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Equity and Efficiency of Minnesota Educational Expenditures with a Focus on English Learners, 2003-2011: A Retrospective Look in a Time of Accountability

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Abstract: Policymakers and practitioners often must balance distributing resources equitably and efficiently while being accountable for high student achievement. This paper focuses on these concepts as they relate to English learners and examines equity and efficiency in Minnesota's educational funding from 2003 through 2011, the years spanning implementation of the No Child Left Behind Act and Minnesota's waiver from its regulations. Equity refers to the distribution of resources in the achievement of established goals (Alexander, 2012); efficiency entails the attainment of those goals using fewer resources (Rolle, 2004). We measure equity by looking at three standard

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distribution measures: (1) McCloone Index; (2) Verstegen Index; and (3) Coefficient of Variation (Odden & Picus, 2008). We operationalize efficiency using data envelope analysis, thus getting at aspects of technical efficiency. We found that distribution of expenditures are increasingly uneven in the nine-year period examined. This inequality was largely driven by low-spending districts falling farther behind the median. Moreover, despite specific guidelines in its school finance formula that awarded additional resources for English learner populations, districts with higher portions of English learners have lower total and instructional expenditures per pupil, not higher. If more dollars are not available for EL programming, then doing more with less becomes paramount. Nevertheless, the efficiency of resource use was relatively constant over the years examined with efficiency in the use of education resources similar for English learners as it was for the population overall.
Keywords: English learners; efficiency; equity; school finance

Equidad y eficiencia de los gastos educativos de Minnesota con énfasis en los estudiantes de inglés, 2003-2011: Una mirada retrospectiva en un momento de rendición de cuentas
Resumen: Los responsables de la formulación de políticas y los profesionales equilibran la distribución de los recursos de manera equitativa y eficiente, al mismo tiempo que son responsables del alto rendimiento estudiantil. Este artículo se centra en estos conceptos, ya que se relacionan con los estudiantes de inglés y examina la equidad y la eficiencia en el financiamiento educativo de Minnesota de 2003 a 2011, los años que abarca la implementación de la ley No Child Left Behind. Equidad se refiere a la distribución de los recursos en el logro de los objetivos establecidos (Alexander, 2012); La eficiencia implica el logro de esos objetivos utilizando menos recursos (Rolle, 2004). Medimos la equidad examinando tres medidas de distribución estándar: (1) Índice de McCloone; (2) Índice de Verstegen; Y (3) Coeficiente de Variación (Odden & Picus, 2008). Operacionalizamos la eficiencia utilizando el análisis de los datos, obteniendo así aspectos de la eficiencia técnica. Encontramos que la distribución de los gastos es cada vez más desigual en el período de nueve años examinado. Esta desigualdad se debió en gran medida a que los distritos de escasos gastos se situaron más lejos de la mediana. Además, a pesar de los lineamientos específicos en su fórmula de financiamiento escolar que otorgó recursos adicionales para las poblaciones aprendices de inglés, los distritos con mayores porciones de estudiantes de inglés tienen menores gastos totales y de instrucción por alumno, no mayores. Si no hay más dólares disponibles para la programación EL, entonces hacer más con menos se convierte en primordial. Sin embargo, la eficiencia del uso de recursos fue relativamente constante a lo largo de los años examinados con eficiencia en el uso de recursos educativos similares para los estudiantes de inglés como lo fue para la población en general.
Keywords: estudiantes de inglés; eficiencia; equidad; finanzas escolares

Equidade e eficiência das despesas de educação Minnesota com ênfase em estudantes de inglês, 2003-2011: Um olhar para trás em um momento de prestação de contas
Resumo: Os fabricantes de formuladores de políticas e profissionais equilibrar a distribuição dos recursos de forma equitativa e eficiente, enquanto eles são responsáveis pela alta desempenho do aluno. Este artigo incide sobre estes conceitos como eles se relacionam com estudantes de inglês e examina equidade e eficiência no financiamento da educação de Minnesota 2003-2011, os anos abrangidos pela implementação do No Child Left Behind. Equidade se refere à distribuição de recursos para a realização dos objectivos fixados (Alexander, 2012); Eficiência envolve a realização destes objectivos, utilizando menos recursos (Rolle, 2004). Medimos a equidade examinando três medidas de distribuição padrão: (1) Índice de McCloone; (2) Índice de Verstegen; E (3) Coeficiente de Variação (Odden & Picus, 2008).

Nós operacionalizado eficiência usando a análise de dados, assim, a obtenção de aspectos de eficiência técnica. Descobrimos que a distribuição dos custos é cada vez mais desigual no período de nove anos examinados. Esta desigualdade é em grande parte devido a maus despesas distritos ficou mais longe da mediana. Além disso, apesar de orientações específicas em sua fórmula de financiamento escola que oferece recursos adicionais para Inglês aprendizes cidades, distritos com maiores porções de estudantes de inglês têm total mais baixo e as despesas de instrução por aluno, não mais. Se não houver mais dólares disponíveis para El programação, em seguida, fazer mais com menos torna-se primordial. No entanto, a eficiência da utilização dos recursos foi relativamente constante ao longo dos anos analisados com eficiência recursos educacionais semelhantes para os alunos de Inglês como foi para a população em geral.
Palavras-chave: estudantes de inglês; eficiência; equidade; finance escola

Minnesota's student population is increasingly diverse. For example, in 2003, the ethnic makeup of the state was 81% white, 7% black, 4% Latino, 5% Asian/Pacific Islander, and 2% Native Americans. By 2011, its student population was 74% white, 9% black, 7% Latino, 6% Asian/Pacific Islander, and 2% Native Americans (National Center for Education Statistics [NCES], 2016a). The percentage of students identified as needing special education remained constant at 15% over that time period, but the percentage of students eligible for federally subsidized lunch prices rose greatly from 27% in 2003 to 40% in 2011. The distribution of non-white, English learners (EL), and poor students remained uneven, where most non-white, EL, and poor children were served in urban districts. Those years of increasing diversity were also marked by a change in the way that the federal government framed accountability, where states had to document how different student groups were doing on state standardized tests. Given the intersection of these forces, this paper takes a retrospective look at accountability in Minnesota, through the prism of its educational funding. We focus this discussion on English learners, the fastest growing sub-population of students in Minnesota since passage of the No Child Left Behind Act.

The number of Minnesotan students classified as English learners (EL) has expanded rapidly over the last decade. In 2003, there were 51,275 students classified as EL; by 2011, that number grew to 63,608. This accounted for an overall growth of 24.1%, and the percentage of EL served by schools grew from 6.1% in 2003 to 7.7% in 2011 (NCES, 2016a) to 8.3% in 2016 (Minnesota Department of Education [MDE], 2014; Minnesota Education Equity Partnership, 2016). Accompanying high growth in EL enrollment numbers were large gaps in performance between EL and their non-EL peers. For example, in 2011, 25.8% of EL students were considered proficient or advanced on the Minnesota Comprehensive Assessments (MCA) III mathematics test, the statewide standardized exam, compared to 56.0% when all students were considered. This gap of 30.2 percentage points is quite substantial. Similarly, on the 2011 MCA III Reading test, only 37.6% of EL students scored at or above proficiency compared to 74.0% of all Minnesotan students, resulting in an even wider gap of 36.4 percentage points.

The accountability stage set by the No Child Left Behind Act (NCLB) helped to make these gaps in student achievement explicit and of particular concern to Minnesota educators and policymakers (Post, 2012). For example, Minnesota began using English-language-proficiency tests as substitutes for regular reading tests for some EL in response to the 2002 enactment of the NCLB but has since dropped that practice (Education Week, 2007). Various districts in the state have implemented innovative newcomer programs to support newly arrived EL (Post, 2012). Educators can look to the Voices in Urban Education (VUE) report published by the Annenberg Institute for School Reform (2013) for an excellent description and review of innovative pedagogical practices aimed at improving student achievement among EL[1]. Our objective is to add to that discourse by exploring the equity and efficiency of funding targeted at English learners.

This paper examines Minnesota school funding from 2003 through 2011, paying particular attention to the distribution and allocation of funding for EL. We chose that time period for three reasons. First, it encompasses the time after passage of the 2002 enactment of the NCLB, which required states to disaggregate student achievement to show the performance of specific student populations, including EL. Second, that era represents a decade since the 1993 ruling in *Skeen v. State of Minnesota*, where the Minnesota Supreme Court reversed an earlier trial court decision and held the state's school finance system constitutionally permissible. The ruling "stemmed from a lawsuit filed in 1988 by 52 outer ring suburban and rural school districts representing 25 percent of the state's K-12 enrollment. The suit claimed that Minnesota's school finance system was unconstitutional because the finance system was not uniform and school districts received disparate amounts of government aid" (Strom, 2016, p. 3). Third, by 2011, Minnesota requested and received a waiver from the requirements of the NCLB; the changes in the accountability system prompted by the waiver would be implemented in the 2012-2013 school year. Thus, examining funding patterns from 2003 through 2011 can provide a useful perspective from which to view efficiency and equity of school funding in Minnesota, especially for English learners, under a NCLB accountability regime.

To address accountability, policymakers and practitioners often shape funding decisions based on having fair distributions of public resources and efficient use of those resources. The first criterion speaks to equity and focuses on the equitable distribution of resources and the latter construct, efficiency, focuses on productivity and returns on investment. Working definitions of equity and efficiency are multifaceted and complex. We conceptualized equity both in terms of equal distributions (horizontal equity) and purposeful variations (vertical equity), where resources are unevenly distributed to reflect the educational objectives of the state (Alexander 2012). We conceptualized efficiency as the attainment of established goals using fewer resources (Rolle 2004).

