes was to examine what factors, taken from the Arkansas Department of Education (ADE) administrative datasets and the Bureau of Legislative Research's (BLR) adequacy survey, might predict performance gaps on the state's Benchmark exam. Gaps on 4th and 8th grade literacy and math exams between Caucasians and African Americans, Hispanics, and economically disadvantaged students were analyzed with regression analyses. Factors considered included NSLA, ADM, teacher salaries, teacher merit pay, principals' time devoted to instructional leadership, per pupil total expenses, weeks of tutoring, weeks of extended school, and weeks of summer school.

None of the factors considered were consistent predictors of gaps between the disaggregated groups. These findings suggest that administrative and survey data do not tap the interpersonal and environmental factors that more likely influence achievement gaps. Future research needs to involve measures of complex personal characteristics and interactions that likely impact student performance in a more direct and powerful way. According to the research literature, these factors include quality of teaching, teacher teamwork, school culture and leadership, professional development, and parental participation.

To gain a better understanding of potential interpersonal and environmental factors that might differentiate "exemplary" from "struggling" schools, a case study was implemented among a select number of Arkansas schools. A "struggling" school and an "exemplary" school was selected from each level representing elementary, middle, and high schools, and to the extent possible, they were matched on percentages of NSLA and minority students. The classification and selection were based on Benchmark scores, school improvement status, and consultation with ADE officials.

Onsite in-depth interviews were conducted by two BLR staff with superintendents, principals, teachers, instructional facilitators, and counselors. The interview protocols were based on research and other interview
schedules found in the professional literature. The interviewers also allowed for new avenues of questioning to arise during the interview, and extensive probes were used for elaboration and mutual understanding.

In conclusion, the following generalizations are informed by the professional research literature and recurring observations and themes made by superintendents, principals, teachers, guidance counselors, and instructional facilitators. Confidence in these generalizations is enhanced by empirical grounding in the research literature, and from confirmation of observations in separate interviews with personnel in different positions in a variety of schools and districts. To the extent possible, the BLR staff tried to match "struggling" and "exemplary" schools in terms of demographic features, but it was impossible, for example, to find an unequivocal "exemplary" middle and high school in a poverty setting to match "struggling" schools in such settings.

A striking feature, according interviews, of all "struggling" schools that seemed to differentiate them to an extent from "exemplary" schools was the level of poverty and all the associated challenges, such as unemployment, crime and substance abuse, mental health problems, and lack of childcare, transportation, and food. That is, while an attempt was made to match "struggling" and "exemplary" schools on NSLA, the level of poverty and associated problems seemed greater in the "struggling" schools. Also, all "struggling" schools had parent centers in addition to parent facilitators to assist parents with problems that hinder their children's education. These "struggling" schools have had to make major investments in extended school, after school tutoring, and summer school. Most students are well below grade in almost all subjects, and they require huge investments of time to bring them up to grade level in reading.

Superintendents and principals indicated that teachers in "struggling" schools in impoverished neighborhoods must be highly committed to individual tutoring and long hours because of the greater demand for instruction assistance in these schools. Many of the teachers in these schools grew up in the neighborhood served by their school because other teachers typically do not want to teach in these type of situations. Teachers who grew up in more affluent neighborhoods require socialization to the culture and lack of resources in these neighborhoods. Many homes in these neighborhoods still do not have running water, utilities, or regular meals, which is a revelation to many new teachers who did not grow up in poverty.

Clearly, principal leadership in instruction is a pivotal factor in turning around "struggling" schools to become more effective academically. All struggling schools visited had recently changed principals, and the principals were in the process of terminating ineffective teachers and helping others become more effective teachers. A major change in direction and personnel is needed to turn a school into a more successful learning enterprise. Instructional facilitators also are critical to enhancing teachers' knowledge and skills, and quality teaching has been shown to be the strongest predictor of student achievement gains. Instructional facilitators not only model skills and instruct teachers, but give feedback on classroom observations and transfer "cutting edge" knowledge and skills from national and regional workshops and conferences.

A rigorous coherent curricula that is well-integrated and coordinated across all subjects and grades in the K12 system is essential to presenting a high quality education to students. The difference between "struggling" and "exemplary" schools is accentuated in the degree to which there is an integrated and coordinated curricula spanning the entire district. This integration and coordination requires concentrated leadership to ensure that teachers meet regularly in horizontal (within subjects) and vertical (across grades) teams to plan such a curricula.
INTRODUCTION

This report is divided into three major sections representing different approaches to examining Arkansas districts and schools. The first major section presents an efficiency analysis of Arkansas school districts as one measure of educational adequacy. The argument made in this report is that efficiency is a key aspect of statewide educational adequacy. Major contributors to the school finance literature (e.g., Guthrie et al., Houck et al., 2010; Odden & Picus, 2008) define efficiency as the maximization of outputs with increases in inputs. The concept of maximization is a key issue in the study of educational efficiency. Researchers and practitioners who examine efficiency address questions about the relationship between inputs (e.g., per pupil expenses) and outputs (e.g., student achievement gains) in each school district. A perfectly efficient district would have a linear relationship, where increases in inputs correspond with greater student performance. The Efficiency Analyses are presented following the section, Evaluating Adequacy by Examining Efficiency.

The second major section discusses statistical analyses aimed at identifying predictors of gaps in student performance on Arkansas Benchmark exams administered in 2007 and 2010. Gaps in performance between Caucasians and African Americans, Hispanics, and economically disadvantaged are analyzed with factors identified in datasets from the Arkansas Department of Education (ADE) and from the Adequacy surveys conducted by the Bureau of Legislative Research (BLR).

Finally, the BLR also conducted in-depth onsite interviews with teachers, instructional facilitators, counselors, and administrators in case studies of selected schools. These case study schools were deliberately selected so that there was at least one “exemplary” and one “struggling” school in each of three grade levels (elementary, middle, and high schools with similar demographics). The designation of “exemplary” and “struggling” was based on ADE Benchmark exam scores, ADE school improvement status, and consultations with ADE officials.

HISTORICAL CONTEXT

To understand how school efficiency is related to educational adequacy, the concept of adequacy needs to be discussed within the context of current educational policies. Two ideological frameworks have served to guide policy-making in primary and secondary education in this country over the past half-century. The equality framework came to fruition in the 1954 landmark case, Brown Vs. Board of Education, which maintained that education “is a right which must be made available to all on equal terms.” The New Jersey Supreme Court in 1973 inaugurated a second wave of equality policies in which the courts primarily sought to achieve “horizontal equity,” or equalization of per pupil funding across school districts within a state.

