Return On Investment in Education

Larry Miller
Sr. Research Fellow
Center on Reinventing Public Education
ljmiller@uw.edu

Kimber Connors
Research Consultant
kimberly.d.connors@gmail.com

October 3, 2015

This report was made possible by a contract from the Oregon Education Investment Board (Master Contract #107-2834-11) to the Center on Reinventing Public Education (CRPE). The statements made and views expressed are solely the responsibility of the authors. The report has not been subject to CRPE's quality assurance process.

Table of Contents

Task No. 1: A Review of the Relevant Return on Investment (ROI) Systems Literature 3
A Brief Introduction to K–12 ROI Systems 3
Figure 1. Decision Science's ROI Graphic Interface 4
Figure 2. Decision Science's Comparative Spending Tool 5
Benefits of an ROI System 5
Using ROI Systems to Change Behavior and Improve Productivity 7
Table 1. Expected Impact of ROI Systems by Phase, Actor, Activity, and Outcome 7

Task No. 2: ROI Design Elements and Performance Capabilities 8
ROI System Design Elements 8
Figure 3: Example ROI Indicator System 9
Figure 4: ROI Reporting for Maine Public Schools 10
Two Approaches to Improving Education Productivity 11
Table 2: A Comparison of Two Approaches to Improving Education Productivity 11
State Measurement and Communication of ROI 12
Maine 12
Florida 13
Figure 5. Florida's ROI Map by District 13
Figure 6. A Sample District from Florida's ROI Reporting System 14
Georgia 14
Figure 7: Proposed ROI System for Georgia from Education Resource Strategies 14
Key Metrics for Which There are Well-Established Returns 15
Estimated Returns to the State 15
Estimated Returns to the Student 16

Task No. 3: A First Approximation of an ROI Framework for Oregon 17
Defining Return on Educational Investment 17
Figure 8: Florida's ROI Index 18
Data Requirements for an ROI System 18
Figure 9. ROI Data Components 19
Student-Level Performance and Demographic Data 19
School-Level Expenditures 20
School Characteristics 21
Bibliography 22
Table 3: Additional ROI Resources Related to Other State Efforts 25

Task No. 1: A Review of the Relevant Return on Investment (ROI) Systems Literature

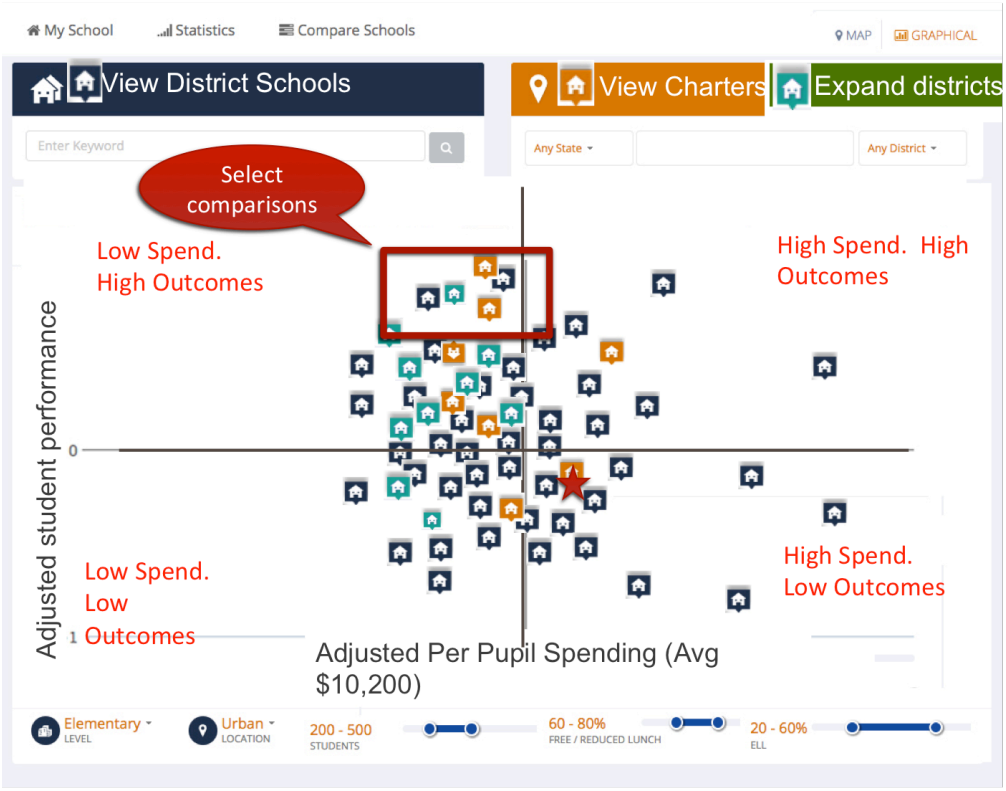
A Brief Introduction to K–12 ROI Systems

An ROI system presents information about the relationship between student performance and spending. An ROI system gathers data annually from separate databases that track demographics, finances, and student performance. These data are then organized into a single database, and that database is used to create charts and tables depicting ROI for that system. The relationship between performance and spending is made meaningful when multiple schools are compared with one another. ROI systems are designed for managers, policymakers, and taxpayers to compare the productivity of schools they manage, govern, or fund, against the productivity of other schools in the state.

Figure 1 presents a screenshot of Decision Science's graphical user interface (Decision Science 2014).[1] It graphs outcomes relative to spending for urban elementary schools enrolling between 200 and 500 students, with free or reduced-price lunch rates between 60 and 80 percent, and with English learner rates of between 20 and 60 percent. The vertical axis measures adjusted student performance on a standard scale, and the horizontal axis measures adjusted school-level spending per student on a numerical scale. The horizontal and vertical lines divide the graph into four quadrants. Schools, represented as squares in this graph, above (below) the horizontal quadrant line have above- (below-) average student performance, relative to their peer schools in this subgroup. Schools to the right (left) of the vertical quadrant line spend more (less) per student than the subgroup average. Charter schools are presented in orange boxes; district schools are presented in blue boxes. Schools are scattered around this graph almost randomly, revealing a weak relationship between outcomes and spending.

[1] Note that the authors have not evaluated the ROI systems presented in this paper. We describe ROI systems in operation to inform the reader about emerging efforts in this new type of analysis.

Figure 1. Decision Science's ROI Graphic Interface



Decision Science n.d., 5

Upper-left quadrant: These high-achieving, low-cost schools are the most productive schools in this sample. Schools in this quadrant should be examined for best practices, and future policies should refrain from impacting their system, as it is productive in its current form. These best-in-system schools can be used as models from which other schools might borrow practices.

Upper-right quadrant: These schools have high performance but also high costs. Despite having strong student results, these schools may be unsustainable at current funding levels.