We intellectualize efficiency broadly and focus on efficiency from two different perspectives and levels of analysis. First, we take a longitudinal perspective focusing on the use of state resources in a state's performance over time to explore if there have been changes in the efficient use of resources over the years examined. Second, we adopt a cross-sectional perspective focusing on the use of district resources in a specific time (i.e., 2010-2011 school year, the most recent year of the study). The latter approach is similar to the analysis employed by Houck, Rolle, and He (2010), Banker, Janakiraman, and Natarajan (2004), and Anderson, Walberg, and Weinstein (1998). The emphasis is therefore more on the overall performance of school districts in any given year rather than on the specific resources used in each district. This differs from typical education production function scholarship (e.g., Hanushek, 2003; Hedges, Laine, & Greenwald, 1994) which focus on the question of effectiveness and the general efficiency of specific resources and policy strategies. Three questions guide this analysis:

1) When considering educational expenditures per pupil from 2003 to 2011, how equitable is the distribution of spending across districts in Minnesota? Are expenditures associated with populations of EL?
2) When considering educational expenditures per pupil from 2003 to 2011, has the state become more or less efficient in its overall resource use since 2003? Is there a similar pattern when considering EL?
3) When considering educational expenditures per pupil from 2003 to 2011, what is the

[1] Annenberg Institute for School Reform (2010). *English language learners: Shifting to an asset-based paradigm*. Providence, RI: Brown University. Retrieved from http://vue.annenberginstitute.org/sites/default/files/issues/VUE37.pdf

relationship between the equity of distribution and the efficient use of resources over time? Is the pattern similar when we focus on EL?

The remainder of the paper is divided into five sections. Section 1 describes Minnesota's education context with a special focus on EL. Section 2 describes the state funding formula. Section 3 offers salient conceptualizations and measures of equity in school finance and continues with a similar treatise regarding efficiency. Section 4 discusses the data and methodology used in this study. Section 5 presents the results of the fiscal analyses. The paper closes with an explicit discussion on policy implications.

English Learners in Minnesota

Minnesota has a fabled education system where all its "children are above average" (Keillor, 1990). The reality is less sublime. While the state persistently ranks in the top 10 in overall student performance, nonwhite, language learners, and poor students continue to do less well than their more privileged peers (NCES, 2016a). In school year 2011, Minnesota comprised 337 districts, 1,969 public schools, and 824,333 students. In 2011, Minnesota spent just below the national average on per-pupil expenditures ($10,674 vs. $11,138). Most of that funding (65.8%) was devoted to instruction and instructional support costs.

All EL are required to take Minnesota Comprehensive Assessments (MCA) as well as the state English language proficiency assessment. Minnesota lawmakers define English learners as "a pupil in kindergarten through grade 12 who meets the following requirements (2015 Minnesota Statutes 124D.59, Subdivision 2):

> the pupil, as declared by a parent or guardian (on the Home Language Questionnaire), first learned a language other than English, comes from a home where the language usually spoken is other than English, or usually speaks a language other than English; and the pupil is determined by a valid assessment measuring the pupil's English language proficiency and by developmentally appropriate measures, which might include observations, teacher judgment, parent recommendations, or developmentally appropriate assessment instruments, to lack the necessary English skills to participate fully in academic classes taught in English. (MDE, 2016, p. 2)

The U.S. Department of Education notes that students considered English learners should participate in appropriate programs of language assistance, including "English as a Second Language, High Intensity Language Training, and bilingual education, to help ensure that they attain English proficiency, develop high levels of academic attainment in English, and meet the same academic content and academic achievement standards that all students are expected to meet" (NCES, 2016b). Provision of these supplemental activities require additional resources either from state, local, or federal jurisdictions.

State and District Enrollment Patterns among English Learners

Growth in overall student population declined slightly from 2003 through 2011, falling from 836,854 students to 823,235, a decline of 1.6% over that time period. There was a concomitant, albeit uneven, rise in the number of EL, which increased from 51,275 in 2003 to 63,608 in 2011, an increase of 24.1%. Nevertheless, almost half (47%) of Minnesota's 337 districts in FY 2011 had no students classified as EL. An analysis of 85% of the districts statewide showed wide disparities in concentrations of EL that have persisted. In 2003, the coefficient of variation was 2.32 (*M* = 2.38, *SD* = 5.53); in 2011, the coefficient of variation was 1.92 (*M* =2.87, *SD* = 5.50).[2]

Over the years examined, the number of EL significantly increased in 124 districts, and the growth of EL from 2003 to 2011 was primarily concentrated in urban or suburban areas. These communities saw a 2,451 increase in their number of EL, from 40,433 in 2003 to 42,884 in 2011, reflecting a 6% increase. For example, St. Paul has more EL than any other school district with more than 13,000 EL enrolled in St. Paul public schools in 2012 (NCES, 2016a). They represent more than 131 languages. Similarly, Minneapolis had the second highest rate of ELs, with almost 8,000 EL students in 2012. To give you a sense of how different these two districts are from the state, in 2016, the percentage of EL in the state was 8.3%. The comparative EL rate for St. Paul and Minneapolis was 34.5% and 24.3%, respectively. It is in this context that St. Paul and Minneapolis have consistently had among the largest achievement gaps among student groups in the state.

Non-metropolitan communities had an overall increase of 982 in their number of English learners, from 6,010 in 2003 to 6,992 in 2011, reflecting a 16 % increase. While most of the state's English learners were in Minneapolis and St. Paul, suburbs of the Twin Cities and communities in rural Minnesota have also seen much of the growth in the number of students who are new to the language (Post, 2012).

Most of the growth of EL in Minnesota is attributable to increasing numbers of refugees from other countries, including Somalia, Burma, and Iraq as well as migrant children (MDE, 2016). It is worth noting that English learners tend to be concentrated in high-poverty districts (i.e., districts having more than 50% of students eligible for lunch subsidies). From 2003 to 2011, the growth of EL student populations in poorer school communities were 27 percentage-points higher than that for more affluent districts (32% v. 5%).

Minnesota School Finance System

State officials typically create finance policy to modify existing discrepancies in the school system. They rely on a "set of formulas and rules for using publicly collected revenues to pay for K-12 education" (Berne & Stiefel, 1999, p. 9). Minnesota's state constitution contains explicit language on education and charges the legislature with providing funding for its schools. It reads:

> The stability of a republican form of government depending mainly upon the intelligence of the people, it is the duty of the legislature to establish a general and uniform system of public schools. The legislature shall make such provisions by taxation or otherwise as will secure a thorough and efficient system of public schools throughout the state. (Minn. Const., art. XIII, § 1)

The financing of elementary and secondary education in Minnesota comes through a combination of state-collected taxes (primarily income and sales) and locally collected property taxes. The equalization of this financing may vary with the fiscal capacity of the school district, students served, or programs offered.

Fiscal Capacity

Minnesota measures fiscal capacity among its districts based on the taxable market value of

[2] While the range in coefficients of variation (CV) is typically between 0 and 1 or 0% to 100%, studies have shown that when wide disparities exist where there are many communities that have none of the value being measured and others with high portions, CV values can exceed the typical range. See, for example, Abdi (2010).

property parcels located within the district. The state then adjusts these values in three ways to derive each district's adjusted net tax capacity (ANTC) per pupil unit (Strom, 2016). These adjustments illustrate efforts to ensure that policymakers are accurately measuring a district's ability to fund its schools and the students they serve.

First, policymakers categorize each parcel of property in a class based on their intended use; property classifications include residential, agricultural, and commercial/industrial groupings. A district's net tax capacity reflects the taxable market value of each of its parcels multiplied by the appropriate class (use) rate for that parcel. Class rates for taxes payable in 2014 ranged from 0.45% on certain homesteads owned by disabled persons to 2% for most commercial/industrial property. Residential homesteads with market values of less than $500,000 were subject to a class rate of 1%. Thus if a residential property had a taxable market value of $400,000, it would have a net tax capacity of $4,000.

Second, to mitigate differences in assessment practices among taxing jurisdictions across the state, the state further adjusts the tax capacity of the school district by dividing its net tax capacity by the sales ratio. A sales ratio is a statistical measure prepared by the Minnesota Department of Revenue that measures the difference between the actual sale prices of property and the assessor's market values on those properties. The sales ratio study compares the assessor's market values with the actual sales prices of properties sold over a 21-month period. The tax capacities are then adjusted by the results of the sale ratio study. That is, the sales ratio is divided into the taxable value (net tax capacity) to obtain the adjusted tax capacity of a school district.

Third, to adjust for district size, the state divides the adjusted net tax capacity by a weighted measure of the district's average daily membership. The weight used depends on the student's grade level. Once this weight is applied, the district student count is adjusted for the actual students served and changes in enrollment over the previous year. The state uses the current year's pupil count if the district student population is stable or increasing. For districts with declining student population, the state uses 77% of the current year's count and 23% of the previous year's count (Strom, 2016).

State Appropriations

Money follows the weighted student. Pupils are weighted by grade level, where kindergarten students were weighted .557 from 2000 through 2007, and .612 for the remaining years examined. Students in first, second, and third grades were weighted 1.115 for the entire years examined. Students in grades 4 through 6 were weighted 1.06, and students in grades 7 through 12 were weighted 1.3. Thus, a district receives funding based on its pupil units, which is equal to the number of full-time pupils served times the appropriate pupil unit weight by grade.

The Minnesotan education finance formula appropriates revenue to its school districts in three major categories: (1) State education finance appropriations (funded with state-collected taxes); (2) State paid property tax credits (funded with state-collected taxes); and (3) property tax levies (funded with local, voter-approved dollars). The state education finance appropriation comprises categorical aids and. general education aid. Categorical revenue formulas are generally used to meet costs that vary significantly among districts (e.g., special education) or promote certain types of programs (e.g., literacy aid, adult basic education aid). The general education aid is the largest share of the education finance appropriation and is intended to provide the basic financial support for Minnesota's K-12 education programs. The data in Table 1 describe the components of the general education program, which comprised between 69.3% and 92.5% of state appropriations to school districts over the nine years examined.

