The cost burden to Minnesota K-12 when children are unprepared for kindergarten

Prepared for the Bush Foundation

DECEMBER 2008

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Acknowledgments

Thanks to the study advisory committee who assisted with framing assumptions and categories of potential costs and benefit: Glenace Edwall, Children's Mental Health; Rob Grunewald, Minneapolis Federal Reserve Bank; Penny Hatcher, Minnesota Department of Health; David Heistad, Minneapolis Public Schools; Peter Hutchinson and Jane Kretzmann, Bush Foundation; and Anita Larson and Judy Temple, University of Minnesota.

Thanks also to staff from the Minnesota Department of Education, Office of Information Technologies, for providing data required for the analyses.

Summary

Most of the studies of the return on investment in early childhood education have focused on the big payoffs in reduced public and societal costs associated with child welfare, public assistance, crime and incarceration, and benefits related to increased education and earnings. Several studies focus specifically on costs and benefits within the K-12 system, primarily measuring the effects of early childhood interventions on special education spending.

This cost-benefit study focuses on the financial costs within the Minnesota K-12 system as a whole due to children entering kindergarten unprepared for school success. The study scope does not include costs or benefits for the child, family, or society.

This study found the estimated cost burden to the Minnesota K-12 system due to children entering kindergarten unprepared for school success is about $113 million annually. These unduplicated costs at the state level are as follows:

- $42 million (37%) is the net loss of per pupil aid to school districts as a result of students dropping out before graduation.
- About $28.9 million (26%) are the estimated teacher-related costs due to absenteeism, turnover, and extra pay to compensate teachers for unsatisfactory working conditions because of behavior problems and low achievement among students that could have been prevented if the students were better prepared for school success.
- About $24.4 million (22%) is the estimated portion of the actual special education and grade repetition costs that can be attributed to children entering kindergarten not fully prepared.
- $11 million (10%) is the estimated cost of serving English language learners with no early education.
- About $6 million (5%) is spending on school safety due to delinquent behavior in the schools that possibly could have been prevented if the students were better prepared for school success.

The total cost of providing a targeted evidenced-based early education program for two years for all low-income (at or below 125% of poverty) three-year-olds not now being served is approximately $377 million, assuming an annual cost of $13,457 per child for 13,229 eligible children. If the potential cost savings at maturity, or $113 million, are subtracted, the annual net cost of such a program is estimated to be about $264 million.

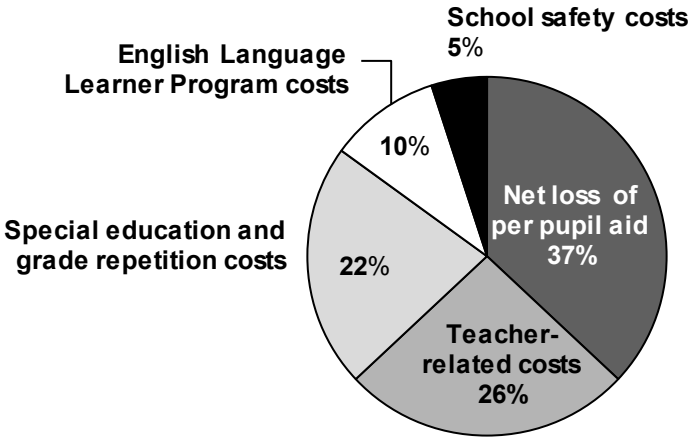
Phased savings as better-prepared students mature through the K-12 system would end up offsetting about $577 million of program costs, or about 10.5 percent of the total gross expenditure over 15 years estimated at $5.5 billion.

After 15 years, the savings would provide an offset of 30 percent of program costs in each succeeding year. (These estimates are based on 100 percent enrollment of eligible low-income three-year-olds in the two-year program and a constant number of children in succeeding cohorts. Lower usage rates or smaller cohorts would reduce estimated costs and savings proportionately.)

Thus, the benefits *within* the K-12 system associated with high quality early education are not enough to cover the costs of a high quality early education program. The bigger payoffs are *outside* the K-12 system.

Many different combinations of program cost, length, and coverage are possible. For example, $113 million could pay for a one-year program for the entire cohort of low-income children considered here if the program could be delivered at a cost of $8,542 per child, or a more basic two-year program costing half as much could also be delivered to the whole cohort for the same total cost. Alternatively, the targeted two-year program could be provided to a smaller group of about 4,200 children determined to be at highest risk for school failure.

1. Sources of $113 million annual cost burden to Minnesota K-12 due to children entering kindergarten unprepared



Introduction

Overview of early childhood education cost/benefit literature

Many studies show that high-quality early learning pays off in the long run (Ehrlich, E. and Kornblatt, T., 2004; Koroly, L.A., Kilburn, M.R., & Cannon, J.S., 2005; Friedman, D.E., 2004; Lynch, R.G., 2007; Temple, J.A. & Reynolds, A.J., 2005; Reynolds, A.J., 2007; Rolnick and Grunewald, 2003). Most of the return on investment is in reduced public costs associated with child welfare, public assistance, crime and incarceration, and benefits related to increased education and earnings.