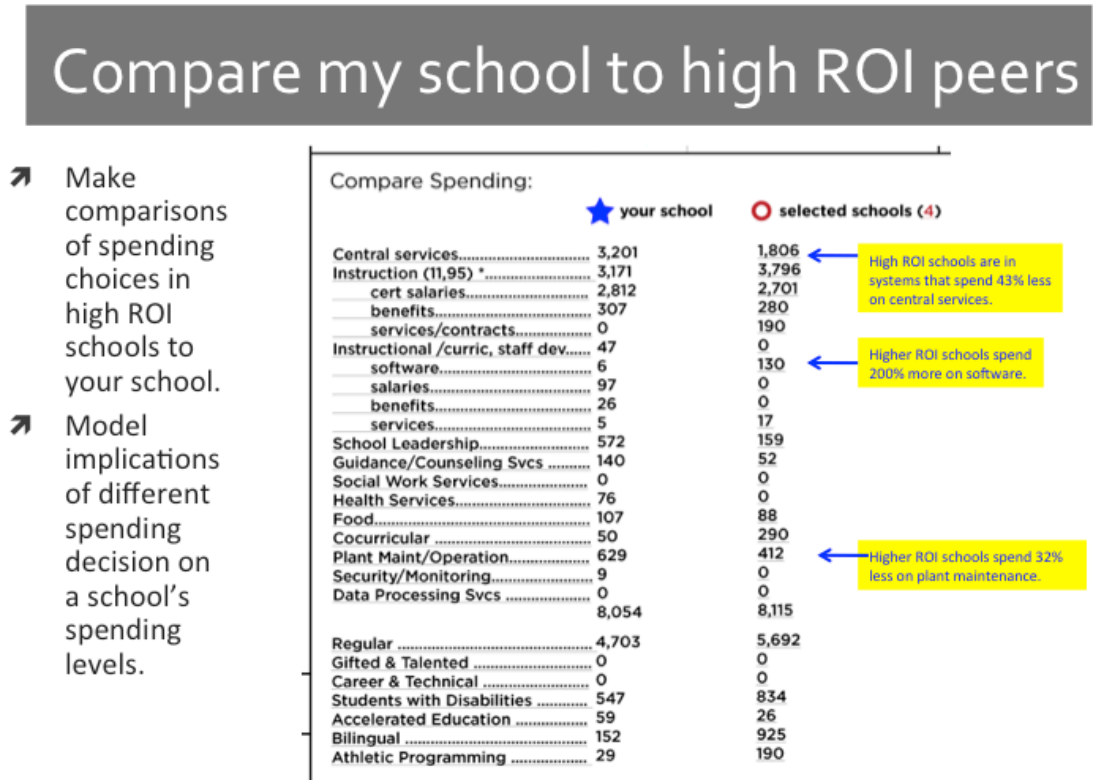
Lower-left quadrant: These schools are low-cost and low-performance. Leaders of these schools could learn from schools in the upper-left quadrant about investment strategies most likely to convert additional resources into improved student performance. Additional investment in these schools may be necessary to improve performance.

Lower-right quadrant: These schools are low-performance and high-cost. Even though they are spending more than the peer average, student performance is below the peer average. Schools in this quadrant may be unsustainable at current funding and performance levels.

Following the comparative analysis and classification of schools described above, ROI systems permit users to make spending comparisons with more productive schools. Decision Science's system (see Figure 2) allows users to select several comparison schools, and then report the average per-pupil expenditure from the selected schools alongside per-pupil expenditures at their own school. Users can

see where they are investing more or less resources, and then ask whether changes in spending patterns could produce better student outcomes.

Figure 2. Decision Science's Comparative Spending Tool



Decision Science n.d., 6

Benefits of an ROI System

Illuminates productivity differences between schools. ROI systems can be used to help identify misplaced spending priorities as well as highly efficient schools (Boser 2014). Close analysis of the data and identification of high-performing, low-cost schools can lead to investigations of best practices to identify the specific educational practices that lead to improved productivity.

Enhances collaboration and information sharing across schools and districts and between local and state actors. By celebrating highly productive schools and attempting to emulate their successes, an ROI system can be used as a method of framing conversations among colleagues in positions from the classroom level through district leadership. This can create an environment in which content alignment across the state occurs (Smith 2006).

Provides regularly updated feedback and ongoing, reliable information about schools' performance over time. This is essential in that it provides valuable information about trends in spending and outcomes for decision makers at all levels. An ROI system saves time by ensuring quality data and by providing predesigned analytical frames, freeing users to discuss results and make better-informed decisions.

Compiles data from myriad sources into a single, streamlined location. In most states, financial data, student demographic information, and student performance results are stored in distinct databases. ROI systems combine data from these three sources into a single, accessible database. By combining these databases and retaining that data for multiple years, end users can more easily produce meaningful ROI graphs. By building an ROI system that is focused on one topic, it can be made user-friendly for non-technical end users such as managers and citizens.

Emphasizes productivity for stakeholders in the education system. Over the past 40 years, educational spending has increased more than threefold (after taking inflation into account) while student achievement has nearly flat-lined (Boser 2014, 7); and yet, spending and student achievement remain separate conversations (Hovey and Boser 2013). In a practical sense, when discussing school performance, ROI systems allow users to ask which quadrant a school is in. The answer can improve the quality of management or inform future policy decisions. ROI systems allow policymakers to adjust their priorities based on actionable, relevant information (Eagan 2014).

Provides transparency to taxpayers. ROI systems regularly report on the productivity of each school in the education system. Transparency encourages closer citizen monitoring, which can lead to improved productivity.

Provides an ongoing source of information that links spending with student performance. This promotes deeper conversations about school performance in the statehouse, by local boards of education, and individual schools. One-off reports and investigations provide a snapshot of performance at a given investment level at a specific site, but an ROI system provides information on this important relationship over time, increasing confidence in reported relationships between investments and student outcomes. This increased availability of reliable, longitudinal data can lead to improved decision making with regard to programmatic and policy choices. Additionally, the ongoing availability of data enhances education researchers' ability to analyze information, draw conclusions, and make recommendations that are founded in evidence.

Makes money matter by directing limited resources on spending priorities that produce results. In an environment with limited resources, it is essential that education dollars be spent in the most productive way possible. By analyzing investment and performance data over an extended period of time, state, district, and school leaders can identify and eliminate low-yield activities, freeing scarce resources to invest in evidence-based, cost-effective programs and practices. ROI systems can be the key instrument for injecting evidence into the budgeting process and result in spending priorities and policies that make the education system more productive.

Builds support for greater school autonomy. ROI systems make it evident that productivity varies across schools. Leaders must ask themselves, "Would this new policy or management decision impact schools in each productivity quadrant differently? Might it, for instance, hurt the productivity of some schools by either driving up their costs or constraining their ability to

use their resources in productive ways?" ROI systems can lead to fewer universal policies and increased flexibility for productive schools.

Improves equity by highlighting spending differences among peer schools. ROI systems, if constructed as suggested here, reveal differences in funding levels across districts within the same state and across schools within the same district. These gaps, when made plainly visible, may increase demand for redistribution from schools funded at below average levels.

Using ROI Systems to Change Behavior and Improve Productivity

Once change agents have access to an ROI report, a four-phase process is set in motion, making productivity the predominant value (Roza 2014b) (See Table 1). The **verification phase** provides time for quality control and reliability checks to ensure that the ROI database is error-free and built on comparable, reliable data. The **benchmarking phase** allows principals and community members alike to compare their productivity with peer schools, building demand for more productive spending in schools with low productivity. The **discovery phase** encourages principals to learn how to make more productive spending choices by collaborating with their high-productivity peers. The **management phase** utilizes data from the ROI system to inform managerial decisions (e.g., enrollment changes, closures, replication) and policy choices (e.g., performance measures, funding formulas).