Table 1
Components of the General Education Program

Program Components of General Education Revenue	Description
Basic Revenue	The basic general education formula establishes the minimum level of funding for school districts. Both the basic formula allowance and the general education levy are set each year in legislation.
Extended Time Revenue	Extended time revenue allows students to generate up to an additional 0.2 (for a total of 1.2 maximum) average daily membership (ADM), which is then used to calculate the district's Average Marginal Cost Pupil Unit, which is multiplied by the extended time formula amount to calculate extended time revenue. The revenue can be used for extended day, week or year programs.
Gifted & Talented Revenue	Gifted and talented revenue must be used to identify gifted and talented students, to provide programming for those students and to provide staff development for teachers of those students. Districts qualify for $12 per pupil for gifted and talented revenue.
Basic Skills Revenue (includes Poverty and EL)	Basic skills revenue includes compensatory, limited English proficiency (LEP) and LEP concentration revenues. Even with the revenues combined into one category, the funding for basic skills revenue is based on separate formulas for the individual components.
Secondary Sparsity Revenue	Sparsity revenue provides additional revenue for small and isolated schools. The secondary school sparsity formula takes into account a secondary school's enrollment, distance from the secondary school to the nearest secondary school and the geographic area of the secondary school attendance area.
Elementary Sparsity Revenue	The elementary sparsity formula provides additional funding for elementary schools that average 20 or fewer pupils per grade and that are 19 miles or more from the nearest elementary school.
Operating Capital	Operating capital revenue replaced the capital expenditure facilities and capital expenditure equipment formulas. The operating capital formula has a component representing the former equipment and technology formulas and is equalized.
Transportation Sparsity Revenue	Transportation sparsity revenue provides districts with additional funding based on the number of pupil units per square mile in the school district.
Equity Revenue	Equity revenue is intended to reduce the per pupil disparity between the highest and lowest revenue districts on a regional basis. For the purposes of equity revenue, there are two regions in the state: the seven-county metropolitan area and the balance of the state. In each region, districts are ranked according to their basic and referendum revenue. There are three components to the equity formula: regular, low-referendum and

Program Components of General Education Revenue	Description
	a supplemental amount. The regular component is based on a district's ranking in their region (rural or metro), the low-referendum component provides additional revenue for districts with referendum amounts below 10 percent of the state average referendum amount, and the supplemental component is a fixed amount for all districts.
Training & Experience Revenue	Training and experience revenue is based on the experience and education of a school district's faculty. Beginning in the 1998-99 school year, only teachers hired prior to 1996-97 are counted for the purposes of computing a school district's training and experience revenue.
Alternative Compensation Revenue	Alternative compensation revenue (was created to encourage districts to adopt alternative pay structures for teachers. A district that adopts such a pay structure is eligible to receive an established amount of additional dollars per unweighted pupil in revenue. Alternative compensation revenue is a combination of aid and equalized levy.
Transition Revenue	Transition revenue is set as a fixed amount per pupil equal to the 2003-04 transition amount, and is undesignated revenue which may be used for any general fund purpose. Transition revenue is a mix of aid and levy, levied against referendum market value
Referendum Revenue	Referendum revenue allows districts to increase their general fund revenue with the approval of the voters in the district. Referendum revenue is capped at an amount equal to the greater of 1) the greater of (a) 26 percent of the basic general education formula allowance or (b) $1,294 multiplied by inflation since 2003-04; or 2) the district's 1994 referendum allowance amount times 1.177 times the inflationary increase between 2003-04 and 2007-08 time one fourth the percentage increase in the basic formula plus the district's 2002 supplemental and transition revenues minus $215. District referendum revenue, except in districts eligible for sparsity revenue, may not exceed this cap. The referendum revenue formula is an equalized formula

Source: Compiled by authors from Minnesota House of Representatives, Understanding state aid, FY 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, and 2011. Retrieved from http://www.house.leg.state.mn.us/fiscal/files for all years.

There are 13 components in the general education program formula: basic revenue, extended time revenue, gifted and talented revenue, basic skills revenue (covers poverty and EL), secondary sparsity revenue, elementary sparsity revenue, operating capital revenue, transportation sparsity revenue, equity revenue, training and experience revenue, alternative compensation revenue, transition revenue, and referendum revenue. Statewide, approximately two-thirds of school districts' total revenue comes from the general education program. Each school district's general education revenue is the sum of the components. Minnesota's school districts use general education revenue to pay for the operating expenses of the district including employee salaries, employee benefits, and supply costs.

General education revenue is provided to school districts, and each local school board determines how to allocate that money among school sites and programs, subject to certain legislative restrictions. That is, while specific categories are included in general education revenue, these revenues largely flow as unrestricted funds to eligible school districts. There are two important exceptions. One is for the portion of revenue attributable to compensatory revenue (i.e., based on counts of students eligible for free or reduced price lunch), which must be passed through to each school site. Another exception is the amount devoted to maintain small classes for students from kindergarten through sixth grade. Of a district's basic general education revenue, a fixed dollar amount per average daily membership ($299 for kindergarten pupils and $459 for first through sixth grade pupils) must be reserved for the purpose of reducing or maintaining the district's average class size for kindergarten through third grade classrooms. The goal is to have average class sizes be 17 students to one full-time classroom teacher for these grade levels. The portion of revenue generated by the number and concentration of ELs do not face similar restrictions (MDE, 2015; Strom, 2016).

State appropriations for general education programs for any given year are different from the revenue calculated based on the formula for those programs due to the statutory requirement that the state pay most education aids over a two-year period. The majority percentage of the current year's entitlement must be paid in the current year, plus the balance of the previous year's entitlement, which is adjusted for changes in formula variables (e.g., pupil counts).

Table 2 provides information on per-pupil funding formula allowance, total state local education revenue, state appropriations, general education revenue, funding for EL, and EL as percentage of overall student population. In the decades preceding FY 2002-03, the general education formula was an "equalized" foundational formula, where the state paid in aid the difference between what was raised by the local levy and the formula allowance. Beginning in 2002-03, the general education levy was eliminated and has only been reintroduced in the formula in FY 2014-15. Thus, in all the years examined, the general education aid was essentially distributed as a flat grant, where all districts received basic formula funding regardless of their property wealth. Over the nine years examined, the formula allowance per weighted student increased from $4,601 in FY 2003 to $5,124 in FY 2011; this represents an 11.4% increase in nominal terms but a 7.5 % decrease when inflation using the consumer price index (CPI) is considered.[3]

The state provided the majority of funding of state and local revenues, and state appropriations as a percentage of state and local education revenues ranged from 75.1% in 2010 to 88% in 2008. The bulk of these expenditures were unrestricted, ranging from 69.3% of state appropriations in FY 2011 to 92.5% in 2006. The dollars targeted at EL comprised a very small portion of these revenues and never exceeded 1.1% of general education dollars over the nine years examined. Further, funding associated with EL decreased both in dollar terms as well as percentage of general education revenue. Dollars tied to the number and concentration of EL declined from $51 million in FY 2003 to $40.3 million in 2011, a decline of 20.1%. EL funding as a percentage of general education revenue fell from 1.1% in 2003 to .89% in 2011. These declines occurred amidst EL comprising a growing portion of the student population, from 6.13% in 2003 to 7.73% in 2011.

State finance formulas often are shaped by the legislative process or in response to court decrees. The *Skeen* ruling in Minnesota made it clear that local funds do not have to be equalized by the state as long as all districts were able to provide a uniform and basic education. Consequently, we do not analyze the fiscal neutrality of funding relative to property wealth. Instead, we focus on EL dollars in the funding formula, which state policymakers provided to address important differences in educational contexts. Because the focus of our analysis is on EL, it is important to provide more details on how they are included in the formula.

[3] If we account for inflation using the education price index (EPI), the formula allowance decreased by 8.6%.

Table 2
Minnesota School Finance 2003-2011, with Focus on English Learners Appropriations

Year	Formula Allowance per Pupil Unit	Total State and Local Education Revenue	State appropriations in $	State Appropriations as % of State and Local Education Revenue	General Education Revenue in $	General Education Revenue as % of State Appropriations	English Learner Revenue in $	English Learner Revenue as % of General Education Revenue	English Learner as percentage of student population
2003	4,601	6,900,984,300	5,409,897,000	78.4	4,619,554,000	85.4	51,000,000	1.10	6.13
2004	4,601	7,095,012,000	5,774,858,800	81.4	4,811,798,000	83.3	50,000,000	1.04	6.43
2005	4,601	7,445,621,733	6,036,534,000	81.1	5,074,190,000	84.1	36,000,000	0.71	6.87
2006	4,783	7,833,673,588	6,344,932,100	81.0	5,871,926,000	92.5	39,000,000	0.66	7.13
2007	4,974	8,219,133,838	6,494,262,150	79.0	5,521,534,000	85.0	38,400,000	0.70	7.65
2008	5,074	8,781,182,768	6,891,435,780	88.0	5,648,592,000	82.0	39,200,000	0.69	7.59
2009	5,124	9,043,837,788	7,009,523,100	77.5	5,718,183,000	81.6	40,300,000	0.70	7.68
2010	5,124	8,762,049,837	6,581,012,100	75.1	5,239,488,000	79.6	41,400,000	0.79	7.63
2011	5,124	9,197,394,936	6,950,722,000	75.6	4,816,855,000	69.3	40,300,000	0.84	7.73

Source: Compiled by authors from data in Understanding state aid, FY 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 and Common Core of Data from NCES.
Note: Pupil unit refers to adjusted pupil count that is the greater of: (1) the total of weighted average daily membership served by the school district in the current school year multiplied times .77 plus the total of the weighted average daily membership served by the school district for the prior school year multiplied times .23, or; (2) the actual current weighted average daily membership served by the district.

English learners in the finance formula. Districts receive EL revenue to provide instruction to students with limited English skills. Programs may include bilingual programs or English-as-a-second-language (ESL) programs. Bilingual education programs provide curriculum instruction to students in their native language. ESL program students are taught to read, write, listen, and speak in English. The state has provided funding for EL programs since 1980. In the early 2000s, the maximum number of years that a student could qualify for EL funding was reduced from seven to five years (Strom, 2016), and the five-year restriction applied to all the nine years examined. There are two parts to the EL portion of basic skills revenue: the first part or basic formula is a set amount per EL pupil units; the second part of the EL formula is a concentration formula. A school district with at least one student eligible for EL services has a statutorily assigned minimum EL pupil count of 20 (Strom, 2016). That is, Minnesota gives additional funding to districts that have higher numbers and portions of students who are EL. The description of this element in the school finance formula reads:

Districts receive LEP revenue based on the cost of providing services to students with limited proficiency in English. In addition, a per-pupil amount is provided to districts with concentrations of LEP students. The per-pupil funding increases as the concentration increases (though the concentration percentage is capped). All school districts will receive some portion of approximately $301 million in basic skills revenue in 2002-03. (The $301 million is based on approximately $250 million in Compensatory revenue and approximately $51 million in the LEP [i.e., EL] revenues). (Crowe, 2002, p. 3)

Thus, for our analysis, we not only want to know how equally expenditures are distributed across districts overall but the association between district expenditures and the percentage of students classified as EL.