However, in 1989 the Kentucky Supreme Court changed the emphasis in educational policy-making from an equality to an adequacy framework by interpreting the education article of Kentucky’s constitution as requiring the state legislature to provide children with an adequate education (Reich, 2006). Over the next 30 years, many states, including Arkansas, followed Kentucky’s lead (as a result of court actions) in favoring the concept of adequacy over the concept of equality as the primary focus of policy-making. According to Reich (2006) and other major policy analysts (Picus & Blair, 2004; Reed, 2001), this shift came about primarily because implementing equality policies proved impractical, and the increasing emphasis on accountability and outcomes in federal legislation [No Child Left Behind (NCLB) Act, 2002]. In regard to practicality, there were fears from the outset, borne out in practice (e.g., California), that states would level down the spending of wealthy districts instead of leveling up spending of the poorest districts. There was a general fear that leveling up spending of all districts would be prohibitively expensive. In addition, evidence was mounting that equality policies had not improved student performance or narrowed gaps in test scores. The increasing emphasis on higher achievement and narrowing gaps in test scores, with the passage of NCLB legislation, favored adequacy over equality because it is more closely associated with outcome performance of students (Odden & Picus, 2008; Reich, 2006).
ADEQUACY AND EFFICIENCY

Providing sufficient resources to ensure an adequate education for all students became the goal of state education systems throughout the country over the past two decades. According to Picus and Blair (2004), the concept of adequacy became the logical tool to link accountability required by NCLB and the school finance system. State policymakers need to supply sufficient resources for all districts to provide an adequate education to every child without encouraging "wasteful spending."

Determining an adequate level of resources has been difficult because adequacy has remained more of a heuristic concept than an empirical one. A heuristic is a sensitizing concept based on professional judgment or experiential observation rather than on empirical data. As such, adequacy has been evaluated mostly by professional judgment, comparisons to successful schools, and trying to replicate empirically-based models found in the professional literature (see Picus & Blair, 2004). Each of these approaches to evaluation have real limitations. Common to all of these methods is the limitation of using judgment instead of systematic evidence as the basis for evaluation. Even the so-called empirically-based method relies mostly on making judgments about the suitability, integrity, and quality of implementing interventions noted in the literature. The use of judgment is subjective and it does not systematically account for extraneous factors that impact outcomes such as poverty or community characteristics. Finally, these approaches to evaluating adequacy have typically led to expensive policies and wasteful spending because they are not based on specific data about individual districts or schools.

EVALUATING ADEQUACY BY EXAMINING EFFICIENCY

An alternative approach to evaluating adequacy is to examine the relative efficiency between districts by analyzing the relationships between inputs (e.g., per pupil costs) and outputs (Benchmark scores) of school districts. Examining the relative efficiency of similarly situated districts can lead to identification of lighthouse or exemplary (model) districts for the purpose of scaling up successful programs. The efficiency analyses presented also allow for classification of districts according to demographics and other influences on efficiency.

These efficiency analyses are based on empirical data provided by Arkansas school districts to ADE and to the BLR in the adequacy surveys. A common problem with other approaches to evaluating adequacy is using “best practices” of school districts in other states, which often have dissimilar characteristics to Arkansas (Picus & Blair, 2004).

The efficiency analyses are based on the assumption that efficiency is represented by a linear relationship between inputs and outputs. That is, increases in inputs (e.g., per pupil costs) are accompanied by increases in outputs (e.g., Benchmark scores) (Houck et al., 2010). If resources (inputs) are being used efficiently, there should be incremental increases in outputs (student performance) with each increase in input.

To examine the efficiency of school districts in Arkansas, a simple mathematical formula is used that places a straight line through data points representing the intersection of actual costs and student performance based on the strength of the relationship between these factors (costs and performance). The line drawn by the formula minimizes the differences between the line and all data points simultaneously. In other words, no other line can be derived that has less total differences between the line and all data points considered simultaneously.

The mathematical procedure used is a straight line or regression formula. The chart shown below illustrates the linear line that minimizes the differences between the data points and the line drawn by the regression formula. The line drawn is referred to as the prediction line, and it represents the linear relationship between costs and performance expected when there is efficiency. Points along the line represent how much output (e.g., benchmark scores) would be expected with each level of input (dollar amounts) if school districts are operating with total efficiency. The data points (green dots) represent the intersection of actual per pupil total expenses and percentage of students who are proficient or above in 4th grade literacy in 2010 for 30 randomly selected school
districts. Only 30 school districts were selected for this illustrative example of efficiency analysis to avoid the confusion of exhibiting all 244 school districts.

In the efficiency analyses, the differences between the predicted data and the actual data are examined by plotting the intersection of these differences in per pupil total expenses and student performance measured on state Benchmark, or ACTAAP, tests for 4th and 8th grade literacy and math. The differences between predicted data and actual data are known as residuals, and these residuals are plotted in the following charts representing efficiency analyses. Three of the residuals are shown in the illustrative example below by gold lines with arrows pointing to the prediction or efficiency line. The difference between the intersection of expenses and achievement (green dots) and the red prediction line is the residual (or difference plotted in the following charts).

To minimize the problem of fitting efficiency analyses (or models) to a specific dataset (or sample), efficiency analyses are conducted in two grades (4th and 8th), subject areas (literacy and math), and years (2010 and 2007). Not only do these multiple analyses allow confirmation of results, they also indicate the shift in efficiency of school districts across the years from 2007 to 2010.

School districts are then classified according to these differences or residuals into 4 groups: 1) low cost - high student performance; 2) high cost - high student performance; 3) low costs - low performance; and 4) high costs - low performance. This classification shows the relative performance of districts that are spending different amounts (Houck et al., 2010). This procedure has been called quadriform analysis because of the 4-group classification (Houck et al., 2010). The quadriform analysis is particularly advantageous because any inputs and outputs can be analyzed, and different inputs and outputs can be combined or compared in separate analyses.
EXAMINATION OF EFFICIENCY AND ACHIEVEMENT GAPS IN ARKANSAS SCHOOL DISTRICTS

EFFICIENCY ANALYSES

4TH GRADE LITERACY

In Chart 1 is shown the scatter plot of residuals resulting from an efficiency analysis of per pupil total expenses and percentage of Arkansas students who are performing at proficient or above on the 4th grade Benchmark exam on literacy in 2010. The efficiency or regression analyses consisted of regressing costs and performance on the same predictors, which are race and NSLA, the only significant predictors of both outcomes. If prediction is perfect, the residuals (difference between predicted and actual expenses and percentage proficient) would be zero for both expenses and test scores. The green line indicates zero expense residuals, whereas the red line designates zero percentage proficient residuals. Each quadrant in Chart 1 indicates whether a district is more or less than zero in expenses and proficiency percentage. For example, the upper left quadrant indicates there are 72, or 30%, of the 244 districts in Arkansas that have below zero expense residuals and above zero proficiency percentage. In other words, these districts actually have less per pupil total expenses than predicted by the efficiency (or regression) analysis, and yet they are above the predicted proficiency percentage. Fifty-two districts have above zero expense residuals and above zero student performance (upper right quadrant), whereas 71 districts are below zero on both factors. Fifty districts are above zero in expenses and below zero in student performance. All quadrant analyses presented in this report controlled for race and NSLA, the only 2 strong predictors of student performance. In other words, the effects of race and NSLA are considered in the same analysis of the relationship between total per pupil expenses and percentage proficient or above in literacy. These quadrants represent efficiencies of districts relative to each other.
The quadriform analysis of 2010 4th grade literacy indicates that 121 (71 + 50) districts (lower 2 quadrants) are not operating at an efficient level in terms of per pupil total expenses and student performance. Each blue dot in Chart 1 represents a separate school district in Arkansas.