In order for an ROI system to motivate behavioral changes at the school level as it is intended, the system must be public and transparent. It should be searchable and easy for non-technical experts to access, manipulate, and understand the data and results. If we can change peoples' behavior—without being prescriptive about how they make the change—then productivity improvements can happen.[2]

Table 1. Expected Impact of ROI Systems by Phase, Actor, Activity, and Outcome

Phase	Actor(s)	Activity	Outcomes
Verification	ROI System administrators, school and district leaders	Respond to user concerns about data used by ROI system. Investigate discrepancies and correct accordingly.	Reliability and fairness: responsiveness and commitment to accuracy builds confidence in the results.
Benchmarking	School leaders, community members	Schools and community members can assess their productivity relative to similar schools in their area.	Focus and alignment: peer assessment and recognition of what is possible.
Discovery	Principals	Learning from peer schools looking for best practices in cost allocation to promote better spending choices.	School-level leadership accountability: promoting better spending choices.
Management	Superintendents, district leaders,	Assessing school performance at a given	Behavioral changes improve productivity:

2 Personal communication with Marguerite Roza, Director of the Edunomics Lab at Georgetown University, August 29, 2014.

	SEAs	spending level to frame policy discussions and management decisions.	management system focuses leaders' attention on same performance metrics, productivity becomes predominant value.

Phases from Roza (2014b), adapted by authors.

Task No. 2: ROI Design Elements and Performance Capabilities

ROI System Design Elements

The following section outlines some key elements emphasized in the literature as important elements to consider when designing an ROI system:

Develop a strategy to get unbiased spending data. If states are interested in a district-level ROI system, the data already exist at that level, and the Center for American Progress (CAP) has developed an ROI system using that data. But if states want to use school-level spending data, then they must develop a plan to collect school-level spending data and organize it into a database. This work can be done internally or outsourced to a vendor with expertise in making spending comparable across schools. In addition, there may be an incentive for schools and districts to minimize reported expenditures when an ROI system becomes more important as a managerial and policymaking tool. States like Oregon that already collect audited school-level expenditure information should review and possibly revise their auditing procedures and expenditure reporting regulations to minimize this risk. Districts may not have access to information about all the spending that takes place on behalf of their schools. Readers should anticipate this to be one of the most difficult challenges of this project.

Standardize definitions. Boser (2014) recommends that ROI systems be based on clear definitions for data points. For instance, in comparing districts across the country, he found many discrepancies between states and districts in how they defined different categories of spending. In order to assure continuity, reporting of outcomes and expenditures ought to be standardized across all reporting agencies within the system. Oregon's uniform chart of accounts and auditing protocols are a benefit with respect to spending measures, if they reach down to the school level, and while the same rigor applies to performance data required by the NCLB Act of 2008, just how consistently and accurately performance in grades and subject matter not covered by NCLB is recorded by schools and districts across the state remains an open question.

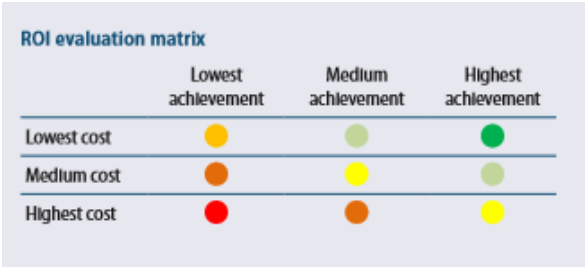
Secure a reliable revenue source to attract talent and build capacity. Given the dynamic environment of education, a data system with a built-in requirement to re-evaluate and update as needs change would be advisable. Similarly, a data system needs maintenance and support over time. As such, a long-term plan that covers training of essential personnel who will engage with the system and a plan for long-term, sustainable financial support are important design considerations. The database is only as good as the staff that builds it, maintains it, thinks about

how to use it, conducts rigorous analysis of the data, and restricts its use and reporting to data-supported findings and policy recommendations.

Demonstrate potential confounding factors. An ROI system design should prominently and accurately note any potentially confounding factors of each data report. This is of particular importance in determining appropriate peer schools and as it relates to capital expenditures. It may not be appropriate to use some schools in peer comparisons given unique circumstances (such as serving solely adjudicated students or being composed of an inordinately high number of students with special needs). Similarly, capital expenditures may also become a confounding factor and should be accounted for in the design of the ROI system. Capital expenditures may vary greatly year-to-year and can skew results (Boser 2014, 17). For instance, a school that requires a new roof in a given year may have a significant increase in spending without an accompanying spike in student performance. Given Oregon's intent to utilize the ROI system as a long-term engagement, it may be appropriate to track capital expenditures but exclude them from calculations for some time.

Present ROI data using a variety of tables and graphs. Different approaches reveal and highlight different findings from the analysis. The scatter plot, Figure 1 discussed above, is one method. Figure 3 below uses a red, yellow, green indicator system (Boser 2014). Color-coding is used to rank districts in one of 9 possible categories. Figure 4 below presents data from an ROI analysis in a different way (Silvernail et al. 2012). After having identified schools within the state of Maine that are either "Higher-Performing" or "Higher-Performing and More Efficient," Silvernail et al. presents the information by Superintendent region.

Figure 3: Example ROI Indicator System



Boser, 2014, p. 20

Figure 4: ROI Reporting for Maine Public Schools

Table 2: Higher Performing and More Efficient Maine Public Schools by Superintendent Region

Regions	K-8 School			Grade School (K-5)			Middle School (6-8)			High School (9-12)		
	Total Schools	HP	HPME	Total Schools	HP	HPME	Total Schools	HP	HPME	Total Schools	HP	HPME
Aroostook	11	1	1	13	3	3	3	0	0	14	1	1
Penquis	9	2	0	36	13	12	20	8	7	16	2	1
Washington	20	4	4	12	0	0	0	NA	NA	6	0	0
Hancock	23	2		2	1	1	2	1	1	5	0	0
Mid-coast	10	4	2	24	9	4	7	2	0	8	1	0
Western Maine	10	2	2	38	4	4	13	1	1	15	0	0
Cumberland	1	1	1	44	16	11	21	8	7	15	7	6
Kennebec	10	0	0	40	9	8	15	0	0	16	0	0
York	2	0	0	29	12	11	12	2	1	12	2	1
Total	**96**	**16**	**10**	**228**	**67**	**54**	**93**	**22**	**17**	**107**	**14**	**9**

Silvernail et al. 2012, 7

Set high expectations for continuous improvement of the data, models, and reporting. ROI systems can use many techniques to control for observable differences across students and schools, but they cannot control for unobservable differences across students and schools. For this reason, when interpreting results from the ROI system, a level of uncertainty is to be expected, and consideration of external factors may be necessary. For example, it may be tempting to accept that two schools with similar student enrollment, free and reduced-price lunch status percentages, and racial compositions may be appropriate peer comparisons. However, if one of the schools in the example were drawing students from a shelter for abused women, their location on a scatter plot may suggest that one school is more productive than the other, all else equal. Once these factors are discovered, they can be added as control variables to the database.