Measuring Equity and Efficiency

Measuring Equity

Equity has long been part of policy discussions, but stakeholders have different philosophies of how equity should be applied to school finance and addressed in economic concerns for education. Abstract notions of fairness play a big role in how we evaluate resource allocation within and between school systems. Alexander (2016) advocated for a system of predictable educational investment and demographically random educational results. A focus on adequacy of inputs is aligned most closely with past research on equity of resource allocation, where horizontal equity and legitimate differences serve as important guideposts for policymakers who seek to be on the "right" equity path.

Providing equal amounts of resources to individuals or groups with different needs would not satisfy commonly held notions of equity (Roellke, Green, & Zielewski, 2004). State officials typically create finance policy to modify existing discrepancies in the school system (Rice, 2004). They rely on a "set of formulas and rules for using publicly collected revenues to pay for K-12 education" (Berne & Steifel, 1999, p. 9). Using school finance formulas to pursue equitable education systems, policymakers need to address whether their actions will cause certain groups or individuals to experience a disproportionate share of the burden or to receive windfall benefits. Interpreting these allocations become even more complicated because Minnesotan policymakers explicitly admonish that definitions of EL and services therein should not be tied to funding. Their comprehensive report on ELs state "State EL funding status is *not* to be used in determining service for ELs. The funding formula exists simply to distribute the state funds available for ELs in an equitable manner across all the districts in the state" (MDE, 2016, p. 10).

Because equity is about distribution, standard indicators of dispersion are important for all three aspects of the education production function – inputs, processes and outputs. We focus on two key principles of equity in this analysis – horizontal and vertical (e.g., Alexander, 2016; Rodriguez, 2004; Rolle & Jimenez-Castellanos, 2014; Verstegen, 2013) and their relevance to school funding in Minnesota for EL. Both these concepts relate to equal and nondiscriminatory treatment; that is, children should be treated similarly unless there is good reason for the differentiation. However, it is often difficult to tell what constitutes a good reason, and there is still wide disagreement on the appropriate role of states, districts, and schools in the matter of achieving education equity. Another complicating factor is policy conceptualizations of EL that call for students to be removed from this group as soon as they are sufficiently proficient in English (Mintrop & Sunderman, 2009).

Odden and Picus (2008) stated that "[f]iscal equity can be regarded as a situation in which each child receives substantially equal educational resources" (p. 29). They go on to say that "[h]orizontal equity holds that students who are alike should be treated the same" (p. 66). This definition of fairness calls for the equal treatment of equals but does not go beyond the basic concept to provide a working definition of what that looks like for the practitioner. It may be applied both to the impact and the cost of policy options. One of the problems with the simple application of horizontal equity is to be able to know what makes for equally situated entities. Because each child is unique, it is difficult to tell which characteristic is a legitimate distinction in the development of policy options. In education finance formulas, states typically have a general formula that applies to all students. To address "legitimate" differences among students, state school finance formulas add special factors that account for different student types, including additional funding for EL. However, questions of equally situated arise because should each EL generate the same amount of additional funding or does it matter if that student is in a school with higher concentrations of students in need? Lipman (2002) would argue that higher concentrations of students placed at risk have additional implications for children beyond what simple number counts would imply.

Odden and Picus (2008) asserted that "vertical equity specifically recognizes differences among children and addresses the educational imperative that some students deserve or need more services than others" (p. 72). This conceptualization of fairness refers to the distribution of goods and services to those in unequal circumstances. This begs the question of what constitutes unequal circumstances. Conceptualizing equity in this way assumes that differential treatment would result in those who need more resources getting that support; those who need less, getting less. That is, vertical equity not only requires appropriate grouping but also appropriate differentiation in the distribution of resources among groups. It is assumed that if policymakers were accurately able to account for these differences, there would be no systemic achievement gaps among student groups. Given the fact that ELs, by definition, are in need of additional support (MDE, 2016), it is not unreasonable to presume that unequal funding among districts in the state would result in those districts with more EL having higher levels of funding.

To address the three questions that guide the analysis, we wanted first to get a sense of funding context and the equality therein. Dispersion measures such as the McLoone index, Verstegen Index and the coefficient of variation (CV) (Odden & Picus, 2008) provide useful information on the funding differences that exist for low-spending school districts and high-spending districts, respectively. The CV provides a broad overview of overall differences in spending. We recognize, however, that unequal does not necessarily mean inequitable because if ELs require more resources, we would want districts with higher portions of these students to be associated with additional dollars.

Measuring Efficiency

While we can capture equity using a variety of simple measures of dispersion, measuring efficiency has often entailed complex statistical analyses. We focus on technical efficiency in this analysis. That is, Rolle (2004) noted that "technical efficiency is achieved when either (a) output levels cannot be maintained with lesser amounts of inputs or (b) output levels cannot be increased while holding inputs constant" (p. 32).

Measuring technical efficiency in education organizations is not new and has been traditionally investigated using education production function models (e.g., Hanushek, 1989; Hedges, Laine, & Greenwald, 1994). Yet as Anderson et al. (1998) appropriately noted, employing production models to measure technical efficiency has some limitations. First, the traditional regression model used in many production function analyses often oversimplifies the relationship between educational inputs and outputs. In addition, the traditional regression approach cannot simultaneously include multiple inputs and outputs in the same model, but it is this complexity that more accurately captures the education process. In addition, the traditional approach to measuring efficiency attempts to compare efficiency scores of organizations against the average score predicted for the group when inputs are held constant. Because the focus is on average performance in regression analysis, it is not possible to compare the level of efficiency in an organization to the most efficient organizations within that group. It would be useful to have comparisons with the highest performing members of the group because they would be able to serve as benchmarks (Eckles, 2015).

Based on these criticisms, scholars have increasingly employed analysis that do not rely on regression to measure technical efficiency. In particular, Knoeppel, Verstegen, and Rinehart (2007) used canonical analysis, a multivariate technique, to examine the relationship between multiple inputs and outputs. Nevertheless, canonical analysis only addresses the limitation of a regression's inability to use multiple outputs in the analysis. In other words, it can only show the relationship between inputs and outputs, but cannot compare efficiency details across organizations or identify specific characteristics of efficient organizations (e.g., districts, schools). Consequently, Rolle (2004) suggested three alternative forms for measuring and comparing educational efficiency: modified quadriform analysis (e.g., Houck, Rolle, & He, 2010), stochastic frontier analyses (e.g., Agasisti & Belfield, 2016), and data envelopment analysis (e.g., Agastisti, Bonomi, & Sibiano, 2012; Anderson et al., 1998; Archibald & Feldman, 2008; Banker et al., 2004; Eckles, 2010; Eff, Klein, & Kyle, 2012; Sala & Knoeppel, 2013).

Among these three nontraditional techniques for measuring technical efficiency, we used data envelope analysis (DEA) for this analysis for four main reasons. First, DEA can utilize multiple inputs and outputs in schooling. Second, the analysis can be easily conducted using free software (i.e., *R* package in this paper). Third, DEA produces relatively intuitive technical efficiency scores of organizations. Finally, compared to the traditional regression approach which requires a statistical assumption about residuals (i.e., homoscedasticity, normality), DEA does not require such assumptions. This is because the DEA is a non-parametric technique used to measure the relationship between multiple inputs and outputs produced by decision-making units (DMU). This method thus constructs an efficiency production frontier based on actual practices (Sheth, 1999).

Studies that employed the DEA method focusing on K–12 education mostly used district- (Banker et al., 2004) or school-level (e.g., Agasisti et al., 2012; Anderson et al., 1998; Sala & Knoeppel, 2013) data. In addition, the studies using DEA in higher education typically focused on organization-level data (e.g., Archibald & Feldman, 2008; Eckles, 2010; Eff et al., 2012). However, to our knowledge, no study has analyzed state-level efficiency across multiple years. This might be because of the advantage of using organization-level data (e.g., district, school) in terms of improving discriminatory power to distinguish between efficient and inefficient units, even though there is no specific rule of thumb for the minimum number of units required to conduct DEA (Sarkis, 2007). Thus, researchers who attempt to analyze the trends in technical efficiency in a state across several school years typically apply DEA using district-level data and utilize the average efficiency scores across districts (see Banker et al., 2004). In addition, no research has examined technical efficiency focusing on specific groups of students (e. g., EL).

Data and Methods

Data

To measure equality, this study uses the Minnesota Department of Education (MDE) data for student population and expenditures (i.e., instructional expenditure and total expenditure) in each district across nine years, 2003 through 2011. This study included only the MDE agency type of regular local school district. Among 337 regular local school districts in the 2010-2011 school year, the equality measures used the data of the 287 districts (85% of total districts) that do not have any missing data for the relevant variables across 9 years. We eliminated 50 school districts due to any missing data from 2003 through 2011. However, the important characteristics of those eliminated districts that might influence our analyses were not significantly different from those of the state average. For example, among those 50 eliminated districts, 44 (88%) were located in rural and town area, which is similar to the percentage of districts located in rural and town areas in Minnesota (87%, or 296 districts). Furthermore, the percentage of students with free and/or reduced lunch, which is critical to funding distribution in school finance, in those eliminated 50 districts was 40.2%, similar to the state average (38.1%). The number of EL in the 287 districts we used was 49,876. This number comprised 78% of total EL (63,608) in the state of Minnesota in FY 2011. Thus, the omitted 50 districts due to missing data should not influence substantively our resulting analyses. Finally, data for regression coefficients also came from the MDE and the NCES Common Core of Data (CCD).

We analyzed technical efficiency using DEA at the state level from the 2002–2003 academic year to the 2010–2011 academic year as well as at the district level for the 2010–2011 academic year. We specifically examined relative technical efficiency accommodating multiple inputs and outputs focusing on EL students in Minnesota. All EL are required to take Minnesota Comprehensive Assessments (MCA), so this is a good output measure to include. For our longitudinal analysis in the state across nine years, we used state-level data admitting potential low discrimination power based on the following reasons: (1) As our analyses specifically focus on EL, data availability is limited at the district level; and (2) one of the purposes of this study is to discern the dynamic relationship between state-level policy and efficiency in state education from a macro perspective. The available district-level data for reading proficiency and graduation rates for EL were available from the MDE for nine years (2003–2011). Thus, the value of efficiency in the longitudinal analysis was measured over nine years. We will only be able to determine if the optimal amount of achievement was produced given the levels of input used in a given year relative to resource use in efficient years identified by our DEA model.