Several studies focus specifically on measuring the effects of early childhood interventions on school systems and special education spending (Barnett, S.W., 1995; Belfield, C.R., 2004; Conyers, L.M., Reynolds, A.J., and Ou, S., 2003; Harvey, J., 2006).

Purposes of this study

This cost-benefit study focuses just on the effects of early childhood care and education (ECE) on the K-12 school system as a whole. It computes the cost burden to the Minnesota K-12 system due to insufficient early learning and early intervention that result in children entering kindergarten not fully prepared. It provides estimates of the dollars already in the K-12 system that could be used differently by the state and school districts to ensure more school readiness and, therefore, less spending at the K-12 level.

The cost burden to the Minnesota K-12 system due to insufficient early learning and early intervention consists of:

- The estimated portion of the actual costs that can be attributed to children entering kindergarten not fully prepared;
- The avoided potential costs as represented by the estimated benefits of early childhood education that would reduce K-12 spending if those benefits were activated; and
- The estimated lost revenues that can be attributed to children entering kindergarten not fully prepared.

The study scope includes costs imposed on the K-12 system such as increased special education and grade repetition as well as potential revenues lost such as per pupil aid because of drop outs. The study scope does not include costs/benefits for the child, family, or society.

Assumptions in the analyses

The analyses chart what the benefits and cost savings would be for the K-12 system as a whole as a 3-year-old cohort moves through their K-12 education.

- The cost/benefit analysis looks at the revenue and expenditures of K-12 (the accounting side), not the effects of schools being efficient and effective at teaching and graduating qualified workers and citizens.
- Costs and benefits are estimated for a preschool cohort in 2009 with spending over time adjusted to 2009 dollars (based on projections of the Consumer Price Index by Global Insight).
- ECE will be targeted to the lowest income children (at or below 125% of poverty) for optimal return (Isaacs 2007). The number of eligible children will be estimated accordingly.
- Accrued benefits are predicated on ECE programs being strong enough to address and prevent the behavior problems. Intervention may have to start before age 3 with prenatal and home visiting interventions for optimal results.

Assumptions regarding the potential early childhood education program

This study examines potential benefits of a voluntary, targeted early childhood education (ECE) program for Minnesota three year olds who are at 125 percent of the federal poverty line or below. Wilder researchers assumed that the program would be of high enough quality to achieve levels of benefit similar to those found within the research literature. For instance, the salary paid to teachers and staff would be competitive relative to other early childhood education programs. Teaching assistants would each have at least an associates degree and lead teachers in each classroom would hold a bachelors degree or greater and have earned certification in early childhood education. The program would be center-based and run throughout the year. The curriculum would be comprehensive, covering areas ranging from socio-emotional development to pre-reading and mathematics skills. The class size would be between 15 and 20 children (Lynch, 2007; Barnett, 1995).

Potential K-12 cost savings

Special education and grade repetition

The largest *potential* savings in K-12 as a whole due to improved early care and education are in special education spending. Minnesota K-12 spending in 2007 totaled nearly $1.3 billion on special education. A portion of these costs could be reduced or prevented if more low-income three-and-four-year-olds participated in early education.

Nationally, approximately 20 percent of children are identified as having special educational needs (High, 2008). Two percent have normative disabilities – blindness, deafness, autism, moderate/profound mental retardation, or significant language impairment. Eighteen percent have non-normative disabilities such as learning disabilities, speech and language delays, mild hearing loss, mild mental retardation, and social/emotional/ behavioral maladjustments that are preventable or ameliorated with early intervention.

Of those with non-normative disabilities (90% of the students in special education), research shows that anticipatory guidance, such as parenting education provides, can reduce social and emotional risks and build protective factors in young children (Edwall, 2008) and quality early care and education can reduce the amount of time spent in K-12 special education (Reynolds, 2007). In addition, research on children with mild hearing loss shows they have more academic difficulties and are more likely to repeat a grade than their peers with normal hearing, which could be prevented with earlier detection and treatment (Tharpe, 2006).

Tables A1 and A2 in the Appendix summarize the estimated effects and net benefits of early childhood education with regard to special education and grade repetition. Based on the outcomes of three major early childhood education studies (High\Scope Perry Preschool, The Abecedarian Project, and Chicago Child-Parent Centers) and a meta-analysis of 48 other studies, the return to each K-12 dollar invested in early childhood education range from 4 cents to 73 cents.

Thus, the benefits associated with special education and grade repetition alone are not enough to cover the costs of a high quality early education program. The bigger payoffs estimated in these studies are *outside* the K-12 system.

Other potential sources of costs and savings

This study looks at other possible benefits *within* the K-12 system in addition to the actual costs of non-normative special education and grade repetition. Other potential costs to avoid, as measured by possible benefits, include costs associated with:

- Student dropout and reduced high school usage (lost per pupil revenue because of students not pursuing more years of K-12 education);
- Teacher turnover due to behavior problems, low achievement, or lack of preparation for K-12 education among students;
- Teacher absenteeism due to behavior problems, low achievement, or lack of preparation for K-12 education among students;
- Extra pay to teachers to compensate for poor working conditions because of behavior problems, low achievement, or lack of preparation for K-12 education among students;
- School safety programs (child or adolescent delinquent or criminal behavior increasing the need for spending on school safety programs); and
- English Language Learner programs (Research indicates that quality early education may improve the English abilities of English language learners, which could reduce the need for future spending in this area (Barnett, 2007; Gromley, 2007; and Magnuson, 2006.).