Report unadjusted and adjusted ROI ratings. The cost of educating students varies based on their background and characteristics. Adjusted spending measures account for these differences so that, in effect, a high-spending school with students that are more costly to educate spends the same (on an adjusted or weighted basis) as a low-spending school with less costly to educate students (Duncome and Yinger 2008). Performance measures can be adjusted in a similar fashion in an attempt to more accurately represent the productivity as it relates to students who are more costly to educate. Productivity cannot be observed; it can only be estimated. Due to the inherent uncertainty with any type of productivity estimation system, it is important to regard conclusions with care.

Design with the end user in mind: Smith (2006) notes that it is important that the data system be designed with the end users in mind. The system should be accessible and comprehensible even for those lacking a financial or technical background. Ideally, the ROI system design is user-

friendly, and even non-technical individuals can comfortably navigate and manipulate it in order to produce the desired reports.

Take political pressure into account: Dynarski's (2014) recent review of President Obama's college ROI ranking system highlighted an important concern: rankings are going to cause some people pain. School leaders and staff may have to change the way they perform their jobs or work harder; additionally, they may lose their jobs if they are unsuccessful in meeting the new productivity standards. Instead of changing their behavior, they may put political pressure on those charged with rating schools to adjust the rating system in a way that reflects positively on their performance. Dynarski suggests using a non-governmental agency insusceptible to political pressure to perform this task.

Two Approaches to Improving Education Productivity

Oregon's Education Investment Board (OEIB) is interested in using the considerable amount of longitudinal data it has collected over several years to improve education productivity. OEIB requested that we compare an ROI system with a research collaborative, because they take two different approaches toward improving education productivity. A research collaborative is typically university-based, seeks evidence about cause-and-effect relationships, and leverages policy to implement changes that support findings. In contrast, ROI systems are performance management systems intended to identify productive schools and then facilitate comparative spending analysis between more- and less-productive peer schools. Table 2 compares and contrasts these two systems along several different dimensions.

Table 2: A Comparison of Two Approaches to Improving Education Productivity

	Research Collaborative	**ROI System**
Leading Examples	The Consortium on Chicago School Research, The Research Alliance for New York City Schools	State of Florida, Center for American Progress, Decision Science
Objective	Conduct research that will improve school quality and student outcomes	Incentivize changes in behavior leading to a more productive education system
Improvement Mechanism	Evidence-based recommendations	Identification of productive schools and comparative spending analysis
Unit of Change	Policy	School
Scope	Comprehensive • School climate studies • Parent, student, teacher satisfaction surveys	Limited • Productivity estimates • Peer comparisons • Funding and spending differences
Data Requirements	Extensive • Teacher personnel files matched to student files • Annual surveys • School finance data	Less extensive • Minimum of school-level performance; student-level performance data preferred • School-level expenditure data
Costs	Relatively higher cost	Relatively lower cost

	• Significant data requirements • High analytic costs	• Fewer data requirements • Does not try to draw causal inferences
Target Audience	Researchers and policymakers	Policymakers, state administrators, district administrators, school leaders, union officials, taxpayers/citizens
Providers and Funders	Public-private partnerships with universities, primarily government or private grant funded	State-run system (DOE), think tank, several independent vendors emerging, state or private grant funded
Appropriate Lines of Inquiry	• What are the benefits to the state if all students can read by third grade? • What is the return to the state (in terms of tax revenue and decreased social services costs) for a student who graduates high school?	• Which are the high-poverty schools in our state that are low-spend, high-performance? • What are the key spending differences between schools that are ranked more productive and less productive? • How do schools that are more productive in science and math spend STEM resources compared with less productive schools?
Levels of Education	• Focus on primary and secondary • Given scope of K–12 work, difficult to expand coverage to early learning and tertiary education	• Current systems focus on primary and secondary • Potential to cover full P–20 student lifecycle

State Measurement and Communication of ROI[3]

Maine

Silvernail et al. (2012) are spearheading a study with the Maine Education Policy Research Institute (MEPRI) at the University of Southern Maine, the Center for Education Policy at University of Southern Maine, and Applied Research and Evaluation (CEPARE) at the University of Southern Maine. The multi-year study will calculate ROI for public schools and create longitudinal efficiency information.

The Center for Education Policy at the University of Southern Maine reported on the efficiency of Maine's public schools for a time period from 2008 to 2010. Their website notes that they produce School Efficiency Profiles (SEPs). SEPs allow users to understand how student performance compares with spending for each public school within the state. The Center for Education Policy defines student performance as related to each school's graduation rate (high schools only) and performance on state standardized tests. They compare each school's performance against the state average and also against

3 During interviews with school finance and education policy experts for this project, we heard stories that California, Texas, Massachusetts, and Wisconsin have ROI systems under development that we could not document.

the expected performance (given observable, student-level factors) to evaluate academic performance. Additionally, schools are evaluated based on the percentage of their students who are meeting or partially meeting the state standards (against the state average). The performance factors described above are placed against school spending to produce SEPs based on return on spending calculations.

Florida

Florida's ROI system is the most robust, single-state system operating in the country because it is the first to attempt to combine school-level spending with school-level student performance. Drawing data from the state's Education Data Warehouse, it estimates ROI at both the school- and district-level (see Figure 5 and 6 below). At the district level, users can view ROI as a state map (Figure 5), a speedometer-like gauge (Figure 6), or a table (not presented). At the school level, the mapping function disappears. We were unable to discern how the state generates school-level expenditure data. Florida's ROI system does not currently facilitate selecting peer schools for spending comparisons. School level mapping and comparative spending analysis would be useful additions in future iterations of the system. Currently, users can only view ROI through 2012 on Florida's ROI website.

Figure 5. Florida's ROI Map by District

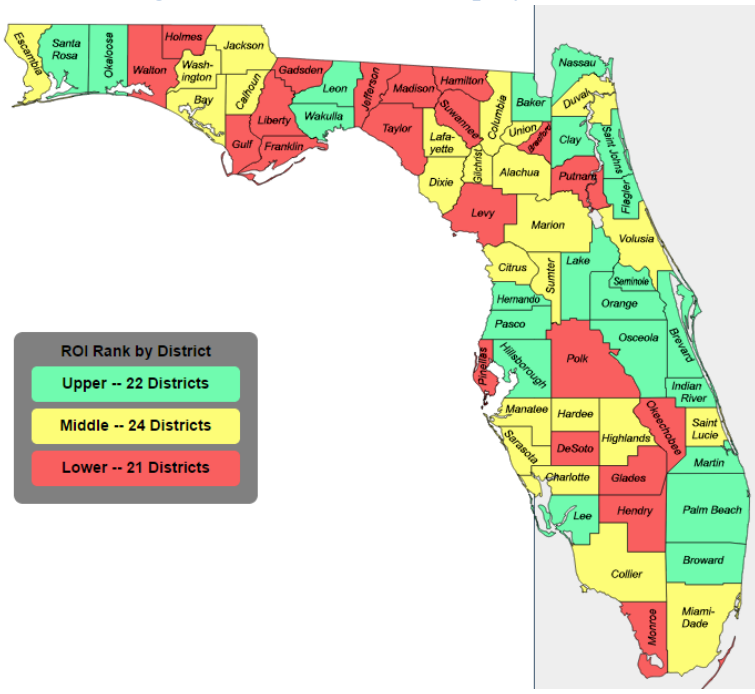
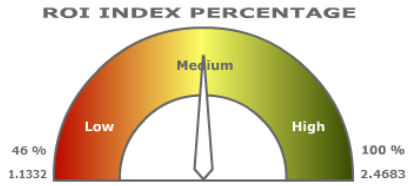