**Chart 1. Linear Relationship Per Pupil Total Expenses to % Proficient or > 4th Grade Literacy 2010**

A critical question in examining the efficiency of school districts is whether they change over a period of time. Table 1 is a cross-tabulation of quadrant analyses for 2010 and for 2007. By looking diagonally, it may quickly be noted that the majority of districts remain in the same quadrant. For example, 67 districts remain in the quadrant for low total per pupil expenses and high student performance. Four districts moved from low expenses and low student achievement to low costs and high achievement.

Additional quadriform analyses for more years will be required to establish a pattern of results that distinguish improvement in efficiency from chance fluctuations in longitudinal data. However, the number and types of shifts seen in the present analyses suggest that shifts are being observed rather than merely chance fluctuations. Table 2 shows a comparison of quadriform categories for 2010 and 2007. This table also emphasizes the shifting in categories between the years.
Table 1. Quadriform Analysis of Total Per Pupil Expenses & % Proficient or > on 4th Grade Literacy for 2007 and 2010

<table>
<thead>
<tr>
<th>Quadrant in 2007</th>
<th>Lo - Hi</th>
<th>Hi - Hi</th>
<th>Lo - Lo</th>
<th>Hi - Lo</th>
<th>Total 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lo - Hi</td>
<td>67</td>
<td>0</td>
<td>10</td>
<td>4</td>
<td>81</td>
</tr>
<tr>
<td>Hi - Hi</td>
<td>0</td>
<td>42</td>
<td>0</td>
<td>4</td>
<td>46</td>
</tr>
<tr>
<td>Lo - Lo</td>
<td>4</td>
<td>0</td>
<td>61</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>Hi - Lo</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>42</td>
<td>52</td>
</tr>
<tr>
<td>Total 2010</td>
<td>71</td>
<td>52</td>
<td>71</td>
<td>50</td>
<td>244</td>
</tr>
</tbody>
</table>

Note: Quadrants labeled for expenses then student performance residuals. Lo = below zero residual, whereas Hi = above zero residual.

Table 2. Categories of Per Pupil Expenditures and 4th Grade Literacy Scores
4TH GRADE MATH

In chart 2 is found the scatter plot for the efficiency analysis of the 4th grade math Benchmark test administered in 2010. The number of districts in each of the quadrants is reported in Table 3. It shows that 85 districts have low total per pupil expenses and high student performance (upper left quadrant). Fifty-one districts (upper right quadrant) have both high expenses and student performance. Fifty-five districts (lower left quadrant) have both low expenses and student performance, while 53 districts have high expenses and low achievement (lower right quadrant).

Chart 2. Relationship Between 2010 Per Pupil Expenses & 4th Grade Math ACTAAP

It should be noted in Table 4 that 32 districts shifted from the low expense – low performance to the low expense – high performance category. Eighteen districts shifted from high expense – low performance to high expense – high performance. In contrast, 18 districts went from high expense – high performance to high expense – low performance.
Table 3. Categories of Per Pupil Expenditures and 4th Grade Math Scores

Table 4. Quadriform Analysis of Total Per Pupil Expenses & % Proficient or > on 4th Grade Math for 2007 & 2010
Efficiency analyses are also conducted with 8th grade literacy and math Benchmark exams because there is considerable variance between 4th and 8th grades across school districts in Arkansas and nationally. In the interest of parsimony, these analyses are presented in greater brevity. Chart 3 shows the scatter plot that results from an efficiency analysis of the 8th grade Benchmark literacy exam in 2010.
In Table 5 are shown the number of school districts in each quadrant displayed in Chart 3. For example, there are 85 districts in 2010 that have low costs and high student achievement (upper left quadrant), whereas there are 57 districts that have both high costs and high student performance (upper right quadrant). Fifty-seven districts have both low expenses and low achievement (lower left quadrant), while 45 districts have high costs and low performance (lower right quadrant). That table indicates that there are some shifts in efficiency categories between 2007 and 2010.

Table 5 Categories of Per Pupil Expenditures and 8th Grade Literacy Scores

<table>
<thead>
<tr>
<th></th>
<th>Low Expend - High Scores</th>
<th>High Expend - High Scores</th>
<th>Low Expend - Low Scores</th>
<th>High Expend - Low Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>70</td>
<td>52</td>
<td>76</td>
<td>46</td>
</tr>
<tr>
<td>2010</td>
<td>85</td>
<td>57</td>
<td>57</td>
<td>45</td>
</tr>
</tbody>
</table>

The specific shifts in efficiency categories are demonstrated in Table 6. Forty-one districts, for example, shifted from low costs and low student performance to low costs and high performance. Twenty districts went from high expenses and low performance to high costs and high performance. In contrast, 24 districts went from low costs and high performance to low costs and low performance.

Table 6. Quadriform Analysis of Total Per Pupil Expenses & % Proficient or Above on 8th Grade Literacy for 2007 & 2010

<table>
<thead>
<tr>
<th>Quadrant in 2007</th>
<th>Quadrant in 2010</th>
<th>Total 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lo - Hi</td>
<td>Hi - Hi</td>
</tr>
<tr>
<td>Lo - Hi</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>Hi - Hi</td>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td>Lo - Lo</td>
<td>41</td>
<td>2</td>
</tr>
<tr>
<td>Hi - Lo</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Total 2010</td>
<td>85</td>
<td>57</td>
</tr>
</tbody>
</table>
**8⁰ GRADE MATH**

The scatter plot for the efficiency (or quadriform) analysis of the 2010 8⁰ grade Benchmark math exam is shown in Chart 4. Table 7 indicates that there are 78 districts in 2010 that have low costs and high performance, whereas 48 districts have high costs and high performance. Sixty-eight districts have both low costs and low performance, while 50 districts have high expenses and low student performance.

**Chart 4. Relationship Between 2010 Per Student Expenses & 8th Grade Math ACTAAP**
Table 7 also indicates that there were 81 districts in 2007 in the low cost – high performance quadrant, 42 districts in the high cost – high achievement quadrant, 65 districts in the low cost – low performance quadrant, and 56 districts in the high cost – high achievement quadrant.