Estimates of potential savings to K-12

The following table shows the range of cost-benefit ratios for each spending category found within the research literature:

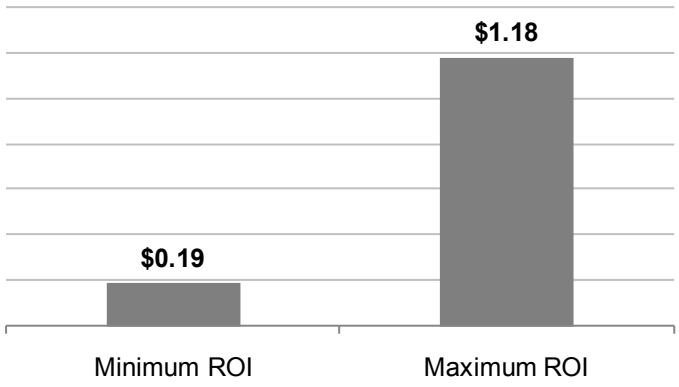
2. Areas of potential reduced spending in Minnesota K-12 due to ECE investment

K-12 spending categories	Estimated ranges of returns on investment (ROI)	Programs/Studies
Special education and grade repetition	.04 to .73	Perry Preschool, Chicago CPC, Abecedarian Project, Aos et al. (2004) meta-analysis.
Dropouts and increased high school usage (state aid/revenue)	No estimates	Lynch (2007)
Teacher turnover	.02 to .09	Proposed universal ECE programs for Massachusetts, Ohio, and Wisconsin.
Teacher absenteeism	.01 to .04	Proposed universal ECE programs for Massachusetts, Ohio, and Wisconsin.
Extra compensation for teachers	.10 to .25	Proposed universal ECE programs for Massachusetts, Ohio, and Wisconsin.
School safety programs	.02 to .07	Proposed universal ECE programs for Massachusetts, Ohio, and Wisconsin.
English Language Learner Program usage	No estimates	Magnuson (2006)

Sources: *Isaacs (2007); Belfield (2006)*

Figure 3 shows the minimum and maximum potential returns to K-12 for investing in targeted early education.

3. Minimum and maximum potential ROI in K-12 due to targeted ECE investment



Estimated cost burden to Minnesota K-12

This section estimates the cost burden to Minnesota K-12 when children are not fully prepared for kindergarten by calculating the estimated total cost savings to K-12 education in Minnesota that would result if all low-income children (at or below 125 percent of the Federal poverty line) starting at age 3 had access to high quality early childhood education for two years. These estimates are based on actual expenditure and enrollment data from Minnesota and program effect sizes and parameters from the existing research on early childhood education.

Special education and grade repetition

For these analyses, we assume that special education enrollment, grade repetition enrollment, and regular track enrollment (students who are neither in special education or grade retained) are distinct educational tracks. Under that assumption, during the 2007-2008 school year about 86 percent of students are on a regular track, 1 percent are grade retained, and 13 percent are enrolled in special education (Figure A3 in the Appendix).

Special education

A literature review performed by the Task Force on Community Preventive Services of the Centers for Disease Control and Prevention found a reduction in the incidence of special education due to early education ranging from 6 to 48 percent with an average impact of 12 percent (Anderson, 2002). Currently, approximately 13 percent of students in Minnesota are enrolled in special education. Figure 4 shows the special education enrollment by type of primary disability for Minnesota during the 2007-2008 academic year.

For this analysis, we assume that while special education can assist in some non-normative areas of special education, such as emotional or behavioral disorder, it cannot assist in normative areas, such as deafness or blindness. Therefore, researchers expect the new ECE program to impact six primary disabilities areas: speech or language impaired (2.1% of all students), mild to moderate developmental cognitive disabilities (.8%), specific learning disability (3.7%), and emotional or behavioral disorder (2.0%), other health disabilities (2.5%), and developmentally delayed education (1.7%).

To account for the effects of the targeted ECE program, we reduced the special education rates in the disabilities that can be reduced or prevented with effective ECE by 12 percent, the average effect size found in the literature.

Although some studies have subtracted the cost of regular track education from the benefits produced by ECE to calculate the net benefit, this analysis does not for two reasons. First, accounting practices in Minnesota schools list the costs of special education as a separate line item, so these costs should be considered as being in addition to regular track costs. Second, most special education services (and especially those being considered as affected by ECE) are delivered in a pull-out basis for students who are mainstreamed rather than in segregated classes or facilities. Accordingly, benefits include the reduction in special education costs but do not net out potential added costs of returning the students to regular classrooms.