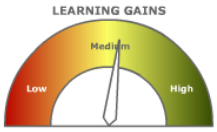
Figure 6. A Sample District from Florida's ROI Reporting System

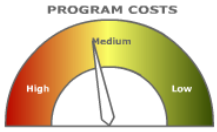
LEVY COUNTY

Return on Investment
2011-2012



The Return on Investment (ROI) index relates financial resources expended by the school district to measures of student achievement. The ROI index is calculated by dividing the school district's weighted learning gains in reading and in math by the total program costs per WFTE student. The weighted learning gains are adjusted by the percentage of students tested. The school district's total program costs per WFTE student are adjusted by the school district cost differential, which is the relative cost of providing instruction in a school district compared to other school districts in the state. A school district with high learning gains and low costs will have a high ROI index. The Return on Investment Percentage gauge is generated by dividing the ROI index for the school district by the highest ROI index generated by all school districts. The result shows how close the school district is to matching the performance of the top school district.





Georgia

In a presentation given to the state of Georgia that is full of new ideas about how the state could use its resources better, Education Resource Strategies (ERS) recommended that the state implement an ROI reporting system (see Figure 6). There is no additional information about the system and whether or not it has been implemented. What is interesting about ERS's recommendation is their graphical approach to presenting ROI. ERS's system uses a stratified approach on a 45-degree angle to rank schools as more or less productive.

Figure 7: Proposed ROI System for Georgia from Education Resource Strategies

STAR Metric

- Adjusts per-pupil spending for student need
- Allocates dollars to the school level
- Links financial data with student growth data to examine cost effectiveness

GaDOE STAR Metric Summary (2013)

Education Resource Strategies Georgia RT3 Resource Use Project: Final Recommendations 63

Key Metrics for Which There are Well-Established Returns

Estimated Returns to the State

What is the return to the educational system (in terms of money not spent on remediation) if a student is a fluent reader by third grade? There are several studies that discuss the importance of reading by third grade because students' early inability to read is associated with many undesirable outcomes, including repeating grades and not graduating high school (Fiester 2010). We were unable to find a study that estimated the ROI in terms of money spent on remediation if students meet third grade reading standards. Remediation is a difficult activity to cost out. Some activities associated with remediation are easier to assign costs to because they are classifiable, targeted activities, such as tutors or extended learning opportunities. Other remediation costs are more difficult to cost out because they involve ability-grouping strategies in classrooms and require teachers to record how they allocate their time across groups. Due to the complexity of estimating the cost of remediation, Oregon would be better off commissioning a study of this question rather than relying on either an ROI system or a research collaborative to answer it using existing data (though researchers in the collaborative could compete for the grant). It is worth noting that ROI systems could make an important contribution to the goal of universal reading fluency by third grade by first identifying schools that are meeting, or are close to meeting, this objective, and then illuminating how those schools are investing their resources. Further investigation and analysis of such schools would be necessary to identify how the school is teaching all of its students to read fluently by third grade, and to determine whether those strategies are transferrable to schools not meeting the goal.

What is the return to the state (in terms of tax revenue and decreased social services costs) for a student who graduates high school? Fiester (2010) reported that each student without a high school degree costs "society an estimated $260,000 in lost earnings, taxes, and productivity" (5). Sum et al. (2009) reported that "the average high school dropout will cost taxpayers over $292,000 in lower tax revenues, higher cash and in-kind transfer costs, and imposed incarceration costs relative to an average high school graduate" (14). Sum et al. derived this conclusion from the calculation that a high school dropout's lifetime net fiscal impact costs taxpayers $5,191 while a high school graduate contributes $287,384 over the course of his or her lifetime (Sum et al. 2009, 14).

What is the return to the state (in terms of tax revenue and decreased social services costs) for a student who completes a two-year degree or certification program? Individuals with some college (not specified as degree or certificate pathway) are reported to pay $461,661 into the system (Sum et al. 2009, 14).

What is the return to the state (in terms of tax revenue and decreased social services costs) for a student who completes a four-year degree? Those who hold a bachelor's degree can be expected to contribute $793,079 over the course of their lifetime to society (Sum et al. 2009, 14).

What is the return to the state (in terms of tax revenue and decreased social services costs) for a student who completes a STEM four-year degree? A literature review did not reveal any research to

date on the estimated return to the state for STEM degree recipients. However, Webber (2014) calculated that a STEM degree-holder can expect lifetime earnings of $3,017,659 which he contrasted with expected lifetime earnings of other degree holders as follows: $2,899,500 (Business), $2,556,089 (Social Sciences), and $2,195,055 (Arts/Humanities) (19). Given the increased lifetime earnings, the state could expect increased tax revenues from STEM degree recipients. Additionally, STEM degree holders have lower unemployment percentages (even during times of recession), which can lead to increased tax revenue and lower unemployment costs to the state (Joint Economic Committee Chairman's Staff of Senator Bob Casey 2012).

What is the return to the state (in terms of tax revenue and decreased social service costs) for a student whose family moves out of poverty? The costs to the state of a child living in poverty are extensive. Increased healthcare costs and increased likelihood of dependence on social programs are just two state expenditures related to children living in poverty. Studies exist which attempt to value the aggregate cost to the state of all children living in poverty, but no estimate on a per-child basis was located during this literature review. Holzer et al. (2007) estimates that children living in poverty produce an aggregate impact on GDP of approximately $500 billion annually (22). This cost is assuming that 15 percent of 4 million children are living in poverty (Holzer 2007, 21). According to our calculations, $500 billion divided by approximately 600,000 children living in poverty, we find that the cost to the state is approximately $833,333 per child growing up in poverty. These costs include estimates related to future foregone earnings, incarceration costs, and healthcare costs. They exclude, however, costs related to increased per-pupil funding while students attend K–12 public schools.

What is the cost in terms of state investment when a teacher leaves the profession before retirement? When a teacher leaves the classroom, the school district must pay to recruit, hire, and train a replacement teacher. Turnover could increase administrative burden, professional development costs, and induction/orientation costs. A pilot study of teacher turnover found that the cost of teacher attrition varies greatly between schools. One small, rural district reported a cost of $4,366 per teacher while the cost of a teacher leaving the classroom in a large, urban district is reported at $17,872 (Barnes, Crowe, and Schaefer ND, 4-5). Darling-Hammond (2003) reports that a statewide study in Texas revealed a cost to the district of approximately $8,000 per teacher that left the classroom (8).