Only 37 districts had all relevant data for the 2010-2011 cross-sectional efficiency analysis. This represents 21.5% of all Minnesota districts that had students classified as EL in 2011. Furthermore, the number of EL in these 37 districts was 29,981, which comprised 82.3% of all EL in regular local school districts in Minnesota, including Minneapolis. Note that St. Paul public school district did not have information on key output variables for EL students in MDE data system for FY 2011, so we were not able to include St. Paul public school district in our cross-sectional analysis even though the number of EL in the district was significant. The cross-sectional efficiency analysis using DEA in 2010-2011 was the only one in which we did not include St. Paul Public School district. While we cannot generalize the results of the analyses to the state as a whole, we can use the cross-sectional analysis to make inferences about the association between district attributes and the relative efficiency of the districts analyzed. Specific details about data and methods, including a brief introduction to the DEA method, will be discussed in the next section.

For both efficiency analyses, we used the same input and output measures. In particular, data for measuring output includes the MCA reading and math proficiency rates for third- and fifth-graders and graduation rates of EL students. Input measures include instructional expenditures per student and the ratio of teacher to EL students in the state and districts. These data sets came from the MDE and NCES, respectively. Instructional expenditures were adjusted for inflation for each year included in the analysis using the Consumer Price Index from the Bureau of Labor Statistics.

Output measures include the MCA fifth-grade reading and math scores and graduation rates from the MDE for each year. Based on the critique that educational organizations produce multiple outputs in addition to student achievement, graduation rates are used because they are also commonly employed by scholars to measure educational outputs in the field (e.g., Jacoby, 2006; Webber & Ehrenberg, 2010). In addition, this study used average total expenditures, average teacher salaries, and average instructional expenditures in the state for multiple inputs in DEA measures.

Method

Horizontal equity. As noted, to measure the horizontal equity of the distribution of instructional expenditures and total expenditures across districts in Minnesota, this study used three measures: (1) the McCloone Index; (2) the Verstegen Index; and (3) the Coefficient of Variation. The McLoone index measures equality for the lower half (i.e., expenditures below the median) of the expenditure distribution in districts (Berne & Stiefel, 1999; Odden & Picus, 2008). This measure is calculated as a ratio of the expenditure of all pupils below the median relative to the total expenditure those pupils would receive if they were at the median per pupil revenue level in Minnesota. The McLoone index ranges from 0 to 1 and higher values indicate higher equality for the lower half of the distribution. By contrast, the Verstegen index measures equality for the upper half of the expenditure distribution (Odden & Picus, 2008). The Verstegen index is calculated as the ratio of the expenditure of all pupils above the median relative to the total expenditure those pupils would receive if they were at the median per pupil expenditure in Minnesota. The Verstegen index ranges from 1 to infinity and higher values indicate higher levels of inequality for the upper half of the distribution. Finally, the coefficient of variation (CV) is calculated as the standard deviation of a distribution divided by the mean. Higher values of CV represents higher levels of inequality in the distribution. Since higher values of the Verstegen index and CV indicate higher levels of inequality, we calculated the inverse of these measures (i.e., divided 1 by these measures) so that they were now capturing measures of equality rather than inequality. This process facilitated comparison across measures of equality and efficiency where higher values for all measures were sought. Further, to compare the equality measures across 2003-2011, we divided each equality measure by its 2003 value so that 2003 serves as a reference. Thus, ratios exceeding 1 indicate that the distribution was more equal than in 2003; measures less than one indicate that the distribution was less equal than it was in 2003.

Vertical equity. We recognize that sometimes unevenness in expenditures are purposeful and measures of equality do not address the legitimate efforts of an educational system to have higher expenditures for entities that need additional support. For example, the education finance system in Minnesota explicitly funds districts with higher portions of students eligible for subsidized lunch prices, higher portions of students who are EL, and students located in rural jurisdictions. To address the state's efforts to achieve vertical equity, this study used regression coefficients examining the relationship between educational expenditure (i.e., instructional expenditure and total expenditure) and portion of students classified as EL in each district across 2003-2011 school years. The regression models used the district location, size, student poverty as measured by free and/or reduced lunch eligibility and portion of black and Hispanic students in a district as control variables. We control for school size because Monk & Haller (1993) and others have indicated that size plays a role in economies of scale and per-pupil expenditures. Further, as noted, sparsity is also considered in the Minnesota school finance funding formula. We considered community type because Taylor (2006) and others have written extensively about the implications of location on the purchasing power of districts. Consequently, we controlled for size and type in our assessment of vertical equity in order to recognize differently situated entities. While district size and location are significantly correlated for the years examined, with associations ranging from $r = 0.58$ in 2003 to $r = 0.63$ in 2011, these associations would not lessen the relationship found between education expenditures and EL concentrations. In particular, this study used the following multiple regression model in each year to obtain the regression coefficients:

$$Expenditure_t = \beta_0 + \beta_1 \mathrm{EL}_t + \beta_2 \mathrm{FRL}_t + \beta_3 \mathrm{ADM}_t + \beta_4 \mathrm{Suburban}_t + \beta_5 \mathrm{Town}_t + \beta_6 \mathrm{Rural}_t + \beta_7 \mathrm{HB}_t + \varepsilon_t \quad (1)$$

where $Expenditure_t$ is the instructional or total expenditure in a district at time t; EL_t is the measure of EL student rates at time t, FRL_t is the measure of free or reduced lunch rates at time t; ADM_t is a measure of district size from average daily membership; $\mathrm{Suburban}_t$, Town_t, and Rural_t are categorical variables, labeled one for those districts in suburban, town, and rural communities, respectively; 0 otherwise; and HB_t is the proportion of black and Hispanic students in a district at time t. We focus on the regression coefficient of β_1 in our discussion of the analysis.

Data Development Analysis (DEA). As previously stated, we operationalized efficiency using data envelope analysis, thus getting at aspects of technical efficiency. Before specifically explaining the DEA analysis, two different concepts about efficiency should be noted. On the one hand, absolute efficiency is the ratio of outputs and inputs related to a specific economic activity. Thus, absolute efficiency is represented as percentages or physical units, such as a dollar divided among the total number of students, which has no limitation for the ranges of a result. On the other hand, relative efficiency of a decision-making unit (DME) is the ratio of its efficiency compared to the most efficient DMU in that particular analysis (Archibald & Feldman, 2008; Banker et al.,, 1984). For example, when the most efficient DMU is standardized as 100% or 1, the relative efficiency of comparative DMUs can be represented as a value of 50% or 0.5.

The DEA method is based on the concept of relative efficiency, which is measured by the ratio of the weighted sums of all outputs and all inputs at the state level across the 2003–2011 school years. The weights are selected to achieve Pareto optimality for each DMU (i.e., each school year in this study). In addition, this study employs the input-oriented Charnes-Cooper-Rhodes (CCR) model to measure the amount by which inputs of each school year can be proportionally reduced, when outputs in each year remaining fixed. See Cooper, Seiford, and Tone (2011) for a detailed explanation of DEA. The mathematical equation for the input-oriented CCR model is as follows:

$$\theta^{k*} = \min_{\theta,\lambda} \theta^k \quad \textit{subject to}$$

$$\theta^k x_m^k \geq \sum_{j=1}^{J} x_m^j \lambda^j \; (m = 1,2, \dots , M)$$

$$y_n^k \geq \sum_{j=1}^{J} y_n^j \lambda^j \ (n = 1,2, \dots, N)$$
$$\lambda^j \geq 0 \ (j = 1,2, \dots, j)$$

The efficiency value of each school year, θ^k, from the input-oriented CCR ranges from 0 to 1. A technical efficiency score of one indicates that the school year is on the frontier (i.e., most efficient use of resources). Note that any score less than one depicts an inefficient decision-making unit. If the efficiency score decreases to zero in a certain year, the year will be far from the frontier and inefficient. In addition, the multiplication of the technical efficiency in school year *k* can show the level of technical efficiency as a percentage point. For example, if the technical efficiency score in 2016 is 0.85, the education process in 2016 shows 85% efficiency relative to the efficient years identified. In other words, for 2016, it might be possible to reduce inputs by 15% of inputs to achieve similar levels of outputs as the most efficient years. For the 2010-2011 district level analysis, a similar assessment may be made. For example, if a district had a technical efficiency score of one, that score indicates that the school district is on the frontier, and was efficient relative to its peers. If the efficiency score is 0, that district will be far from the frontier and inefficient. Note that anything less than one is inefficient. The efficiency measure using DEA in this study uses aggregated state-level analysis and compares the efficiency score from each year with that from other years for the longitudinal analysis. Similarly, the efficiency measure using DEA uses district-level data for the 2010-2011 cross-sectional analysis. We used the *Benchmarking* package (Bogetoft & Otto, 2014) of *R* software to conduct the DEA analysis.

Results

Empirical Results for Horizontal Equity Analysis among Districts

From 2003 to 2011, average total state expenditures per pupil increased from $8,299 (in 2011 constant dollars) to $10,741, an annual real average gain of 3.27% over the nine-year period. Analyzing horizontal measures that examine the coefficient of variation showed that there were wide disparities among districts in total expenditures per pupil where the ratio between the standard deviation and the mean of the distribution far exceeded the 10% variation recommended by leading scholars in the field (e.g., Odden & Picus, 2008) for all years examined (see Table 3a). However, inequality in the distribution of total expenditures per pupil was less pronounced in 2011 than in 2003, although both ratios showed high levels of inequality (.669 *vs.* .563, respectively). In addition, reductions in the McLoone Index, from .942 down to .917, indicate that levels of equality are decreasing for those districts spending below the median. However, slight reductions in the Verstegen Index, from 1.18 to 1.16, indicate that levels of equality are improving for those districts spending above the median. Overall, even though the state educational dollars per student increased in real terms during the nine-year period examined, and levels of inequalities decreased for the typical and high-spending districts, horizontal inequities remained relatively high.