4. Minnesota Special Education enrollment, 2007-2008

Primary disability	Number of students	Percent of all students
Non-normative disability		
Developmental Cognitive Disabilities: Mild-Moderate	6,728	0.8%
Developmentally Delayed Education	3,743	0.45%
Emotional/Behavioral Disorder	16,429	2.0%
Specific Learning Disability	30,791	3.7%
Speech/Language Impaired	17,419	2.1%
Mild Hearing Loss and Other Health Disabilities	14,098	1.7%
Normative disability		
Developmental Cognitive Disabilities: Severe Profound	2,180	0.3%
Physically Impaired	1,581	0.2%
Deaf-Hard-Of-Hearing	2,066	0.25%
Visually Impaired	357	0.04%
Deaf-Blind	51	0.01%
Autistic Spectrum Disorders	9,992	1.2%
Traumatic Brain Injury	423	0.05%
Severely Multiply Impaired	779	0.09%
Total	106,637	12.9%
Total Enrollment	828,243	100%

***Source**: Minnesota Department of Education.*

The potential costs and savings for K-12 are calculated using expenditure data from the Minnesota Department of Education. This analysis uses the disability coded as primary type, which is tied to spending, but may not be the only or actual type. The per pupil costs for each primary disability area of special education that could be prevented or ameliorated through ECE are shown in Figure 5. The costs of special education are assumed to be in addition to the cost of educating students on a regular track.

5. Cost of special education by type of disability, Minnesota Special Education enrollment 2007-2008

Primary disability (non-normative)	Per pupil costs
Developmental Cognitive Disabilities: Mild-Moderate	$16,169
Developmentally Delayed Education	$28,502
Emotional/Behavioral Disorder	$14,188
Specific Learning Disability	$7,575
Speech/Language Impaired	$6,057
Other Health Disabilities	$2,260

Source: *Minnesota Department of Education includes costs of administration and instruction.*

Estimated potential annual savings: $21.64 million

Grade repetition

The literature review also found that quality early childhood education reduced the incidence of grade repetition ranging from 6 percent to 23 percent with an average impact of 21 percent (Anderson, 2002).

In Minnesota, about one percent of students have repeated a grade. To account for the targeted ECE program's effect, the grade repetition rate of one percent that would have been experienced by the program participants in the absence of the new ECE program is reduced by 21 percent. For this analysis, we assume that each student who repeats a grade is retained on average a single year.

The cost of grade repetition is assumed to be the cost of an additional year of regular track education for those students who are held back during their K-12 career. In 2007-08, the per pupil cost of regular track enrollment was $7,521.

Estimated potential annual savings: $2.79 million

Net loss of per pupil aid

Inadequately prepared students tend to drop out at a higher rate, and, consequently, schools lose per pupil aid. The evaluation of the Chicago Parent Child Centers found that children who enrolled in that program attended school for .35 more years relative to those who did not participate in the program (Reynolds, 2007). For this analysis, we assume the same results. In the absence of the targeted ECE program, children in the 3-year-old cohort will attend .35 fewer years of school, thereby losing per pupil aid.

However, this per pupil revenue lost due to dropouts must be reduced to account for costs of increased high school usage (per pupil expenditures) if those students do not drop out, usually measured based on teacher wages (Lynch 2007). If only a single student is added to a school, the marginal cost to the school is close to zero. Conversely, if 30 students are added to a school, a new teacher must be hired and additional administrative and transportation costs incurred. This analysis assumes that approximately 1,500 more students would be enrolled in Minnesota schools each year, approximately 4 per high school. Since the added students would tend to be concentrated in certain school districts, a percentage of average cost per student was netted against the increased revenue to the schools as a whole. The average per pupil annual revenue is $9,577, and the marginal cost of serving an additional student is estimated at 20 percent of that amount.

Estimated potential annual savings: $42.30 million

Teacher, school, and K-12 system-specific benefits

Using data from the Early Education Longitudinal Study, Belfield (2004) finds that children who participate in Ohio preschool programs have significant behavioral and cognitive gains over those who do not participate in early childhood education. He estimates that when 40 percent more students attend pre-K:

- Teacher turnover is reduced 24 percent.
- Math and reading achievement scores increase by .3 standard deviation.
- Student behavior improves by 32 percent.

He further finds that a .3 standard deviation increase in student achievement leads to a 19 percent reduction in physical attacks on teachers. The 32 point improvement in student behavior raises the probability that the kindergarten teacher will report "really enjoys current job" or "would choose teaching again."

These findings suggest that there are additional teacher, school, and school system related benefits that can be produced by early childhood education. Belfield (2004) identifies five areas that could potentially be affected by increases in early childhood education enrollment: teacher dissatisfaction, teacher turnover, teacher absenteeism, pupil achievement programs, and school safety expenditures. Following Belfield's analysis, we examine four of these areas for which Minnesota data are available as described below. (No data are available on student achievement or remedial program expenditures in Minnesota.)

We also add a category not examined by Belfield. Recent research suggests that early childhood education may increase the English proficiency of those who are English language learners (Barnett, 2007; Gromley, 2007; and Magnuson, Lahaie, and Waldfogel, 2006).