Despite the costs outlined above, the state actually *saves* money when a teacher leaves the profession before retirement. Since the state pays retirement benefits to teachers, the burden associated with pensions and other retirement savings plans are reduced when a teacher leaves the classroom and is (often) replaced by a less experienced teacher. Additionally, it is less expensive to employ a teacher with fewer years of experience. The combined savings of lower wages and reduced retirement benefit payouts exceeds the total costs outlined above in terms of rehiring and training a replacement teacher (Roza, personal communication).

Estimated Returns to the Student

What is the return to the student (in terms of future wages) if he/she graduates high school? Estimates drawn from two different studies put the lifetime wage differential for a high school graduate compared to non-graduates between $272,000 and $435,000. The expected lifetime earnings of an individual with a high school diploma is $1,371,000 (Julian 2011, 4). This is contrasted with expected

lifetime earnings of $936,000 for educational attainment less than eighth grade, and $1,099,000 for some high school, but no diploma (Julian 2011, 4). Another source values the lifetime earnings in 2009 dollars of a high school diploma holder at $1,304,000, versus $973,000 for individuals without a high school diploma (Carnevale, Rose, and Cheah 2011, 3).

While the expected return on investment to the individual if he/she graduates from high school is well established, an ROI system would focus on differences between schools with higher and lower graduation rates. Analysis of ROI data could serve as an incentive for superintendents, principals, and voters served by lower-performing secondary schools to change their behavior and focus on improving graduation rates. Early changes might include a comparative analysis to higher-performing peers, identification of new investment strategies, and implementation of new approaches to teaching and learning. In the longer term, if graduation rates do not improve, voters might elect new leaders who may hire new management and teachers to improve graduation rates.

What is the return to the student (in terms of future wages) if he/she completes a two-year degree or certification program? The expected lifetime earnings of an individual with an associate's degree is $1,813,000 (Julian 2011, 4). The Center on Education and Workforce at Georgetown University values an associate's degree similarly at an expected lifetime earnings of $1,727,000 in 2009 dollars (Carnevale, Rose, and Cheah 2011, 3). One question the state should ask is how returns to both students and the state are distributed across two-year degree granting institutions and certification programs within the state. An ROI system can be used to rank private returns in the form of labor market earnings against the cost of such institutions. When using an ROI system for higher education, it is important to consider both state and federal aid and tuition to estimate the total cost of each program.

What is the return to the student (in terms of future wages) if he/she completes a four-year degree? The expected lifetime earnings of an individual with a bachelor's degree is $2,422,000 (Julian 2011, 4). The Center on Education and Workforce at Georgetown University values lifetime earnings of a bachelor's degree holder at $2,671,000 in 2009 dollars (Carnevale, Rose, and Cheah 2011, 3).

What is the return to the student (in terms of future wages) if he/she completes a STEM four-year degree? Webber (2014) calculates lifetime earnings associated with college degree type. Once controlled for observable characteristics, he calculates that a STEM degree-holder can expect lifetime earnings of $3,017,659. This is contrasted with expected lifetime earnings of different majors as follows: $2,899,500 (Business), $2,556,089 (Social Sciences), and $2,195,055 (Arts/Humanities) (Webber 2014, 19).

Task No. 3: A First Approximation of an ROI Framework for Oregon

Defining Return on Educational Investment

Oregon should determine the ROI formula it will use first, because the formula will determine the system's data requirements. Florida's ROI index makes two important adjustments to this basic approach (see Figure 8). First, it weights learning gains by the percent of students tested. Schools can achieve higher ROI by increasing the percent tested (holding results constant). Second, Florida removes spending on students who are more costly to educate, making spending comparable across schools.

Other ROI systems do not use an ROI formula, instead using outcome and spending data to display information about the relationship (Roza, personal communication). Baker (2014), in a critical review of CAP's national system, summarizes the cost and efficiency literature and recommends seven factors to consider. Baker's (2014) recommendations include considering economies of scale, local wages, and regional wages. He recommends a state-by-state approach due to variation in state policies and testing instruments, and the difficulty of estimating efficiency with precision.

Figure 8: Florida's ROI Index

ROI Index Formula

The formula to calculate a school district's ROI index is as follows:

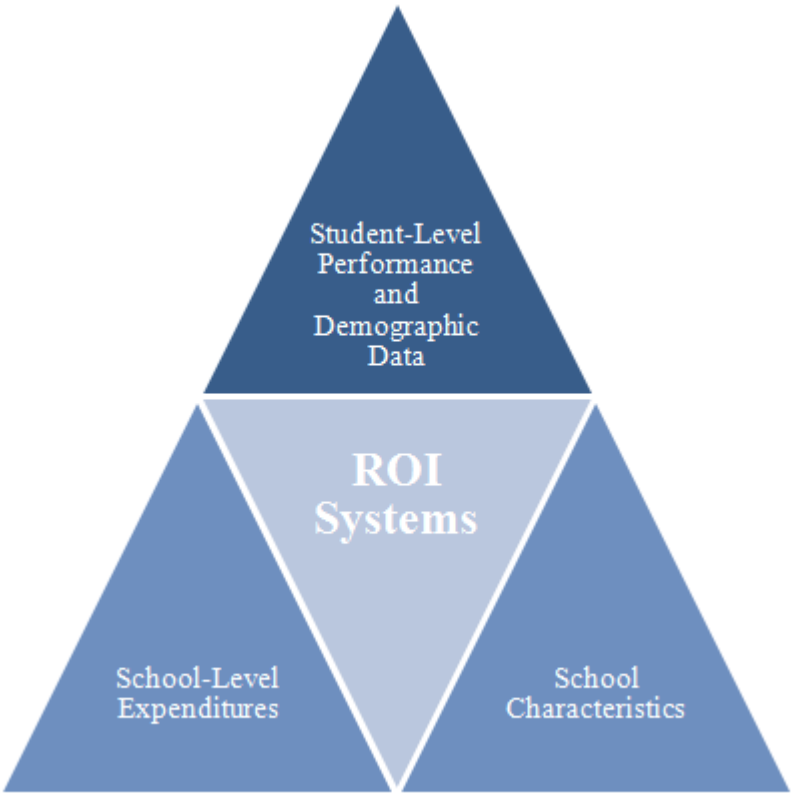
$$\frac{(\text{Weighted Learning Gains} \times \text{Percentage Tested})}{(\text{Total Program Cost per WFTE Student} \div \text{District Cost Differential})} \times 100$$

While much of this report has focused on K–12 schools, Oregon could develop ROI systems for early childhood education programs and for colleges, universities, and technical schools. Because of significant differences in the way those systems are financed (parents or students pay a much larger share), and the way returns are calculated (for colleges it is often labor market earnings), separate systems are needed. ROI systems perform best when they have lots of schools to compare to one another. While there are likely enough early childhood programs and community colleges in Oregon, the sample size may be prohibitive at the university level, where other national systems are already calculating ROI (Lewin 2013).

Data Requirements for an ROI System

Figure 9 presents the three categories of data required by an ROI system: student-level performance and demographic data, school-level expenditures, and school characteristics.