Table 3a
Three Standard Measures for Distribution of Total Expenditure per Student Before and After Conversion

Year	Original			Converted		
	CV	McLoone	Verstegen	C_Equality	M_Equality	V_Equality
2003	0.6689	0.9417	1.1802	1.0000	1.0000	1.0000
2004	0.6242	0.9278	1.1664	1.0715	0.9852	1.0119
2005	0.6440	0.9187	1.1614	1.0385	0.9756	1.0162
2006	0.5893	0.9165	1.1529	1.1350	0.9732	1.0237
2007	0.5289	0.9113	1.1315	1.2646	0.9677	1.0430
2008	0.4811	0.9183	1.1492	1.3902	0.9752	1.0270
2009	0.5627	0.8923	1.2042	1.1886	0.9475	0.9801
2010	0.8107	0.9017	1.1562	0.8250	0.9575	1.0208
2011	0.5627	0.9174	1.1646	1.1886	0.9742	1.0134

Note: The measure of C_Equality in each year is the CV in each year divided by the value of the CV in 2003. The measure of M_Equality in each year is the McLoone index in each year divided by the value of the McLoone index in 2003. The measure of V_Equality in each year is the Verstegen index in each year divided by the value of the Verstegen index in 2003.

From 2003 to 2011, average instructional expenditures per pupil increased from $5,316 (in 2011 constant dollars) to $7,066, an annual real average gain of 3.66% over the nine-year period. Analyzing horizontal measures that examine the coefficient of variation showed that there were wide disparities among districts in instructional expenditures per pupil where the ratio between the standard deviation and the mean of the distribution far exceeded the 10 percent variation recommended by leading scholars in the field (e.g., Odden & Picus, 2008) for all years examined (see Table 3b). Inequality in the distribution of instructional expenditures per pupil fluctuated greatly over the nine-year period, with a range of .681 to 1.09). Looking at overall changes, the CV was relatively flat from 2003 to 2011, although both ratios depicted high rates of inequality (.759 vs. .762, respectively). In addition, reductions in the McLoone Index, from .919 down to .891, indicate that levels of equality are decreasing for those districts spending below the median. Moreover, slight increases in the Verstegen Index, from 1.16 to 1.17, indicate that levels of equality are also declining for those districts spending above the median. Overall, even though the state instructional dollars per student increased in real terms during the nine-year period examined, levels of inequalities remained high and increased for all districts.

We found that those years we have identified as having relatively more horizontal equity tended to have higher total expenditures per pupil, larger sized districts, lower percentages of students eligible for subsidized lunch prices, and higher percentages of students identified as EL. Because the distribution of poor and EL students are uneven across the state, it is helpful to examine the association between expenditures and these demographics so that levels of horizontal inequities may be placed in context.

Table 3b

Three Standard Measures for Distribution of Instructional Expenditure per Student Before and After Conversion

Year	Original			Converted		
	CV	McLoone	Verstegen	C_Equality	M_Equality	V_Equality
2003	0.7590	0.9193	1.1633	1.0000	1.0000	1.0000
2004	0.7578	0.8994	1.1632	1.0017	0.9783	1.0001
2005	0.9045	0.8928	1.1657	0.8391	0.9712	0.9979
2006	0.7798	0.8954	1.1696	0.9734	0.9740	0.9947
2007	0.7087	0.9026	1.1598	1.0710	0.9818	1.0031
2008	0.6814	0.8951	1.1571	1.1139	0.9737	1.0054
2009	0.7238	0.8822	1.2445	1.0486	0.9597	0.9348
2010	1.0927	0.8877	1.1939	0.6946	0.9656	0.9744
2011	0.7622	0.8910	1.1773	0.9958	0.9692	0.9882

Empirical Results for Vertical Equity Analysis among Districts

It is important to note that state expenditures are supposed to be unequal if the educational finance system is vertically equitable and appropriately reflect the different educational contexts faced by districts. From 2003 to 2011, there were positive and statistically significant associations between total expenditures per pupil and the portion of students that were eligible for subsidized lunch prices for all nine years (Table 4a). The beta coefficients fluctuated over the period examined ranging from β = 97.1 in 2003 to β = 172.2 in 2010. Overall, the strength of associations between total expenditures per pupil and the percentage of students eligible for free or reduced price lunches increased from β = 97.1 in 2003 to β = 135.6 in 2011.

From 2003 to 2011, there were positive and statistically significant associations between instructional expenditures per pupil and the portion of students that were eligible for subsidized lunch prices for all nine years (see Table 4b). The beta coefficients fluctuated over the period examined from β = 56.5 in 2003 to β = 132.1 in 2010. Overall, the strength of associations between total expenditures and the percentage of students eligible for free or reduced price lunches increased from β = 56.5 in 2003 to β = 88.9 in 2011. This indicates that higher levels of funding were associated with higher portions of poor children over the nine years examined, suggesting that vertical equity improved for this group of children.

From 2003 to 2011, there were negative associations between total expenditures per pupil and the portion of EL students served by the district for all nine years (Table 4a). The beta coefficients fluctuated over the period examined and were statistically significant for four of the nine years examined (2004, 2007, 2008, and 2010). The significant beta coefficients ranged from β = -183.2 in 2008 to β = -350.02 in 2010. Overall, the association between total expenditures per pupil and EL students were increasingly negative, indicating that vertical equity worsened.

From 2003 to 2011, there were negative associations between instructional expenditures per pupil and the portion of EL students served by the district for all nine years (see Table 4b). The beta coefficients fluctuated over the period examined and were statistically significant for five of the nine years examined (2004, 2007, 2008, 2010, and 2011). The significant beta coefficients ranged from β = -166.7 in 2006 to β = -314.4 in 2010. Overall, the association between expenditures and EL students over the nine years examined were increasingly negative. Given the objectives of Minnesota school finance system, we would have expected that there would be a positive not negative relationship between the number and portion of EL and per-pupil expenditures.

Table 4a
Result of Measures for Efficiency, Horizontal Equity, and Vertical Equity using Total Expenditure per Student in Minnesota Over Time (2003-2011)

Year	Efficiency	Horizontal equity			Vertical equity	
		C_Equity	M_Equity	V_Equity	RC_FRL	RC_EL
2003	1.0000	1.0000	1.0000	1.0000	97.1036***	-167.6593
2004	0.9923	1.0715	0.9852	1.0119	108.9340***	-236.6390*
2005	0.9975	1.0385	0.9756	1.0162	129.9068***	-134.8862
2006	1.0000	1.1350	0.9732	1.0237	163.5530***	-184.2211
2007	0.9940	1.2646	0.9677	1.0430	140.3125***	-259.2868**
2008	1.0000	1.3902	0.9752	1.0270	134.3111***	-183.1851*
2009	0.9855	1.1886	0.9475	0.9801	140.4061***	-174.3024
2010	0.9815	0.8250	0.9575	1.0208	172.2292***	-350.0163*
2011	1.0000	1.1886	0.9742	1.0134	135.5760***	-214.4057

Note: **p* < .05, ** *p* < .01, ****p* < .001

Table 4b
Result of Measures for Efficiency, Horizontal Equity, and Vertical Equity using Instructional Expenditure per Student in Minnesota Over Time (2003-2011)

Year	Efficiency	Horizontal equity			Vertical equity	
		C_Equity	M_Equity	V_Equity	RC_FRL	RC_EL
2003	1.0000	1.0000	1.0000	1.0000	6.4549 **	-102.1146
2004	0.9923	1.0017	0.9783	1.0001	70.4224***	-163.1652*
2005	0.9975	0.8391	0.9712	0.9979	86.1642***	-130.8592
2006	1.0000	0.9734	0.9740	0.9947	107.8122***	-166.6611
2007	0.9940	1.0710	0.9818	1.0031	90.4902***	-237.1813**
2008	1.0000	1.1139	0.9737	1.0054	85.6829***	-179.4772*
2009	0.9855	1.0486	0.9597	0.9348	97.6987***	-139.9793
2010	0.9815	0.6946	0.9656	0.9744	132.1046***	-314.4347*
2011	1.0000	0.9958	0.9692	0.9882	88.9424***	-195.9491*

Note: **p* < .05, ** *p* < .01, ****p* < .001

Empirical Results for Efficiency Analysis

Across years, 2003-2011. The results of the data envelope analysis of efficiency illustrate changes in overall efficiency. A technical efficiency score of one reflects that resources were efficiently used in the year specified as it is located on the frontier line. Ratios that are less than one indicate that resources were less efficiently used in the identified year and inputs could be reduced (i.e., instructional expenditure per student, teacher to EL student ratio) compared to the most efficient years. Efficiency rates remained relatively constant over the nine years studied, ranging from .983 in 2009 to 1.000 in 2003, 2006, 2007, 2008, and 2011. In four years (i.e., 2004, 2005, 2009, and 2010), resources were used less efficiently than in those five years on the frontier line that are considered efficient years. We compared key variables for efficient and inefficient years (see Table 5). We found that instructional expenditures per pupil were higher in inefficient years than those in efficient years, even though the ration of teachers to EL students is almost the same. In addition, not surprisingly, all educational outputs (i.e., MCA third- and fifth-grade reading proficiency rate and graduation rate) in efficient years were higher than those in inefficient years.

Table 5
Mean of Variables Comparing Efficient and Inefficient Years Using DEA

Variables		Efficient years	Inefficient years
Inputs	Instructional expenditure per student ($)[a]	5,593.57	5,819.44
	Teacher to student ratio	0.06	0.06
Outputs	MCA 3rd EL student reading proficiency rate (%)	44.49	42.42
	MCA 5th EL student reading proficiency rate (%)	39.56	38.31
	Graduation rates (%)	51.81	50.16

Note: Efficient districts: 2003, 2006, 2007, 2008, and 2011; Inefficient years: 2004, 2005, 2009, and 2010.
[a]Annual instructional expenditure per student in Minnesota, adjusted for inflation to 2011 dollars.

Among districts, 2010-2011. The results of the district-level data-envelope analysis illustrate the differences in key attributes between efficient and inefficient districts (see Table 6).

Table 6
Mean of Variables Comparing Efficient and Inefficient Districts Using DEA

Variables		Efficient districts	Inefficient districts
Inputs	Instructional expenditure per student ($)[a]	6213.96	6972.50
	Teacher to student ratio	0.99	1.08
Outputs	MCA 3rd EL student reading proficiency rate (%)	59.99	44.10
	MCA 5th EL student reading proficiency rate (%)	57.68	46.79
	Graduation rate (%)	70.71	59.66

Context	Average daily membership	6887.10	10333.22
	Number of teachers	399.74	624.16
	Percentage of EL students (%)	9.88	8.97
	Percentage of free or reduced lunch eligible students (%)	33.52	35.83
	Percentage of Hispanic and black students (%)	18.79	23.04
	Percentage of urban and suburban districts (%)	80.00	74.07
	Percentage of suburban and town districts (%)	20.00	25.92

Note: Efficient districts: 2003, 2006, 2007, 2008, and 2011; Inefficient years: 2004, 2005, 2009, and 2010.
[a]Annual instructional expenditure per student in Minnesota, adjusted for inflation to 2011 dollars.