Teacher turnover

Minnesota has 2,620 kindergarten teachers, 22,945 elementary teachers, 22,732 secondary teachers, and 8,969 special education teachers. For this analysis, we assume that as the cohort of three year olds progresses through each grade level, the tendency for teachers to leave their jobs at each grade level will be reduced relative to the extent to which students have had ECE program participation.

A recent report by the National Center for Education Statistics (NCES) found that the teacher turnover rate nationally is about 16 percent, half moving to different schools and half leaving the teaching profession (Marvel et al., 2006). Based on the reasons teachers expressed for leaving their jobs, about 60 percent are potentially related to dissatisfaction with working conditions due to student behavior or performance that could be influenced by early education. Therefore, we used an estimated turnover rate of 9.6 percent in this study.

For this analysis, we assume that as the cohort moves from grade to grade, the turnover rate for teachers who will encounter students who were enrolled in the targeted ECE program decreases by the estimated Belfield impact of 24 percent.

To calculate the turnover costs, we use a model developed by the Bureau of Labor Statistics which assumes that the cost of turnover is 33 percent of the teacher's salary plus benefits at a rate of 30 percent of salary. The average salary for Minnesota educators is $49,718. Using the Bureau of Labor Statistics model, we estimate the average cost per teacher turnover in Minnesota is about $21,329.

Estimated potential annual savings: $6.22 million

Teacher absenteeism

Similar to the analysis for teacher turnover, we assume that as the cohort of three year olds progresses through each grade level, the tendency for teachers to be absent at each grade level will be influenced by whether students have had an ECE program experience.

This analysis is based on an average number of 171 instructional days for Minnesota school districts and a Minnesota teacher absentee rate of 8.1 percent. Public school teachers in Minnesota who usually work full time but who worked less than full time during the week they were surveyed reported being absent due to personal illness, vacation or personal day, or other family or personal obligations (Kim, 2004; King et al., 2004).

Accordingly, we assume that teachers will be absent about 14 instructional days because of personal illness, vacation or personal days, and other family or personal obligations. All of these reasons are potentially related to dissatisfaction with working conditions due to student behavior or performance that could be influenced by early education. For this analysis, similar to Belfield, we assume that as the preschooler cohort moves from grade to grade, the 14 absent days decrease by about 5 percent for those teachers who will encounter students who were enrolled in the targeted ECE program.

To calculate the costs of teacher absenteeism, we assume that a substitute teacher is hired to cover all instructional days that the teacher is absent and that they are paid the average national substitute teacher rate of $105 per day (National Alliance for Substitute Teachers).

Estimated potential annual savings: $3.74 million

Extra compensation for teachers for unpleasant working conditions

Similar to the analysis for teacher turnover and teacher absenteeism, for this analysis, we assume that as the cohort of three year olds progresses through each grade level, the tendency for teachers to be dissatisfied at each grade level will be influenced by whether their students have had an ECE program experience. Similar to Belfield, we assume that as a cohort without early education moves from grade to grade, teachers would require extra "combat" pay to counterbalance their dissatisfaction, to prevent turnover, and to compensate them for unpleasant working conditions in schools with behavior problems, low achievement, or lack of preparedness for K-12 education among students. That extra pay is equivalent to 3 percent of the average teacher salary of $49,718 or about $1,492 per teacher.

Estimated potential annual savings: $18.89 million

School safety

In 2007-08, the state of Minnesota spent approximately $29 million on school safety initiatives. Following Belfield (2004), we assume that the expansion of early childhood education will increase school safety by 19 percent.

Estimated potential annual savings: $5.85 million

Programs for English language learners

The Des Moines Public Schools report on their web site that, on average, English language learners spend 4.5 years enrolled in specialized programs. Magnuson et al. (2006) find that students of immigrants who enrolled in ECE have English proficiency scores .22 points higher than those not enrolled.

Based on data regarding English language proficiency of parents from the American Community Survey, we estimate that 1547 children in the 3-year-old cohort have a high probability of needing services for English language learners. We assume that students enrolled in ECE will need .22 fewer years of those services by the time they reach the end of their K-12 career. To calculate the costs savings, we use the estimated cost per pupil for English Language Learner services of $1,527.

Estimated potential annual savings: $11.27 million

Figure 6 summarizes the total estimated annual costs of inadequate early preparation for school success are $113 million, ranging from $42 million per year net loss of per pupil aid because of more dropouts to $2.8 million as a result of students repeating a grade.

6. K-12 costs attributable to Minnesota children entering the K-12 system unprepared for school success

Cost category	In millions
K-12 Special Education	$21.64
K-12 Grade repetition	$2.79
K-12 Net loss of per pupil aid	$42.30
K-12 Teacher turnover	$6.22
K-12 Teacher absenteeism	$3.74
K-12 Extra compensation for teachers	$18.89
K-12 School safety	$5.85
K-12 English Language Learner Program usage	$11.27
Total K-12 costs	$112.70

Additional considerations and issues

Many of the savings that we enumerate were considered and measured only by a subset of the relevant studies of the impact of early childhood education. And, in some cases, we have used the best assumptions made by other researchers because no accurate measurements of certain cost savings have been made to date. Nevertheless, we believe these cost savings estimates to be conservative for two reasons.