Table 7 Categories of Per Pupil Expenditures and 8th Grade Math Scores

<table>
<thead>
<tr>
<th>Number of Districts</th>
<th>Low Expend - High Scores</th>
<th>High Expend - High Scores</th>
<th>Low Expend - Low Scores</th>
<th>High Expend - Low Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>81</td>
<td>42</td>
<td>65</td>
<td>56</td>
</tr>
<tr>
<td>2010</td>
<td>78</td>
<td>48</td>
<td>68</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 8 presents the shifts in efficiency categories among school district between 2007 and 2010. For example, 23 districts shifted from low cost – low performance to low cost – high performance. Similarly, 17 districts shifted from high cost – low performance to high cost – high performance. By contrast, 26 districts went from low cost – high performance to low cost – low performance.

Table 8. Quadriform Analysis of Total Per Pupil Expenses & % Proficient or > on 8th Grade Math for 2007 and 2010

<table>
<thead>
<tr>
<th>Quadrant in 2010</th>
<th>Total 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lo - Hi</td>
</tr>
<tr>
<td>Quadrant in 2007</td>
<td></td>
</tr>
<tr>
<td>Lo - Hi</td>
<td>55</td>
</tr>
<tr>
<td>Hi - Hi</td>
<td>0</td>
</tr>
<tr>
<td>Lo - Lo</td>
<td>23</td>
</tr>
<tr>
<td>Hi - Lo</td>
<td>0</td>
</tr>
<tr>
<td>Total 2010</td>
<td>78</td>
</tr>
</tbody>
</table>
SUMMARY OF EFFICIENCY ANALYSES

The efficiency analyses indicate that school districts in Arkansas can be differentiated in terms of efficiency by examining the linear relationship between per pupil total expenses and performance on the state Benchmark exam. Analyses show that approximately 20% of the districts fall into the high expense – low performance category, while around a third of the districts are classified as low expense – high performance.

To gain an understanding of what factors might distinguish between the 4 quadrants of the efficiency analyses, a discriminant analysis (Klecka, 1981) was conducted on each of those analyses. The discriminant analyses indicate that districts with high per pupil expenses and high student performance are more likely to have teacher merit pay than other districts. On the other hand, those with high or low expenses and low student performance (inefficient districts) are offering more weeks of tutoring, extended school, and summer school. These discriminant analyses only indicate how well factors discriminate between the quadrants; they do not test causal relations.

Districts in the efficiency analyses are also compared by examining characteristics of districts with extreme residuals in costs and student performance. Keep in mind that a residual is the difference between predicted value based on total efficiency and the actual value for the district. This difference represents how far districts are from efficiency. It was decided to compare districts that have at least a $250 expense residual and a double digit (10 or >) student performance residual. These residuals can be + or – differences, depending on whether actual value (expense or Benchmark %) is higher or lower than the predicted value. Despite controlling for NSLA and ADM in the efficiency (regression) analyses, the discriminant analyses of the quadrants resulting from those analyses clearly indicated that districts that are classified as high cost – low student performance still have noteworthy higher NSLA percentages and lower ADM. No differences were noted in race.
ANALYSES OF GAPS IN BENCHMARK PERFORMANCE BETWEEN DISAGGREGATED GROUPS OF STUDENTS

Another major accountability issue of NCLB is narrowing the gap in achievement between particular disaggregated groups (i.e., Caucasians, African Americans, Hispanics, and economically disadvantaged).

In the interest of parsimony, the bar charts that indicate the percentages of students who perform at proficient or advanced levels on the Arkansas Benchmark 4th and 8th grade literacy and math exams in 2007 and 2010 are presented in Appendices A through D.

The gaps between Caucasians and other disaggregated groups for 2007 and 2010 are presented in Tables 9 – 12.

Table 9 indicates that the gap in percentages of students performing at a proficient or advanced level in 4th grade literacy between Caucasians and African Americans narrowed from 26.7% in 2007 to 16.7% in 2010. It narrowed from 22.7% in 2007 to 13.1% in 2010 between Caucasians and Hispanics, and from 12.6% in 2007 to 7.2% in 2010 between Caucasians and economically disadvantaged.

Table 9. Gap Between Caucasian & Other Groups - 4th Literacy

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>16.62%</td>
<td>16.75%</td>
<td>0.13%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>21.74%</td>
<td>19.07%</td>
<td>-2.15%</td>
</tr>
<tr>
<td>Econ Disadvantaged</td>
<td>12.36%</td>
<td>7.19%</td>
<td>-5.16%</td>
</tr>
</tbody>
</table>
Table 10 shows that the gaps between these disaggregated groups also narrowed from 2007 to 2010 in 4th grade math. Similarly sized narrowing of gaps is seen in Table 11 for 2007 and 2010 in 8th grade literacy for the same disaggregated groups.

**Table 10. Gap Between Caucasian and Other Groups - 4th Math**

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>Hispanic</th>
<th>Econ Disadvantaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>26.07167167</td>
<td>15.44</td>
<td>13.4157</td>
</tr>
<tr>
<td>2010</td>
<td>15.34</td>
<td>9.0632</td>
<td>6.3045</td>
</tr>
</tbody>
</table>

**Table 11. Gap Between Caucasian and Other Groups - 8th Literacy**

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>Hispanic</th>
<th>Econ Disadvantaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>24.52297297</td>
<td>22.78064516</td>
<td>13.034117554</td>
</tr>
<tr>
<td>2010</td>
<td>22.35584416</td>
<td>12.32157605</td>
<td>6.0009908858</td>
</tr>
</tbody>
</table>

Examination of Efficiency and Achievement Gaps in Arkansas School Districts
In Table 12, we also see a narrowing of gaps between these groups for 8th grade math, but the amount of reduction is less for Hispanics and economically disadvantaged. Still, there is an encouraging pattern of decreasing the gap between the disaggregated groups.

**Table 12. Gap Between Caucasian and Other Groups - 8th Math**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>29.972</td>
<td>25.64</td>
</tr>
<tr>
<td>Hispanic</td>
<td>15.615</td>
<td>15.71</td>
</tr>
<tr>
<td>Low Disadvantaged</td>
<td>24.274/1007</td>
<td>21.989/1007</td>
</tr>
</tbody>
</table>

**PREDICTION ANALYSES OF GAPS**

In order to gain some preliminary understanding of what factors in available datasets might be related to these gaps in achievement, several commonly used (i.e., ordinary least squares) multiple regression analyses were conducted (Freund & Wilson, 1998). It is common practice to conduct exploratory analyses in different fields of study to try to identify significant predictors that can be further examined in experimental and quasi-experimental designs to test causal relationships. For example, in the fields of health and mental health epidemiological studies are conducted to identify predictors (or correlates) of pathologies, which are then examined in more rigorous experimental studies to determine causality.

In the present study, numerous factors were analyzed in various combinations to try to identify significant predictors of the gaps in student achievement between the disaggregated groups discussed in the previous section. The factors considered in the analyses came from district data provided by ADE and data derived from BLR surveys.