Figure 9. ROI Data Components



Student-Level Performance and Demographic Data

At a minimum, ROI systems collect aggregate data at the school level regarding student performance and demographics. However, ROI systems that record student-level performance and demographic information will be more useful; they provide a more nuanced understanding of student populations that enhances the pairing of peer schools for more realistic cross-school productivity comparisons. Advantages of a student-level system include the ability to calculate individual student gain scores, which controls for differences in performance across cohorts, and allows enhanced reporting options. Rather than representing schools as dots on a scatter plot, an ROI system based on student-level data could report schools as box and whisker plots (or similar). These plots would tell the user about variation in student performance in the school. Are most of the students centered on the mean or does performance have a bimodal distribution? Student-level data can make answers to such important questions visually apparent.

Oregon has a comprehensive set of student-level performance indicators, demographic data, and other student characteristics. Our review of the data dictionary revealed few missing variables. We feel it is important to note that free and reduced-price lunch students are reported together. We recommend disaggregating the two groups because of the 50-percentage point difference in income relative to the federal poverty line separating these two categories of economic disadvantage.

In reviewing the data dictionary provided by OEIB, Oregon has access to longitudinal standardized test scores in reading, math, speaking, and writing, along with GPA, report card grades, SAT and ACT scores, and retention and graduation data. While the performance measures included in Oregon's data dictionary are quite extensive related to math, reading, and writing (showing a variety of test scores, modifications offered for students, version of the test used, etc.), data related to science, social studies, and other academic subjects is largely absent. Schools teach more than the subjects tested and schools that excel at visual and performing arts instruction, for instance, will appear less productive than they actually are. Another concern is that the system relies heavily on NCLB's accountability framework. This means that performance data on early childhood education, K–12 students, and students enrolled in tertiary programs is more difficult to obtain and not comparable to the performance data collected for students in grades 3 to 8 and one high school grade (Miller and Smith 2010).

The current data dictionary in place has a data point named Limited English Language Proficiency (LEP). Students who are LEP vary in terms of their ability to read, write, understand, and speak English. An indicator that can take all this variation into account will be more useful to ROI users. It would be useful for the ROI system to distinguish which language the student speaks, and if the student is receiving English language services. Similar to the example above, this type of more sophisticated data in the system could provide more nuanced information when ROI data is analyzed.

School-Level Expenditures

School-level operating expenditures, available for the past ten years in Oregon, are essential. If the expenditures are targeted for students with specific needs, such as special or compensatory education, that information should be captured because it allows analysts to adjust spending levels accordingly. The goal is to adjust for differences in student population and compare schools with similar peers in order to improve the reliability of comparisons. Once comparison schools are identified, additional spending detail by function, object, program, and activity can be used to help schools and leaders understand differences in the ways schools allocate their resources. The following is a partial list of examples of the data points that should be included in this component of the ROI system:

- Spending by subject matter.
- Teacher, administrator, and staff salary, stipends, and benefits spending.
- Contractor and consultant fees paid.
- Portion of each staff member's time dedicated to a specific program (Levenson et al. 2014, 10).
- Variable school-level costs (facilities, materials, supplies, transportation, utilities, etc.).
- Curriculum investments.
- Spending on professional development and training.
- Educational technology purchases and investments.
- Building and land purchases and improvements.

Expenditures in large districts within the state may require additional reporting requirements. In large districts, spending often happens at the central office level rather than in individual schools. In these cases, it is useful to ensure in advance those central offices, to the extent possible, code their services to the building level. This will enhance the ability of future analyses to assess school-level spending more accurately (Miller, Roza, and Swartz 2005). Given that in the last fifty years, the growth of non-teaching staff has far outpaced the number of teachers (Richmond 2014, 1), it may be worth also tracking

ancillary personnel files. The percentage the U.S. spends on ancillary personnel far outpaces other, similarly economically positioned OECD countries, which may mean that tracking non-teaching staff information could play an integral part of an ROI system (Richmond 2014, 6).

The challenge of getting complete spending data at the school level for all dollars from all sources cannot be overestimated. The challenge was insurmountable to CAP, which reported district-level ROI estimates. Florida's school-level expenditure methods are not described in enough detail to know whether they have captured all the funding correctly. Oregon must avoid calculating school-level expenditures by formula. The success of an ROI system hinges on capturing actual spending in its entirety at the school level.

School Characteristics

Collecting a wide range of variables about school characteristics and programmatic aspects of the school facilitates new frames on the ROI analysis:

- School characteristics (grades served, enrollment).
- Operating status (charter- or district-managed, CMO/EMO affiliated).
- Population density (rural, suburban, urban).
- Special status (magnet, school-wide Title I, Indian education).
- Special focus (personalized, blended, virtual, STEM, performing arts).
- Enrollment method (neighborhood zoned school, choice, lotteries in/out).
- Length of school day and year.
- Comprehensive services (medical and dental care, social services, adult programming).

Tracking school characteristics in addition to student demographic information is essential to the identification and pairing of peer-schools for analysis. For more reliable estimates of productivity, it is helpful to compare schools with other institutions that are as similar as possible in their structure, operations, and student population. By tracking school characteristics such as those defined above, researchers can more effectively compare similar schools throughout the state to make more accurate evaluations and recommendations.

Bibliography

Bruce Baker, "If It Doesn't Work, Don't Do It! CAP's ROI," School Finance 101 (blog), January 22, 2011, http://schoolfinance101.wordpress.com/2011/01/22/if-it-doesnt-work-dont-do-it-caps-roi/

Bryk, Anthony S., Penny Bender Sebring, Elaine Allensworth, Stuart Luppescu, and John Q. Easton. *Organizing Schools for Improvement: Lessons from Chicago.* Chicago: University of Chicago Press, 2010.

Barnes, Gary, Edward Crowe, and Benjamin Schaefer. n.d. "The Cost of Teacher Turnover in Five School Districts: A Pilot Study," Washington, DC: National Commission on Teaching and America's Future. http://nctaf.org/wp-content/uploads/CTTFullReportfinal.pdf

Boser, Urich. 2014. "Return on Educational Investment: 2014 – A district-by-District Evaluation of U.S. Educational Productivity," Washington, DC: Center for American Progress. http://www.americanprogress.org/issues/education/report/2014/07/09/93104/return-on-educational-investment-2/

Carnevale, Anthony, Stephen Rose, and Ba Cheah. 2011. "The College Payoff: Education, Occupations, and Lifetime Earnings," Washington, DC: Center on Education and the Workforce. https://www2.ed.gov/policy/highered/reg/hearulemaking/2011/collegepayoff.pdf

Darling-Hammond, Linda. "Keeping Good Teachers: Why It Matters, What Leaders Can Do," *Educational Leadership* 60, no. 8 (2003): 6-13. http://bhssnell.weebly.com/uploads/5/0/9/8/5098492/1_1_darlinghammond.pdf

Decision Science. n.d. "Connecting K-12 Education Spending and Performance by School." Provided to the authors by Marguerite Roza, September 19, 2014.

Duncombe, William and John Yinger. "Measurement of Cost Differentials." In *Handbook of Research in Education Finance and Policy* edited by H. Ladd and T. Fisk, 257-275. Mahwah, NJ: Lawrence Erlbaum Associates, Inc., 2007.