First, where we had a choice of a given effect from among several studies which showed a range of effects, we chose the average effect or from the lower part of the range.

Second, there is an additional list of potential cost savings to the K-12 system that was not included in this analysis. These include reduction in the use of achievement enhancement and remedial education programs, reduced non-instructional and health costs related to special education and preventable health problems, reduced costs for alternative schools, recapture of lost revenues from parents choosing private or charter schools, and reduced costs of having to provide education to students in juvenile detention. While there is reason to believe that early childhood education could affect these categories of school expenditure, these savings could not be included because there has been no research to measure or monetize the effects of ECE programs in these areas. To the extent that savings might be realized in all or some of these areas, the estimates presented here understate the total savings to the K-12 system.

Cost burden relative to cost of targeted program

According to the research literature, $113 million of K-12 cost could be saved through providing a two-year early childhood education program that follows key principles of effectiveness identified in evidence-based programs for a targeted population of three-year-olds. This savings could defray part of the cost of such a program. The total cost of the two-year program envisioned here is $188.7 million per year per cohort of students, or about $377 million over two years to serve all of the estimated 13,229 three year olds in the target population not currently being served at a cost of $13,457 per student.

Enrollment rates

Currently, 5.9 percent of three year olds at or below 125 percent of poverty line attend some form of private preschool or nursery school, and 15.2 percent of three year olds attend a public program (Ruggles et al., 2008). Given the quality of Minnesota's current ECE initiatives, researchers assumed that the enrollment levels in the current group of early childhood programs would stay the same after creation of the new program. Therefore, the main effect of the program would be to extend early childhood education to children within the target group who currently do not have access to it. Figure 7 (next page) displays the enrollment figures under the current system of provision and under 100 percent, 75 percent, and 60 percent enrollment rates for the proposed ECE program. Under a 100 percent enrollment rate of the target group about 79 percent of these three year olds will be enrolled in the new program. With a 75 percent enrollment rate about 59 percent will be enrolled in the new program, and 47 percent would be enrolled with a 60 percent enrollment rate.

7. Provision of early childhood education for children age 3 in Minnesota

	3 year olds at or below 125% of poverty		All 3 year olds		
	Count	Percent	Count	Percent	Percent Change
Current ECE Provision					
Public PK or Nursery School	2,551	15.2%	9,375	12.9%	na
Private PK or Nursery School	983	5.9%	10,094	13.8%	na
Total Not Enrolled	13,229	78.9%	53,479	73.3%	na
Total Enrolled	3,534	21.1%	19,469	26.7%	na
New ECE Provision (100% Enrollment)					
New ECE Program	13,229	78.9%	13,229	18.1%	na
Public PK or Nursery School	2,551	15.2%	9,375	12.9%	0.0%
Private PK or Nursery School	983	5.9%	10,094	13.8%	0.0%
Total Not Enrolled	0	0.0%	40,250	55.2%	-24.7%
Total Enrolled	16,763	100%	32,698	44.8%	67.95%
New ECE Provision (75% Enrollment)					
New ECE Program	9,922	59.2%	9,922	13.6%	na
Public PK or Nursery School	2,551	15.2%	9,375	12.9%	0.0%
Private PK or Nursery School	983	5.9%	10,094	13.8%	0.0%
Total Not Enrolled	3,307	19.7%	43,557	59.7%	-18.55%
Total Enrolled	13,456	80.3%	29,391	40.3%	51.0%
New ECE Provision (60% Enrollment)					
New ECE Program	7,937	47.4%	0	0.00%	na
Public PK or Nursery School	2,551	15.2%	6,824	12.2%	0.0%
Private PK or Nursery School	983	5.9%	9,111	16.2%	0.00%
Total Not Enrolled	5,292	31.6%	40,250	71.6%	-14.8%
Total Enrolled	11,471	68.4%	15,935	28.4%	40.8%
Total Population	16,763	100%	72,948	100%	na

Source: *American Community Survey 2006*

Program costs

The cost per child per year of preschool and early childhood education programs varies substantially. For instance, the annual cost of the Abecedarian program for three and four year olds was $13,170 per student; while the cost per year for Chicago Child Parent Centers (CPC) was $6,913 (Issacs, 2007; Karoly, Kilburn, and Cannon, 2005). For the new Minnesota program, researchers assumed an annual per pupil cost of $13,457. This figure was calculated by averaging the program costs for Abecedarian, Chicago CPC, and Perry Preschool and adjusting for inflation. For perspective, the MELF Saint Paul Scholarship Program provides $13,000 per child and Educare Centers cost about $15,000 per child. Therefore, for the targeted full-day ECE program which would enroll 13,229 three year olds, the total yearly cost is about $188.7 million. The two-year cost of $377 assumes that the costs in the second year are not reduced because the three-year-olds will stay in the program rather than transfer to a different program.