All data analyzed measured factors at the district level. They include average teacher salaries, use of salary bonuses for teachers (yes or no), teacher merit pay (yes or no), average daily attendance membership (ADM), national school lunch administration (NSLA), total per pupil expenses, percentage of total expenses for instruction, number of additional units of various courses, FTE of instruction technology facilitators, weeks of tutoring, weeks of extended school, and weeks of summer school.

Taken together, the results of these regression analyses clearly indicate that administrative data and surveys designed primarily to investigate resources do not provide measures that predict student performance or gaps in performance. It may be confidently surmised from these results that future research on gaps in achievement
between disaggregated groups must “drill down” deeper into the personal, interpersonal, and environmental fabric of the educational experience. The professional literature (e.g., Educational Testing Service, 2003; Odden, Borman, & Fermanich, 2004) and experience provide valuable clues about candidates for predicting achievement gaps, such as quality of teaching, leadership, and professional development.

Based on these findings on gaps in achievement, the BLR research division decided that some initial in-depth case studies would provide valuable information about possible influences on achievement for future research. In-depth qualitative methods are often used to uncover more complex processes, such as leadership, than are measured in surveys or administrative data (National Governors Association, 2008).

**CASE STUDY OF SELECT ARKANSAS SCHOOLS**

BLR staff conducted in-depth onsite interviews with teachers, instructional facilitators, counselors, and administrators in six schools. These interviews were guided by protocols designed by the BLR staff; however, the format also allowed for further probing and exploring unforeseen discoveries.

These case study schools were deliberately selected to have at least one “exemplary” and one “struggling” school in each of three levels of schools (elementary, middle, and high schools). Schools were matched as closely as possible according to race and NSLA percentage. The designation of “exemplary” and “struggling” was based on ADE Benchmark exam scores, ADE school improvement status, and consultations with ADE officials.

In this particular report, the observations gleaned by the case study method are generalized in terms of factors that seem to differentiate between “exemplary” and “struggling” schools. While these observations are less systematic than empirically validated measures used in experimental and rigorous survey designs, they are informed by professional literature, and they are based on asking experienced teachers and administrators what factors they would identify as most responsible for their “successes” and “failures.” Teachers, counselors, and administrators were interviewed separately. Interviews were conducted with two BLR staff present to facilitate different perspectives in the line of questioning and to allow for comparisons of notes in summarizing observations.

Keys to success in obtaining candid and valid responses from practitioners in their field setting include establishing rapport and a trust in the confidentiality and anonymity of responses. Without exception, taking time to develop rapport seemed to establish an open dialog between BLR staff and school personnel. The volume and detail of information provided suggested that teachers and administrators were honest and forth-coming in these interviews. BLR staff were treated with the utmost respect and we encountered no hesitancy or resistance to interviewing teachers or counselors without administrators being present. Furthermore, teachers seemed to feel free to share information and opinions, even being quite critical of certain procedures and policies.

Confidence in the observations shared in this report is increased because they are based on hearing similar reports from administrators and teachers in separate interviews and on research found in the professional literature. In summary, the case study seemed to provide reliable and valid data on factors investigated.

**FACTORS IDENTIFIED IN THE CASE STUDY**

A particularly striking characteristic of the settings in which the “struggling” schools are located is the blatant evidence of poverty. Without exception, these struggling schools are in blighted neighborhoods, often surrounded by more affluent housing, characterized by unemployment, dilapidated houses and buildings, high crime and substance abuse, and personal pathologies. Superintendents, principals, teachers, and counselors confirmed well-established factors associated with poverty, such as lack of parental interest in or support for education, single-parent or grandparent households, high prevalence of substance and child abuse, and seriously deficient resources. For example, in three of the “struggling” schools, there are many students living in homes without
running water, heat, and regular meals. Some of the homes do not have electricity on a regular basis, and many caregivers do not have transportation or childcare.

As school officials noted, there is a definite “culture of poverty” challenge to overcome in educating many students in these “struggling” schools. Many of these students have limited or no experience with computers or other technology being used in the classroom. Daily or weekly communication with parents through the internet (e.g., Edline) is not possible because of the lack of home computers. The challenges of poverty are so great for all 3 “struggling” schools in the Case Study, their parent centers and parent facilitators are overwhelmed with trying to provide adequate services. Their assistance includes, but is not limited to, helping find food, clothes, shelter, employment, child care, health and dental services, and transportation.

A major intervention designed to directly improve student achievement, especially among low-performing students living in poverty, involves the use of para-professionals and tutors (tutors refer to certified teachers). Each of these staff are assigned approximately 10 students, but teachers work with every student in class so these assigned students are not identified. They tutor students throughout the day and after school, and tutoring primarily entails reiterating classroom teaching rather than focusing on homework. Interviews indicated that tutoring is especially aimed at concepts and skills typically found on Benchmark exams. In sum, the degree of poverty seems to be one of the most discriminating factors between “struggling” and “exemplary” schools. In fact, while the BLR tried to match “struggling” and “exemplary” schools on demographic characteristics, the closest we could come to an “exemplary” school was one that had made impressive strides toward raising the percentage of students performing at proficient and advanced levels on the state Benchmark exams.

LEADERSHIP

Research is very clear that leadership, culture of learning, collegiality, tutoring, parent involvement, and consensus on high expectations are the most potent predictors of success in student achievement (see reviews, Center of Education Policy, 2009; Corallo & McDonald, 2002; What Works Clearing House, 2008). Succinctly stated, common themes are observed in narrative reviews and meta-analysis of research on school reform and student achievement, and these are noted briefly where appropriate throughout this report.

In all 3 “struggling” schools visited, there had been a change in principals, either in the current (2010-11) school year or in the previous year, and in every instance the former principal was replaced because of deficient student performance and general dissatisfaction with leadership. In all cases, the current principal had considerable teaching and administrative experience within the same school district and in other districts. Also, the three principals grew up in poverty in the neighborhood where they are serving as a principal, and so they are familiar with the culture and many of the families. Each of these principals believes that their background and experiences allow them to better understand problems faced by parents, and to find ways of assisting families with multiple needs. A problem identified by all 3 principals is the naivety of many faculty regarding living in poverty. They have implemented in-service training to sensitize faculty to the “culture” and problems of the surrounding neighborhood.

All three principals have Master’s degrees in education administration from local universities and have finished training in a leadership program. In the elementary and middle schools, several “ineffective” teachers have been replaced, or they retired, as a result of failing to perform at an acceptable level. The principal at the high school is in his first year, and is still in the process of identifying and working with ineffective teachers. In each of these schools, teachers are given extensive professional development opportunities before being encouraged to leave their position. Data on teaching are gathered through impromptu conversations with students on playgrounds and at lunch, unannounced classroom observations, lesson plans, formative assessments, and wall displays. Professional development also is specifically tailored to address the deficiencies identified among these “struggling” teachers. Teachers and principals indicated that they believe professional development is critical to improving teaching, which according to the literature, is one of the strongest predictors of student achievement gains (Odden et al., 2004). Effective professional development, however, must be directly targeted to individual
needs (grade- and subject-specific), continuous in terms of accumulating knowledge and skills, and it must entail follow-up coaching and monitored practice. Teachers need to be able to observe models and receive immediate feedback on their practice of skills.