Dynarski, Susan. "Why Federal College Ratings Won't Rein in Tuition." *New York Times* (New York, NY). Sept. 20, 2014. http://www.nytimes.com/2014/09/21/upshot/why-federal-college-ratings-wont-rein-in-tuition.html?smid=nytcore-iphone-share&smprod=nytcore-iphone&_r=0&abt=0002&abg=1

Education Resource Strategies. "ERS Final Findings and Recommendations for the GA DOE RT3 Resource Use Project" Presented at the GA DOE Office, December 19, 2013.

Fiester, Leila. 2010. "Early Warning! Why Reading By the End of Third Grade Matters," Kids Count Project, Baltimore, MD: Annie E. Casey Foundation. http://www.aecf.org/m/resourcedoc/AECF-Early_Warning_Full_Report-2010.pdf

Holzer, Harry J., Diane Whitemore Schanzenbach, Greg J. Duncan, and Jens Ludwig. 2007. "The Economic Costs of Poverty in the United States: Subsequent Effects of Children Growing Up Poor." Institute for Research on Poverty Discussion Paper No. 1327-07. http://www.irp.wisc.edu/publications/dps/pdfs/dp132707.pdf

Hovey, Don, and Ulrich Boser. 2014. "The New Education CFO: From Scorekeeper to Strategic Leader," Washington, DC: Center for American Progress. http://www.erstrategies.org/library/the_new_education_cfo

Jacob, Robin T., Roger Goddard, and Eun Sook Kim. "Assessing the Use of Aggregate Data in the Evaluation of School-Based Interventions: Implications for Evaluation Research and State Policy Regarding Public-Use Data," *Educational Evaluation and Policy Analysis* 36, no. 1 (2014), 44-66. doi: 10.3102/0162373713485814.

Joint Economic Committee Chairman's Staff of Senator Bob Casey. 2012. "STEM Education: Preparing for the Jobs of the Future," Washington, DC: U.S. Congress Joint Economic Committee. http://www.jec.senate.gov/public/index.cfm?a=Files.Serve&File_id=6aaa7e1f-9586-47be-82e7-326f47658320

Julian, Tiffany. 2011. "Work-Life Earnings by Field of Degree and Occupation for People with a Bachelor's Degree," Washington, DC: U.S. Department of Commerce. http://www.census.gov/prod/2012pubs/acsbr11-04.pdf

Kena, Grace, Susan Aud, Frank Johnson, Xiaolei Wang, Jijun Zhang, Amy Rathbun, Sidney Wilkinson-Flicker, and Paul Kristapovich. 2014. "The Condition of Education 2014," Washington, DC: National Center for Education Statistics. http://nces.ed.gov/pubs2014/2014083.pdf

Levenson, Nathan, Karla Baehr, James C. Smith, and Claire Sullivan. *Spending Money Wisely: Getting the Most From School District Budgets.* Boston: District Management Council, 2014. http://www.dmjournal.org/spending-money-wisely-book/

Lewin, Tamar. "Obama's Plan Aims to Lower Cost of College." *New York Times* (New York, NY). Aug. 22, 2013. http://www.nytimes.com/2013/08/22/education/obamas-plan-aims-to-lower-cost-of-college.html

Miller, Lawrence J., Marguerite Roza, Claudine Swartz. 2005. "A Cost Allocation Model for Shared District Resources: A Means for Comparing Spending Across Schools." Developments in School Finance: 2004. Fowler, W.J. ed., U.S. Department of Education, National Center for Education Statistics. Washington, DC: Government Printing Office, 69-80.

Miller, Lawrence J. and Stephanie C. Smith. 2010. "Did the No Child Left Behind Act Miss the Mark? Assessing the Benefits of an Accountability System for Early Childhood Education." Educational Policy 25(1): 193-214.

Richard, Matthew. 2014. "The Hidden Half: School Employees Who Don't Teach," New York, NY: Thomas B. Fordham Institute. http://edexcellence.net/publications/the-hidden-half

Roza, Marguerite. 2013. "Leveraging Productivity for Progress: An Imperative for States," San Antonio, TX: Building State Capacity and Productivity Center at Edvance Research, Inc. http://www.bscpcenter.org/wp-content/uploads/2013/11/SEA_of_the_Future_Essay1_Leveraging_Productivity-11-2013.pdf

Roza, Marguerite. 2014(a). "A State Information System to Support Improvements in Productivity," San Antonio, TX: Building State Capacity and Productivity Center at Edvance Research, Inc. http://www.bscpcenter.org/wp-content/uploads/2014/05/Chap4_SEAF3_Roza.pdf

Roza, Marguerite. "Building a State Information System to Support Improvements in Productivity" Webinar to state education agency leaders, online, February 26, 2014(b). http://edunomicslab.org/webinar-building-state-information-system-support-improvements-productivity/

Silvernail, David L., Erika K. Stump, Richard Barnes, Kenneth Kunin, Sarah E. Wintle. 2012. "A Study of Maine's More Efficient Public Schools," Portland, ME: Maine Education Policy Research Institute at the University of Southern Maine. http://www.maine.gov/education/data/eps/studyofMaineEfficientPublicSchools2012.pdf

Smith, Nancy. 2006. "Increasing Returns on Investment Data Systems: Lessons Learned From Recipients of IES Statewide Longitudinal Data Systems Grants," Washington, DC: Data Quality Campaign. http://www.dataqualitycampaign.org/files/events/resources/Meetings-DQC_Quarterly_Issue_Brief_112906.pdf

Sum, Andrew, Ishwar Khatiwada, Joseph McLaughlin, and Sheila Palma. 2009. "The Consequences of Dropping Out of High School: Joblessness and Jailing for High School Dropouts and the High Cost for Taxpayers," Boston, MA: Center for Labor Market Studies. http://www.northeastern.edu/clms/wp-content/uploads/The_Consequences_of_Dropping_Out_of_High_School.pdf

Webber, Douglas A. "The Lifetime Earnings Permia of Different Majors: Correcting for Selection Based on Cognitive, Noncognitive, and Unobserved Factors," *Labour Economics* 28, (2014), 14-23. doi: http://dx.doi.org/10.1016/j.labeco.2014.03.009

Table 3: Additional ROI Resources Related to Other State Efforts

Analyst	State	Website
Decision Science Labs	California, Tennessee	http://decisionsciencelabs.com
Maine Education Policy Research Institute (MEPRI) at the University of Southern Maine, the Center for Education Policy at University of Southern Maine, and Applied Research and Evaluation (CEPARE) at the University of Southern Maine	Maine	http://www.sau56.org/wp-content/uploads/2010/03/Marshwood-Part.pdf http://usm.maine.edu/cepare/maine-public-school-efficiency-profiles
Florida Department of Education	Florida	https://app2.fldoe.org/Ranking/DistrictROI/ http://leg.mt.gov/content/Committees/Interim/2007_2008/edu_local_gov/conference/lessons_montana_january_2009.pdf
Education Resource Strategies	Georgia	http://www.erstrategies.org/library/return_on_investment_in_education
Center for American Progress	National	http://www.americanprogress.org/press/release/2014/07/09/93536/release-report-evaluates-educational-productivity-in-georgia-assigns-educational-return-on-investment-ratings-to-school-districts/