Figure 8 compares the cost savings in different categories with the total cost of the program. As the table shows, the total cost savings represent about 30 cents for every dollar of program cost. That level of savings is within the range of potential return on investment from 19 cents to $1.18 shown in Figure 3.

The calculations in Figure 8 assume that the entire targeted group of 13,229 three year olds are enrolled in and complete the two-year early childhood program. Amounts are calculated in 2009 projected dollars.

8. Costs of inadequate preparation compared to the cost of a targeted two-year early childhood education program

Cost category	
K-12 Special Education	$0.06
K-12 Grade repetition	$0.01
K-12 Net loss of per pupil aid	$0.11
K-12 Teacher turnover	$0.02
K-12 Teacher absenteeism	$0.01
K-12 Extra compensation for teachers	$0.05
K-12 School safety	$0.02
K-12 English Language Learner Program usage	$0.03
Total K-12 Costs	**$0.30**
Total savings	$113 million
Total early childhood education program costs	$377 million

Note: *The costs per category were rounded to the nearest penny. Before rounding, the costs added to .30.*

Net costs per year relative to enrollment rates in targeted program

These estimates imply that 30 percent of the costs of an early childhood program would eventually be recouped in lower costs in the K-12 system. Thus, the annual net cost implementing and maintaining such a program is estimated to be about $264 million dollars, the difference between $377 million of program costs and $113 million of savings. Those figures assume 100 percent enrollment in the early childhood program by eligible students. If the usage rates were lower, the program costs and cost savings would be correspondingly lower. Figure 9 shows the comparison of net costs for three different usage rates.

9. Net cost of the proposed ECE program with different enrollment rates

$ In Millions	100% enrollment	75% enrollment	60% enrollment
Gross ECE Program Cost	$377	$283	$226
K-12 Cost Savings	$113	$85	$68
Net Cost	$264	$198	$158

The data in Figures 8 and 9 show the total cost savings that would be realized throughout the K-12 system when children at all grade levels have had the benefit of the early childhood program being analyzed here. However, if such a program were initiated, the savings in K-12 would only be realized as each cohort of students moved up though the grades. In particular, no savings in the K-12 system would be realized in the first year of program. As cohorts of students enrolled in kindergarten and then moved through the grades, the savings would increase each year until they reached the full $113 million in the fifteenth year of the operation of the program. Thus, the phasing in of such a program would involve annual net costs of more than $264 million, the estimated ultimate net annual cost of the early childhood program.

Net costs over 15 years

Figure 10 presents estimates of the gross annual spending on the early childhood program, the realized benefits in each year, and the estimated net cost of the program during its first 15 years of operation.

10. Estimated annual ECE spending and K-12 savings for first 15 years of the ECE program ($ in millions)

Year	Grade of 1st cohort	ECE Program Cost	K-12 Education Savings	Net Cost
1	Pre 3	$189	-	$189
2	Pre-4	$377	-	$377
3	Kgn	$377	$5.4	$372
4	1st	$377	$10.8	$366
5	2nd	$377	$16.2	$361
6	3rd	$377	$21.7	$355
7	4th	$377	$27.1	$350
8	5th	$377	$32.5	$345
9	6th	$377	$37.9	$339
10	7th	$377	$43.3	$334
11	8th	$377	$48.7	$328
12	9th	$377	$54.1	$323
13	10th	$377	$73.7	$303
14	11th	$377	$93.2	$284
15	12th	$377	$113	$264
Totals		$5.47 billion	$577 million	$4.89 billion

As the data in the figure show, the phasing in of savings as the students mature would end up offsetting about $577 million of program costs, or about 10.5 percent of the total gross expenditure. Total gross expenditures for the 15 years are estimated at $5.5 billion. The deduction of $577 million of savings reduces the net expenditure to $4.9 billion over 15 years. Thereafter, the savings would provide offset of 30 percent of program costs in each succeeding year.

These estimates are based on 100 percent enrollment in the program and a constant number of three year olds in succeeding cohorts. If the usage rate is less than 100 percent, estimated costs and savings would be reduced proportionately. If later age cohorts were larger or smaller than the 13,229 used in this analysis, the dollar figures would be correspondingly larger or smaller.

Program options for spending potential cost savings

Figure 11 shows 3 alternatives for spending the potential cost savings of $113 million per year. For example, $113 million would pay for:

- A one-year program for the entire cohort of low-income children considered here if the program could be delivered at a cost of $8,542 per student;
- A more basic two-year program costing half as much could also be delivered to the whole cohort for the same total cost;
- A targeted two-year program provided to a smaller group determined to be at highest risk for school failure.

Many different combinations of program cost, program length, and program coverage are possible. Further research and analysis would be necessary to determine which strategy might produce the greatest savings for the schools.