Much of the modeling, classroom observation of teaching, and feedback is provided by instructional facilitators in the schools visited. In only one of the “struggling” schools did instructional facilitators have their own classroom teaching assignments in addition to working with teachers. There is a consensus among teachers and administrators that these instructional facilitators are essential to professional development of teachers and higher quality teaching. Many of the professional development experiences for teachers are provided by instructional facilitators. Moreover, instructional facilitators play a major role in transferring knowledge and skills from national and regional workshops and conferences to teachers.

Another major source of professional development for teachers is America’s Choice. Superintendents, principals, and teachers reported that they receive useful instruction and guidance from the America’s Choice representative at their school. They indicated that representatives of America’s Choice have provided very useful teaching strategies and curriculum guidance. Several school officials interviewed noted that America’s Choice services have significantly improved in the past couple of years. In prior years, the representative from America’s Choice often did not show up at the school until the Spring semester, and they were unreliable in providing services.

Although schools in Arkansas are moving toward offering individually tailored professional development that has continuity over time, a significant portion of this training still consists of disjointed, single sessions that are required of all faculty, irrespective of need or teaching assignments. This silo format of professional development has been shown to be ineffective in enhancing teaching skills (National Center for Education Research, 2007). Professional development sessions should be linked together in a coherent, progressively-developing sequence to build a body of knowledge and skills.

Principals must work directly with teachers to design an individually tailored professional development plan over time that addresses specific weaknesses and deficiencies. The Chair of the National Math Panel reports that the majority of math teachers in this country do not have sufficient knowledge to teach their courses. He indicated that this is one reason American students are scoring lower in math than students in other industrialized nations (National Conference of State Legislatures, 2009). Principals in “struggling” schools visited in Arkansas indicated that they are in the process of developing teaching capacities and “counseling out” a few teachers who are not performing adequately.

SCHOOL CULTURE

Principals play a major role in developing the school culture. A huge problem identified at the “struggling” high school visited is the absenteeism of both students and teachers. The new principal reported that he is presenting an unrelenting message to students and teachers, individually and in meetings, that he will not tolerate absences for inappropriate reasons. He is also having to address apathy and a sense of defeatism among students and faculty. These problems had gotten so severe, an engineering concentration developed as part of a federal grant had to be dropped because of a lack of interest among students and faculty.

Cultural change requires very deliberate and concentrated efforts to convey a more positive message to students, teachers, and parents. The “struggling” elementary and middle schools hold brief rallies at the beginning of each day when groups of students and classes are recognized for various achievements and positive accomplishments. The constant theme of these rallies is high achievement expectations and proper comportment. Messages seen on wall-boards and banners communicate an optimism that students will perform well in classes and on exams, and will be prepared to go on to college. Hallways display the pennants from colleges and universities across the country, including several prestigious universities, to remind students of the school’s message that they are college bound.
One of the major discriminating factors between “struggling” and “exemplary” seemed to be teachers’ and parents’ access to principals. Interviews indicated that principals at “exemplary” schools, and new principals at “struggling” schools, have a more open-door policy, and are more willing to entertain ideas from teachers and parents, than principals who have been replaced. At the same time, interviews also indicate that this receptivity to input from parents and teachers must be balanced with assuming a leadership role in ensuring rigorous curriculum and performance standards. In most schools, the principal is in a better position than anyone to make sure teachers meet regularly in horizontal (subjects) and vertical (grade levels) teams to plan, implement, evaluate, and revise curricula and assessment strategies. Someone has to assume responsibility for making sure teachers remain on task to create a seamless coordinated and integrated curricula that encompasses different grade levels and subject areas.

Another major factor that seemed to differentiate “successful” from “unsuccessful” schools is the commitment of principals to assuming the leadership role in creating a coherent curricula for the entire district that links course content across subjects (e.g., math, literacy) and grade levels. All “struggling” schools visited had already hired a new principal with this vision of developing curricula. Superintendents, principals, and teachers indicated that a primary reason former principals at “struggling” schools were replaced is because they had not assumed a leadership role in curriculum. New principals and principals at “exemplary” schools invariably communicated a missionary zeal toward raising academic and teaching standards and developing high achievement expectations for students. In the elementary and middle schools, the principals met with teachers at least weekly throughout the summer in preparation for classes in the Fall. Student portfolios and test scores were used to plan curriculum for the Fall semester. In one of the struggling elementary schools, the new principal requires teachers to make at least one home visit each semester, and they are to be available to meet with parents who have issues at the school. In all of the schools visited, it was noted that principals spend much of their day “doing a walk-through” to observe classroom teaching and interactions, as well as the use of wallboards. Principals also informally talk to students to see if they understand concepts and skills being taught.

PARENT CONTACT

In every school visited for the case study, principals and teachers indicated that there is a small percentage of parents who attend any school activities geared to parental involvement, but the problem is amplified in “struggling schools.” Despite offering free meals, a small percentage (5% to 10%) attend what are called science nights, math nights, and so on. Parent attendance at school functions did not approach 50% at any of the schools visited, but it was significantly lower at “struggling” schools. Parental involvement is meager in “struggling” schools because parents have a limited appreciation for education, and because of the many impediments associated with poverty, such as lack of childcare, transportation, and ability to take time off from work. Many of these parents are school dropouts and undereducated. Yet, the literature is clear that parental involvement is essential to student achievement gains (National Center for Education Research, 2007). Parental expectations and tutorial support are significant influences on student achievement.

A program offered at two of the “struggling” schools, including the high school, involves offering courses to parents that teach content their children are being taught. The underlying assumption is that parents are more likely to help their children if they learning the same content. However, these programs also have elicited meager participation for the same reasons that have been discussed.

These course offerings for parents were not found at the exemplary schools. The most striking difference between “struggling” and “exemplary” schools is probably the characteristics of parents and neighborhoods. Indeed, all “struggling” schools were located in an extremely impoverished neighborhood, where parents tend to be uninterested in education, and too overwhelmed with problems associated with poverty to be involved in school activities. Despite similar NSLA rates, the “struggling” schools seemed to be located in even more impoverished neighborhoods than the “exemplary” schools. This extent of impoverishment appeared to be evident in terms of unemployment, irregular utilities, lack of food and clothing, and no transportation and childcare.
Another distinguishing feature that stems from being impoverished is the lack of regular communication between teachers and parents in “struggling” schools in comparison to “exemplary” schools. In most schools in Arkansas, there is some form of regular internet communication between the school and parents. In some schools, this communication is limited to district-wide activities, policies, and lunch and bus schedules. However, many schools have regular e-mail communication between parents and teachers, and they post school-level activities and grades. A smaller percentage of schools post assignments so parent can assist children and see their performance. In “struggling” schools, however, none of this communication is possible because the vast majority of homes do not have computers.