Note that these findings are illustrative and not generalizable given the number of districts with missing data. That said, we found that efficient districts had somewhat lower instructional expenditures per pupil than inefficient districts ($6,214 vs. $6,973) and had slightly higher student to teacher ratios (16.57 vs. 16.41). While inputs were relatively even, the outputs were substantially larger for the efficient districts: they had higher rates of EL proficiency on third grade MCA III Reading (60% vs. 44%); higher rates of EL proficiency on fifth grade MCA III Reading (57.7% vs. 46.8%) and higher EL graduation rates (71% vs. 60%). Context seemed to play a role in the different levels of efficiency found among districts in 2010-2011. More efficient districts tended to be smaller with mean average daily membership of 6,887 compared to more inefficient districts that had mean average daily membership of 10,333 pupils. Efficient districts, on average, had fewer numbers of teachers to serve its student population, was comprised of lower portions of rural and town districts (20% vs. 26%) and higher portions of urban and suburban districts (80% vs. 74%). Further, more efficient districts tended to have lower percentages of students eligible for free and/or reduced lunch (33.5% vs. 35.8%), smaller percentages of black and Hispanic students (19% vs. 23%) but slightly higher percentages of EL (10% vs. 9%).

Comparison of Horizontal Equity and Efficiency

We standardized the various measures of horizontal equity to use 2003 as a reference year in order to see how relative patterns of equality and efficiency changed across time. These results are illustrated in Figure 1. Similar patterns were found for both instructional and total expenditures per pupil. We found that while efficiency remained constant, horizontal equity measures were less stable, especially for those districts that spent below the median. Two years stand out, 2005 and 2010, where low-spending districts lagged increasingly farther behind on instructional expenditures. These years may be reflecting impacts in changes in the Minnesota school finance formula. That is, in 2003, the bulk of the general educational funds appropriated by the state was now done through mechanisms more closely resembling flat rather than foundational grants. Odden and Picus (2008) have noted, for example, that flat grants typically are not effective at generating fiscal neutrality among districts unless they are very large, providing little incentive for districts to spend above the grant. Districts were initially aided in that transition by having an increase in the basic formula allowances provided to districts. By 2005, the full negative effects of that fiscal change would have been felt by lower spending districts. In 2010, the state had maintained its freeze on expenditures per pupil allocated through its basic general education formula, which accounted for a large portion of district expenditures.

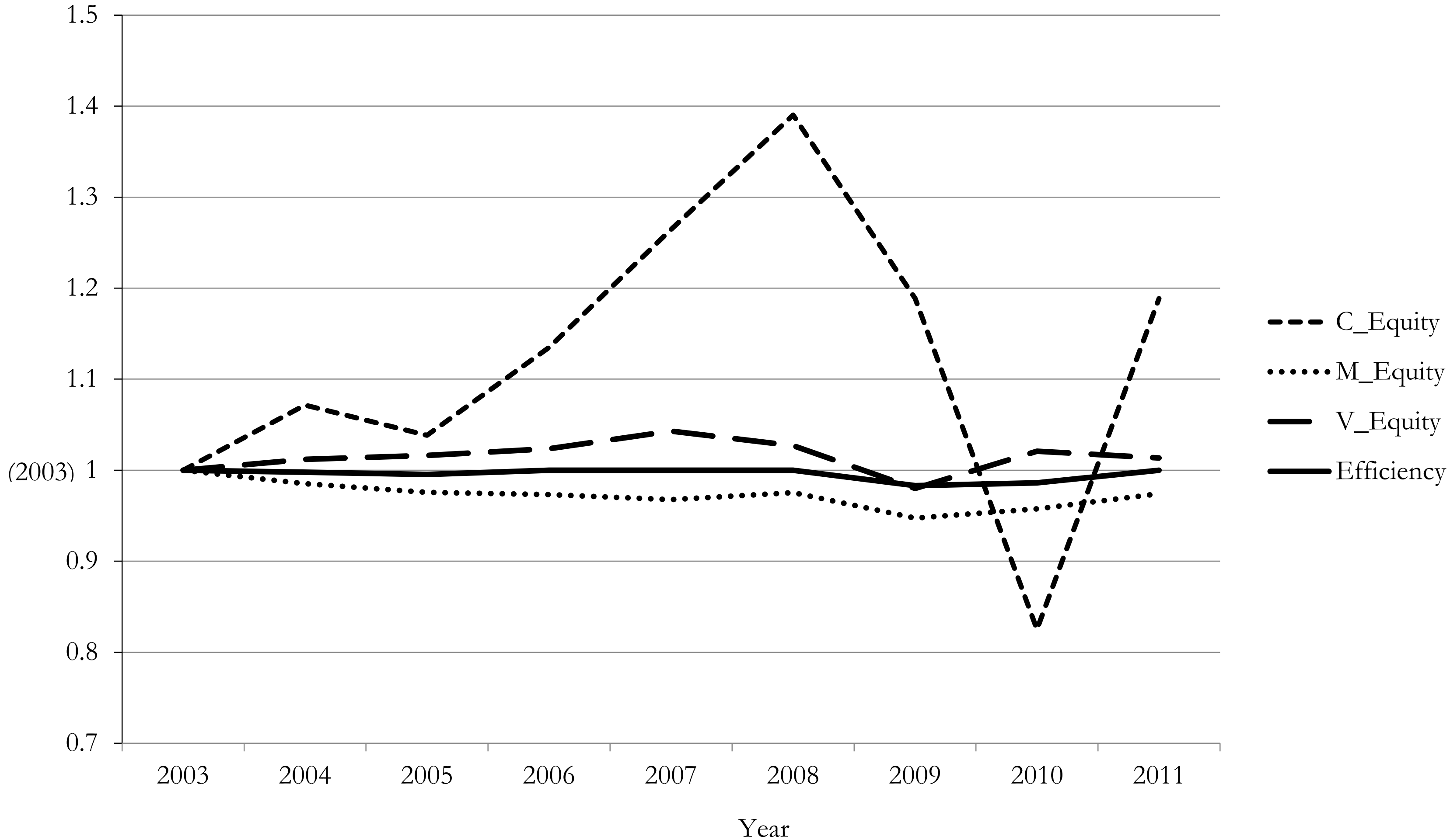

Figure 1. Comparison of efficiency and equality of distributions of total expenditure in Minnesota over time, 2003-2011
Note: Similar patterns were found for instructional expenditures per pupil. We standardized the three measures of horizontal equity to use 2003 as a reference year.

Discussion

English learners are a fast-growing portion of Minnesota's student population but still account for less than 10% of its student body. Nevertheless, while populations of EL increased by 24.1% from FY 2003 to FY 2011, the state education dollars devoted to EL programming fell 20%, declining from $50 million to $40.3 million and accounted for lower percentages of general education revenues (from 1.1% in 2003 to .84% in 2011). Since the NCLB made addressing the gaps among student populations more relevant in accountability considerations, we wanted to explore the associations among funding, equity, and efficiency with a focus on EL.

EL funding comprised a small part of general education funding in Minnesota, but monies are fungible, so it was possible that more dollars were associated with EL even if the formula did not officially classify those resources in that way. That was not the case in the years examined. While, the state's total and instructional expenditures per student increased in inflation-adjusted terms during the nine-year period examined, levels of inequalities remained high and largely increased over that time period. Distributions of expenditures were increasingly uneven. This inequality was largely driven by low-spending districts falling farther behind the median. Inequality in spending among districts is particularly troubling if those districts with the population most placed at risk are the ones spending less on students. We, therefore, looked more closely at the distribution of education expenditures as it relates to the population of English learners.

The additional dollars targeted at EL in the school finance formula were not reflected in more dollars being associated with EL for all nine years examined. For the most part, districts with higher portions of EL had lower expenditures per pupil, not higher. These inequities are not unique to Minnesota and require a broader policy discussion. For example, the fiscal inequities found in this study are consistent with Jimenez-Castellanos and Topper (2012) who concluded that costing out the needs of EL are inconsistently addressed across both research and practice. The results of our analysis are also consistent with those of Rolle and Jimenez-Castellano (2014) regarding the efficacy of the Texas school finance system. They found that "for the particular case of students receiving revenue for bilingual services, unless ELL [English Language Learner] students are in wealthy districts, needed services may not be provided—any additional resources support the general academic program" (p. 219).

These fiscal challenges are even more pronounced in Minnesota because most of its EL students are in urban districts, which typically have higher rates of poverty than the state as a whole. Further, while Minnesota policymakers have provisions to address additional costs for districts with high student need, such as poverty, these efforts are somewhat muted because metropolitan schools are often located in markets that also have relatively high labor costs. Thus, urban districts incur higher educational outlays not only because of student demographics but also because the cost of providing education programs is higher in these communities than for districts in lower-cost markets (e.g., Alexander, Kim, & Holquist, 2015; Taylor, 2006).

If more dollars are not available for EL programming, then doing more with less becomes paramount. Nevertheless, efficiency remained relatively consistent for the state across the years examined, 2003 through 2011. This is surprising given the attention being paid to computer assisted instruction and other technologies that were expected to improve achievement for little or no additional costs (Yeh, 2010). Further, when focusing on the different district attributes associated with efficiency, the data suggest that context played a role in 2010-2011. As noted, in this very limited sample, more efficient districts tended to be smaller, had fewer numbers of teachers to serve its student population, and had lower percentages of students eligible for free and/or reduced lunch. Nevertheless, the ratio of students to teachers was very similar in efficient and inefficient districts.

One could speculate that this suggests that districts may not suffer large declines in student achievement when they make negligible increases in class size (e.g., Yeh, 2009).

Finally, given the definition of English learners, it is not entirely clear what conclusions one can draw from the associations between funding and the performance gap between EL and non-EL students. That is, a student is no longer classified as EL once he or she has attained the necessary English skills to participate fully in academic classes taught in English (MDE, 2016). On the one hand, this definition suggests that those students classified as EL will always need additional support, which implies additional funding (e.g., Rolle & Jimenez-Castellano, 2014). On the other hand, given the definition, it seems that regardless of support, there will always be a definitional gap in achievement between EL and their non-EL peers. There is no easy answer, but these dual constraints suggest that policymakers will have to reconsider what it means to achieve equity and to use resources efficiently in an accountability regime.