11. Alternative early childhood programs that would cost $113 million

	Full coverage of target low-income group for one year	Full coverage of target low-income group for two years	Targeted to most at-risk low-income group for two years
ECE cost per year per student	$8,542	$4,271	$13,457
Years of ECE per student	1 year	2 years	2 years
Number of students served	13,229	13,229	4,199
TOTAL COST	$113 million	$113 million	$113 million

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Appendix

A1. K-12 Effects of Early Childhood Education Programs

	Perry Preschool		Abecedarian		Chicago CPC		Aos et al. (2004) meta-analysis of ECE Programs
Outcome	Percent difference		Percent difference		Percent difference		Effect Size
Special Education	-12%*	(of years by age 19)	-23.2%*	(by age 15)	-10.2%***	(by age 18)	-0.13
Emotional or behavioral disorder	–		–		0%[a]	(grades 1 to 8)	–
Mental retardation	–		–		-0.9%[a]	(grades 1 to 8)	–
Specific learning disability placement	–		–		-3.5%*[a]	(grades 1 to 8)	–
Speech and language impairment placement	–		–		-1.7%[a]	(grades 1 to 8)	–
Grade Retention	-0.2	(years by age 27)	-23.3%*	(by age 15)	-15.4%***	(by age 15)	-0.18

Source: *Karoly and Cannon (2005) Table 3.5. Conyers, Ou, and Reynolds (2003); Aos (2004) Table C1.a*

Notes: *Percent difference refers to the experimental group's figure subtracted from that of the comparison/control group.*

The figures followed by "a" are adjusted for several demographic characteristics; see Conyers, Ou, and Reynolds (2003).

*Statistical significance is indicated by asterisks: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

A2. K-12 Costs and Benefits of Early Childhood Education (2008 $)

	Perry	Head Start	Chicago CPC	Abecedarian	Aos et al. (2004) meta-analysis of ECE Programs
Special Education (SE)	No data	$2,211.33	$5,498.85	No data	$138.68
Grade Retention (GR)	No data	$207.57	$910.34	No data	$223.75
Grade Retention and Special Education	$16,706.12	$2,418.90	$6,409.19	$8,790.52	$362.43
Cost of Program	$17,282.51	$14,750.75	$8,056.24	$49,960.79	$7,785.87
Ratio of GR and SE benefits to program cost	0.38	0.17	0.73	0.21	0.04

Source: *Karoly and Cannon (2005) Table 4.4; Aos (2004) Appendix E; Masse and Barnett (2002) Table 8.2 ; Reynolds et al. (2002) Table 5A; Currie (2001) Table 3; Isaacs (2007) Table 2; Barnett (1985) Table 3*

Notes: *K-12 Benefits include grade retention and special education. Values are adjusted using the Consumer Price Index for All Urban Consumers. na=not applicable/available. Benefits and costs are per participant.*

A3. Minnesota K-12 Enrollment 2007-2008

Grade	Total	Special Education	Special Ed & Reduced lunch	Special Ed & Free lunch	% Special Ed	% Special Ed and Reduced	% Special Ed & Free lunch	Non special Ed	Grade Retained	% Grade retained	Regular Track	% Regular track	Less than English	% LEP
KG	60845	6,019	610	2161	9.89%	1.00%	3.55%	54,826	985	1.62%	53,841	88.49%	6,886	11.32%
1	60433	6,593	697	2504	10.91%	1.15%	4.14%	53,840	463	0.77%	53,377	88.32%	6,979	11.55%
2	59537	6,823	711	2593	11.46%	1.19%	4.36%	52,714	122	0.20%	52,592	88.33%	6,378	10.71%
3	59092	7,783	797	2937	13.17%	1.35%	4.97%	51,309	79	0.13%	51,230	86.70%	5,897	9.98%
4	59327	8,566	897	3036	14.44%	1.51%	5.12%	50,761	37	0.06%	50,724	85.50%	5,266	8.88%
5	59238	8,953	855	3221	15.11%	1.44%	5.44%	50,285	40	0.07%	50,245	84.82%	4,948	8.35%
6	60723	8,399	828	3125	13.83%	1.36%	5.15%	52,324	65	0.11%	52,259	86.06%	4,335	7.14%
7	62947	8,504	819	3266	13.51%	1.30%	5.19%	54,443	174	0.28%	54,269	86.21%	4,019	6.38%
8	64676	8,485	855	3247	13.12%	1.32%	5.02%	56,191	236	0.36%	55,955	86.52%	3,820	5.91%
9	68876	8,744	835	3392	12.70%	1.21%	4.92%	60,132	571	0.83%	59,561	86.48%	4,233	6.15%
10	69698	8,637	755	3313	12.39%	1.08%	4.75%	61,061	456	0.65%	60,605	86.95%	4,132	5.93%
11	70471	8,264	669	2860	11.73%	0.95%	4.06%	62,207	472	0.67%	61,735	87.60%	3,090	4.38%
12	73321	10,867	670	3465	14.82%	0.91%	4.73%	62,454	4755	6.49%	57,699	78.69%	2,643	3.60%
Total	828,243	106,637	9,998	39,120	12.88%	1.21%	4.72%	721,606	8,455	1.02%	714,092	86.22%	62,626	7.56%
Avg	63,783	8,203	769	3,009	12.85%	1.22%	4.72%	55,581	650	0.95%	54,930	86.21%	4,817	7.71%

Source: *Minnesota Department of Education*