While “struggling” schools can continue to have children hand-carry assignments and messages home to parents, this method of conveyance is unreliable and typically discourages regular communication. Yet, research suggests that regular communication between teachers and parents regarding coursework encourages parental participation in their children’s education.

### RIGOR OF CURRICULUM AND PORTFOLIOS

Another striking difference between “exemplary” and “struggling” schools before the introduction of a new principal was the rigor, documentation, and overall organization of curricula and assessments. While it should come as no surprise that the rigor of curricula is related to student achievement, many outside the teaching profession are likely unfamiliar with the organization and documentation of performance contained in student and teacher portfolios.

The two most impressive schools visited, one “exemplary” and one “struggling” but in transition, based their student performance on three primary areas of emphasis: 1) a very tightly interwoven rigorous curricula, 2) detailed teacher and student portfolios, and 3) highly educated instructional facilitators, who are strongly committed to remaining at the “cutting edge” of their expertise by continuing college coursework and all professional workshops and conferences that can enhance their knowledge and skills.

Teachers in most if not all schools meet weekly in horizontal teams to develop curriculum and pacing in their respective areas of teaching, and monthly in vertical teams to coordinate and synchronize content by grade levels. While all schools seem to have some degree of this organizational arrangement, the two impressive schools being discussed have taken this organization to a higher level of rigor and integrity. For example, starting in pre-school and continuing through high school, a portfolio is maintained on each student that follows them until they leave the district or graduate high school.

The portfolio is a complete transcript of all assignments, assessments, tests, papers, grades, course outlines, and teacher comments the student receives during their education experience. These portfolios are a major reference in designing courses and lesson plans within the schools and within the district. Student portfolios have been and are used in nearly all schools in Arkansas, but what differentiates the “exemplary” high school being discussed is the amount of detail contained in the portfolio and the accumulation and linkage of assignments and teaching across courses and grade levels. Teachers meet regularly to discuss how to coordinate teaching for particular students in different courses. Furthermore, teachers regularly meet with former teachers to discuss how to build on knowledge and skills of particular students.

This high school is also impressive because the principal maintains teacher portfolios, which are an ongoing account of lesson plans, regular observations of classroom teaching, parent comments, and formal evaluations. Of particular note, these teacher portfolios contain a detailed plan of professional development (PD), including a statement of ambitions, self-assessments, evaluations, a description of content and skill areas to be developed, and a discussion of which PD activities addressed particular needs. Teacher portfolios are rare and yet they document a teacher’s performance over time and they specify professional development needs and accomplishments.
Finally, this “exemplary” high school provided a particularly impressive model of horizontal and vertical integration of curricula for an entire district. In this school, there is a small library with extensive volumes of course materials that document the coordination and integration of courses within grade levels, within subjects, and across grades and schools within the districts. It is the degree of documented rigor in organizing a district-wide curricula that made this school standout from the others visited. A major reason this “exemplary” high school has been able to thoroughly document student performance, teacher performance, and horizontal and vertical coordination and integration of curricula is because the two full-time instructional facilitators have assumed a role of assisting the principal in organizing these efforts. Both facilitators have more than 20 years of classroom teaching, Master’s degrees in their respective subject areas (i.e., math and literacy), and many additional certifications and courses in their areas of expertise. Both instructors also view their role as helping the principal lead curricula development in the district.

**Conclusions and Considerations**

The case studies and efficiency analyses proved to be worthwhile pursuits in trying to distinguish higher performing schools and districts from those at the other end of the spectrum. The findings in Arkansas are in accord with those found in the professional literature. Indeed, the case studies clearly indicated that principals need to assume an active and strong leadership role in curriculum, instructional facilitators are essential to enhancing teachers’ knowledge and skills, curriculum needs to be coherent and rigorously integrated across subjects and grade levels district-wide, teachers must meet regularly to develop curriculum and individualized student instruction, teaching needs to be evaluated regularly in the classroom, professional development needs to be targeted and planned as sequential growth, student and teacher portfolios provide invaluable information for classroom and administrative decisions, schools in impoverished neighborhoods present unique challenges and require specific resources (e.g., parent centers), and new approaches to parental involvement need development.

The efficiency analyses discussed in this report demonstrate that school districts can be differentiated into categories according to levels of per pupil expenses and student performance on exams. The quadriform analyses performed indicate that approximately 20% of the Arkansas school districts have high per pupil total expenses and low student performance on the state Benchmark exams. Approximately a third of the districts are classified as efficient.

The attempt to identify predictors of gaps in achievement was not successful because of the nature of data available in files created for administrative purposes and in surveys designed to examine resource allocation. The literature suggests that gap analyses will require “drilling down” deeper into personal, interpersonal, and community factors, such as quality of teaching and leadership, collegiality, and poverty factors. These data would require more in-depth interviews and/or well-established survey instruments. Also, longitudinal data are needed to examine questions about narrowing gaps in achievement.

Considerations for further study from the BLR research team include, but are not necessarily limited to: 1) repeat visits to schools in the case studies to develop a longitudinal perspective, 2) analyses of factors associated with different sized gaps in achievement among districts, 3) study of absenteeism, 4) further examination of “outliers” (or extreme cases) in the efficiency analyses, and 5) comparison of NAEP and benchmark scores among disaggregated groups.
REFERENCES


APPENDIX A - PERCENT PROFICIENT OR ABOVE 4TH GRADE LITERACY

APPENDIX B - PERCENT PROFICIENT OR ABOVE 4TH GRADE MATH
APPENDIX C - PERCENT PROFICIENT OR ABOVE 8TH GRADE LITERACY

![Bar Chart for Percent Proficient or Above 8th Grade Literacy](chart.png)

- **Combined**: 64.2% (2009), 74.5% (2010)
- **Caucasian**: 69.7% (2009), 78.5% (2010)
- **African American**: 45.1% (2009), 58.0% (2010)
- **Hispanic**: 52.4% (2009), 71.2% (2010)
- **Econ Disadvantaged**: 55.6% (2009), 68.1% (2010)

APPENDIX D - PERCENT PROFICIENT OR ABOVE 8TH GRADE MATH

![Bar Chart for Percent Proficient or Above 8th Grade Math](chart.png)

- **Combined**: 47.1% (2009), 61.8% (2010)
- **Caucasian**: 54.3% (2009), 64.6% (2010)
- **African American**: 24.4% (2009), 39.6% (2010)
- **Hispanic**: 47.9% (2009), 62.2% (2010)
- **Econ Disadvantaged**: 37.8% (2009), 54.5% (2010)
Examination of Efficiency and Achievement Gaps in Arkansas School Districts:
Case Studies and Statistical Analyses

This report reviews results from 3 approaches to examining efficiency and achievement in Arkansas school districts. These are 3 studies that augment the adequacy study reported earlier.