References

Adbi, H. (2010). Coefficient of variation. In N. Salkind (Eds.), *Encyclopedia of research design* (pp. 1-5). Thousand Oaks, CA: Sage.

Agasisti, T., & Belfield, C. (2016). Efficiency in the community college sector: Stochastic frontier analysis. *Tertiary Education and Management*, 1-23. http://dx.doi.org/10.1080/13583883.2016.1238956

Agasisti, T., Bonomi, F., & Sibiano, P. (2012). "Adjusted" efficiency measures for schools: a two-stage empirical analysis with Bootstrap DEA and Tobit regression. Paper presented at the 37th Annual Conference of the Association for Education Finance and Policy, Boston, MA.

Alexander, N. A. (2012). *Policy Analysis for Educational Leaders: A Step-by-Step Approach*. New York, NY: Pearson.

Alexander, N. A. (2016). Public investment in education: Economics of education. In B. A. Jones, & A. Rolle (Eds.), *Leading schools in challenging times* (pp. 227-252). Charlotte, NC: Information Age Publishing.

Alexander, N. A., Kim, H., & Holquist, S. (2015). Locating equity: Implications of a location equity index for Minnesota school finance. Paper presented at the 40th Annual Conference of the Association for Education Finance and Policy, Washington, DC. Anderson, L., Walberg, H. J., & Weinstein, T. (1998). Efficiency and effectiveness analysis of Chicago public elementary schools: 1989, 1991, 1993. *Educational Administration Quarterly, 34*(4), 484-504. https://doi.org/10.1177/0013161X98034004003

Archibald, R. B., & Feldman, D. H. (2008). Graduation rates and accountability: Regressions versus production frontiers. *Research in Higher Education, 49*(1), 80-100. https://doi.org/10.1007/s11162-007-9063-6

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, *30*(9), 1078-1092. https://doi.org/10.1287/mnsc.30.9.1078

Banker, R. D., Janakiraman, S., & Natarajan, R. (2004). Analysis of trends in technical and allocative efficiency: An application to Texas public school districts. *European Journal of Operational Research, 154*(2), 477-491. https://doi.org/10.1016/S0377-2217(03)00183-8

Berne, R., & Stiefel, L. (1984). *The measurement of equity in school finance: Conceptual, methodological, and empirical dimensions*. Baltimore, MD: Johns Hopkins University Press.

Berne, R., & Stiefel, L. (1999). Concepts of school finance equity: 1970 to the present. In H. F. Ladd, R. Chalk, & J. S. Hansen (Eds.), *Equity and adequacy in education finance: Issues and perspectives* (7-

33). Washington, DC: National Academy Press.

Bogetoft, P., & Otto, L. (2014). Benchmarking with DEA and SFA, R package version 0.24.

Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). *Handbook on data envelopment analysis* (Vol. 164). New York, NY: Springer Science & Business Media.

Crowe, G. (2002). Understanding the K-12 general education funding program 2002-03. Retrieved from http://www.house.leg.state.mn.us/fiscal/files/02gened.pdf

Eckles, J. E. (2010). Evaluating the efficiency of top liberal arts colleges. *Research in Higher Education, 51*(3), 266-293. https://doi.org/10.1007/s11162-009-9157-4

Education Week. (2007). States adopt new tests for English-Learners; Changes aim to meet federal requirements, though some protest. *Education Week*, p. 26.

Eff, E. A., Klein, C. C., & Kyle, R. (2012). Identifying the best buys in US higher education. *Research in Higher Education, 53*(8), 860-887. https://doi.org/10.1007/s11162-012-9259-2

Hanushek, E. A. (1989). The impact of differential expenditures on school performance. *Educational researcher*, *18*(4), 45-62. https://doi.org/10.3102/0013189X018004045

Hanushek, E. A. (2003). The failure of input - based schooling policies. *The Economic Journal*, *113*(485), F64-F98. https://doi.org/10.1111/1468-0297.00099

Hedges, L. V., Laine, R. D., & Greenwald, R. (1994). An exchange: Part I: Does money matter? A meta-analysis of studies of the effects of differential school inputs on student outcomes. *Educational Researcher*, *23*(3), 5-14. https://doi.org/10.3102/0013189X023003005

Houck, E. A., Rolle, R. A., & He, J. (2010). Examining school district efficiency in Georgia. *Journal of Education Finance, 35*(4), 331-357. https://doi.org/10.1353/jef.0.0022

Jacoby, D. (2006). Effects of part-time faculty employment on community college graduation rates. *Journal of Higher Education*, *77*(6), 1081-1103. https://doi.org/10.1353/jhe.2006.0050

Jimenez-Castellanos, O., & Topper, A. M. (2012). The cost of providing an adequate education to English language learners: A review of the literature. *Review of Educational Research*, *82*(2), 179-232. https://doi.org/10.3102/0034654312449872

Keillor, G. (1990). *Lake wobegon days*. New York, NY: Penguin Books.

Knoeppel, R. C., Verstegen, D. A., & Rinehart, J. S. (2007). What is the relationship between resources and student achievement? A canonical analysis. *Journal of Education Finance*, *33*(2), 183-202.

Lipman, P. (2002). Making the global city, making inequality: The political economy and cultural politics of Chicago school policy. *American Educational Research Journal*, *39*(2), 379–419. https://doi.org/10.3102/00028312039002379

Minnesota Department of Education. (2014). Math proficiency by special populations 2013. Retrieved from http://education.state.mn.us/mdeprod/idcplg?IdcService=GET_FILE&dDocName=056707&RevisionSelectionMethod=latestReleased&Rendition=primary

Minnesota Department of Education. (2015). K-12 Education Finance Overview 2014-2015. Retrieved from http://education.state.mn.us/mdeprod

Minnesota Department of Education. (2016). English learner education in Minnesota, 2015-2016. Retrieved from https://education.state.mn.us/mdeprod/idcplg?IdcService=GET_FILE&dDocName=MDE035523&Re`ionSelectionMethod=latestReleased&Rendition=primary

Minnesota Education Equity Partnership. (2016). Networks: Exchange knowledge and inspire trust. Retrieved from http://mneep.org/english-language-learners-ell/

Minnesota House of Representatives. (2016). Minnesota school finance: A guide for legislators. Retrieved from http://www.house.leg.state.mn.us/hrd/pubs/mnschfin.pdf

Mintrop, H., & Sunderman, G. L. (2009). Predictable failure of federal sanctions-driven accountability for school improvement—and why we may retain it anyway. *Educational Researcher*, *38*(5), 353-364. https://doi.org/10.3102/0013189X09339055

Monk, D. H., & Haller, E. J. (1993). Predictors of high school academic course offerings: The role of school size. *American Educational Research Journal*, *30*(1), 3-21. https://doi.org/10.3102/00028312030001003

National Center for Education Statistics. (2016a). *Common Core of Data* [Data file]. Retrieved from https://nces.ed.gov/ccd/ccddata.asp

National Center for Education Statistics. (2016b). The condition of Education 2016. Retrieved from https://nces.ed.gov/pubresearch/pubsinfo.asp?pubid=2016144

Odden, A., & Picus, L. (2008). *School finance: A policy perspective* (4th ed.). Columbus, OH: McGraw-Hill Education.

Post, T. (2012). For Minn.'s newest pupils, language is top job. *St. Paul Pioneer Press*, p. 1. Rice, J. K. (2004). Equity and efficiency in school finance reform: Competing or complementary goods? *Peabody Journal of Education*, *79*(3), 134-151. https://doi.org/10.1207/s15327930pje7903_7

Rodriguez, G. M. (2004). Vertical equity in school finance and the potential for increasing school responsiveness to student and staff needs. *Peabody Journal of Education*, *79*(3), 7-30. https://doi.org/10.1207/s15327930pje7903_2

Roellke, C., Green, P., & Zielewski, E. H. (2004). School finance litigation: The promises and limitations of the third wave. *Peabody Journal of Education*, *79*(3), 104-133. https://doi.org/10.1207/s15327930pje7903_6

Rolle, R. A. (2004). Out with the old-in with the new: Thoughts on the future of educational productivity research. *Peabody Journal of Education, 79*(3), 31-56. https://doi.org/10.1207/s15327930pje7903_3

Rolle, R. A., & Jimenez-Castellanos, O. (2014). An efficacy analysis of the Texas school funding formula with particular attention to English language learners. *Journal of Education Finance*, *39*(3), 203-221. https://muse.jhu.edu/article/539806

Sala, D. M. R., & Knoeppel, R. C. (2013). Strategic planning for school improvement: The use of data envelopment analysis. JEPPA, *2*(2), 39-53.

Sarkis, J. (2007). Preparing your data for DEA. In J. Zhu, & W. D. Cook (Eds.), *Modeling data irregularities and structural complexities in data envelopment analysis* (305-320). New York, NY: Springer.Sheth, N. (1999). *Measuring and evaluation efficiency and effectiveness using goal programming and data envelopment analysis in a fuzzy environment* (Unpublished doctoral dissertation). Virginia Polytechnic Institute and State University, Blacksburg, VA.

Strom, T. (2016). Minnesota school finance: A guide for legislators. Retrieved from http://www.house.leg.state.mn.us/hrd/pubs/mnschfin.pdf

Taylor, L. L. (2006). Comparable wages, inflation, and school finance equity. *Education*, *1*(3), 349-371.

Verstegen, D. A. (2013). Leaving equity behind? A quantitative analysis of fiscal equity in Nevada's public education finance system. *Journal of Education Finance, 39*(2), 132-149.

Webber, D. A., & Ehrenberg, R. G. (2010). Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education?. *Economics of Education Review, 29*(6), 947-958. https://doi.org/10.1016/j.econedurev.2010.04.006

Yeh, S. S. (2009). Class size reduction or rapid formative assessment?: A comparison of cost-effectiveness. *Educational Research Review*, *4*(1), 7-15. https://doi.org/10.1016/j.edurev.2008.09.001

Yeh, S. S. (2010). The cost effectiveness of 22 approaches for raising student achievement. *Journal of Education Finance*, *36*(1), 38-75. https://doi.org/10.1353/jef.0.0029

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