The first approach entails an examination of district efficiency with a relatively new statistical procedure known as quadiform analysis.

Quadiform analysis is emerging in the school finance literature as an accepted procedure for examining the relationship between inputs (e.g., per pupil costs) and outputs (e.g., student performance on state Benchmark tests). Maximum efficiency assumes there is a linear relationship between inputs and outputs. Quadiform analyses test this assumption in school districts.
### Efficiency Analyses

Quadiform analysis tests the assumption of linearity by comparing predicted output values (test scores), based on maximum efficiency, to values actually reported for each district.

The linear relationships between per pupil total expenses and student performance on Benchmark exams are examined for 4th grade and 8th grade literacy and math for FY 2007 and 2010.

This performance outcome is measured by the percent of students in the districts that performed at or above proficient on the Benchmark exams.

Proficient signifies grade-level performance in Arkansas.

### Regression Analysis

Regression statistics are used to test the linear relationship between per pupil total costs and student performance.

The regression formula derives a prediction line of predicted values (district % proficient) for each cost value, assuming maximum efficiency, or a linear relationship between cost and performance.

In the efficiency analyses, the differences between these predicted values and actual values (green dots in Chart) are examined.

A random sample of 30 districts is shown in the following Chart to avoid the confusion of displaying 244 districts. Three of the differences between predicted and actual values are shown predicted and actual %'s are shown by blue arrows. These differences are called residuals and they are plotted to examine efficiency in the quadiform analyses.
Quadiform Scatterplots

Quadiform scatterplots represent the intersection of per pupil cost and student performance residuals obtained from regression analyses of both factors.

Both factors were regressed on race; NSLA; ADM; teacher salaries; merit pay; FTE technology instructor; and weeks of tutoring, summer and extended school. Only race and NSLA were retained in final analyses.

In Chart 1 is shown the scatter plot of per pupil costs and student performance residuals for 244 districts in 4th grade Benchmark literacy for 2010. Each blue dot represents a school district.

The scatterplot is divided into quadrants according to zero cost (red line) and zero performance (green line) residuals (zero shows no difference between predicted and observed values).
Quadiform Scatterplots

In the top left quadrant are districts with lower than predicted costs and higher than expected performance, whereas the top right quadrant has higher than expected costs and performance.

The lower left quadrant has lower than expected costs and performance, while the lower right has higher than expected costs with lower than expected performance.

In Chart 1 is shown the scatter plot of per pupil costs and student performance residuals for 244 districts for 2010 in 4th grade Benchmark literacy. Each blue dot represents a school district.

The scatterplot is divided into quadrants according to zero cost (red line) and zero performance (green line) residuals (zero shows no difference between predicted and observed values).
Gap Analyses of Benchmark Exams

To gain some preliminary understanding of what factors in available datasets (ADE and BLR) might predict performance gaps on Benchmark Exams (4th & 8th grade math & literacy) the same regression statistics were used (i.e., ordinary least squares).

Gaps between Caucasians and African Americans, Hispanics, and economically disadvantaged were examined. These are the groups identified in No Child Left Behind (NCLB) for disaggregated analyses.

All available data from ADE files and BLR adequacy surveys were considered in various combinations to identify predictors of gaps. None of the available variables was a significant predictor of the differences in % proficient between these groups.

The same variables identified earlier for the efficiency analyses were analyzed as predictors of differences (gaps) between the NCLB disaggregated groups.
Case Studies of Selected Districts

In-depth interviews were conducted with superintendents, principals, teachers, instructional facilitators, and guidance counselors in 6 schools. 2 “exemplary” and 2 “struggling” schools were selected from elementary, middle, and high schools.

To the extent possible, exemplary and struggling schools were matched on demographics. Matching schools on poverty levels proved less than optimal. School designations came from Benchmarks and ADE consultation.

Interviews were conducted separately with school personnel. Tenor and consistency of responses indicated candor, and concordance with research gives support to the validity of responses.

For example, responses confirmed research findings that the most important influence on student achievement is quality of teaching. Struggling schools currently are in the process of dismissing ineffective teachers after they have been given professional development.

Another major influence on achievement is leadership. Principals must take an active role in curriculum development and implementation and professional development of teachers. In every struggling school visited, there had been a change in principals to enhance leadership.

In exemplary schools, instructional facilitators assumed major roles in professional development, mentoring, and curriculum. To have an integrated and coordinated district-wide curriculum, someone must assume responsibility to ensure that teachers meet in horizontal and vertical teams and remain on task.

Instructional facilitators also play a key role in professional development in exemplary schools. Aside from teaching knowledge and skills in their areas of expertise, they model teaching and give feedback from classroom observations. They are conduits for conferences.

Exemplary schools also a portfolio system for students and teachers that documents development across years. Teacher portfolios have evaluations, professional development, lesson plans, student assignments, and other indicators of quality of teaching. Portfolios document development.
Student portfolios contain assignments, projects, exams, teacher comments, formative and summative assessments, parent conferences, and other materials that can be used to assess students' achievement and interpersonal development.

Student portfolios follow them as long as they remain in the district, so teaching have a longitudinal record of achievement for each student. Teachers are able to consult about students across courses, grades, and years. Scheduled meetings also ensure consultations across years.

Struggling schools reported extensive use of tutors, summer school, and extended school. Personnel at all of these schools indicated that many students read well below grade level. Part of the reason for reading deficits is the lack of reading materials and interests in the home.

Struggling schools were located in neighborhoods characterized by extreme poverty, despite attempts to match schools on demographics. Many homes have irregular utilities, meals, and employment. Several parents have limited education, childcare, and transportation.

Many parents in struggling schools are too overwhelmed with the realities of poverty to become involved in their children's education. Parent participation at these schools was reported to be 5% to 10% on nights set aside for parents, when meals were served.

Parent centers and facilitators have been very valuable in helping parents find services and resources such as transportation, childcare, counseling, and social services. Problems that directly affect education include lack of electricity, computers, and reading materials.

Personnel at two struggling schools reported a pervasive problem with lack of motivation and apathy among teachers and students. One high school principal reported having to discontinue a specialty curriculum that was federally funded due to lack of teacher and student interest.

Teachers at struggling schools were more critical of their professional development (PD), indicating that the majority of PD is mandated for Everyone, irrespective of needs or specialty areas. It is dominated by single-session lectures with no time for practice or follow-up.
Conclusions

Finally, a particularly salient observation about exemplary schools was their very tightly woven curriculum, where course objectives and content were well-integrated across course areas, grades, and school levels (elementary, middle, and high schools). In other words, the entire district had a coherent curriculum with clearly articulated developmental sequences. Each course built on previous courses and prepared students for the following course.

This coordination requires teachers and leaders to take integration of courses very seriously, and someone has to take responsibility to make sure horizontal and vertical meetings occur and contribute to an overall coherency.