

Preschool Outcomes: A Literature Review

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Executive Summary

The early childhood education outcomes literature demonstrates that quantifiable lifetime benefits in excess of program costs can be substantiated by longitudinal data for certain pre-kindergarten (pre-K) programs. This was done convincingly in randomized or quasi-experimental studies of three local programs operating in Michigan, Illinois and North Carolina three to five decades ago. At least for certain subsets of the population and certain types of preschools, many studies provide support for the three programs' various findings, which are commonly cited. Preschool participation appears to have a favorable effect on whether a child receives special education services, repeats a grade, graduates from high school, undertakes postsecondary education, commits crime, maintains employment, has good earnings, relies on welfare programs, and avoids harmful substances.

On the other hand, careful research evaluating short- and long-term impacts of Head Start preschools nationwide and state-instituted, "high-quality" preschools in

Tennessee, both in the early 2000s, showed mixed results, suggesting favorable lifetime cost-benefit outcomes are by no means guaranteed. The Tennessee study benefitted from a randomized research design that followed children about five years from pre-K enrollment.² The Head Start research, based on established longitudinal surveys, controlled for family characteristics and documented outcomes through adulthood. Collectively, they show us that pre-K benefits in terms of kindergarten preparedness and broader criteria may fade by the third grade, and some subgroups of participants may not be any better off than similar children who did not attend preschool. We cannot assume pre-K outcomes in a particular setting will include a complete array of lifetime benefits documented for other pre-K programs.

In spite of known pitfalls, one research approach involves estimating dollar benefits of preschool programs based on preschool effects generalized from the literature described in the first paragraph, including the Michigan, Illinois, and North Carolina experiences. Such statewide studies are not strictly measuring something that happened in the state of interest. Instead, they use outside findings to predict what may have happened or what might happen there. They select from the literature a set of outcomes they expect will be relevant to their setting. For at least six states noted, a research institute has prepared this type of non-longitudinal study in a fairly sophisticated way, given inherent limitations in matching treatment effects from cobbled sources with costs from (mostly) local data.³

Impediments to reliable preschool impacts evaluations include the uncommon occurrence of an appropriate

A companion two-page document provides highlights from the early childhood education literature and a succinct summary of this report. See "Snapshot: Review of Early Childhood Education Research" by the Kem C. Gardner Policy Institute, also December 9, 2015.

experimental design, the lack of relevant longitudinal data, and the limited applicability in other settings of results from a few well-documented programs.

An ideal research design involves random selection of subjects to treatment and control groups, which is uncommon in real-world, publicly-funded programs with purposeful admission criteria. Non-experimental research designs construct comparison groups matched to preschool treatment groups with varying degrees of suitability.

As for longitudinal data availability, follow-up with preschool participants rarely extends beyond a post-preschool assessment or test scores during grade school. Data requirements to avoid heavy reliance on inference and imputation include individual-level observations without too much attrition covering educational attainment, crime, earnings, welfare program participation, health and other topics over subjects' lifetime.

Finally, model preschool programs and those designed for inner-city residents are not the same as the ones Salt Lake County or some other place would implement. Some essential characteristics are the duration of preschool, curriculum design and delivery, class size, funding level, and requirements to enter the program. Furthermore, even if students receive the same preschool opportunities, factors affecting their futures may vary significantly by community, such as family support, race, student choices, culture, and work opportunities. Studies of programs operating recently will be inadequate because insufficient time has passed to permit follow-up through adulthood.⁴

Table 1 presents estimates of lifetime benefits associated with preschool participation in three prominent programs, along with program costs and the associated benefit-cost ratios. Outcomes from these programs, as well as a

meta-analysis of many others, suggest certain preschool programs in the U.S. have generated dollar benefits over the very long term of between 2.4 and 16.2 times the cost of operating them. Next we discuss these numbers and why several studies discussed in this literature review are not represented in the table, before providing an overview of this reports remaining sections.

All seven benefits estimates in the "Benefit-Cost Results..." table include savings during K–12 education from fewer *grade retentions* and *special education* placements. *Crime* reduction impacts are also evaluated in all of the studies, although the crime effect for Abecedarian students is zero. All but the last study include *lifetime earnings*. Benefit components that are estimated only in certain studies are as follows: participants' *welfare* use as adults in the Abecedarian and HighScope Perry studies, *child welfare* needs in the Chicago CPC studies, the value of *child care* in five studies excluding Temple and Reynolds (2007) and Heckman et al. (2010a), *health* outcomes in both Abecedarian studies, *maternal earnings* in Temple and Reynolds (2007), and *second generation earnings* in Barnett and Masse (2007). Finally, Aos et al. (2004) estimate benefits from *high school graduation* and *test scores*, which presumably are proxies for lifetime earnings or other outcomes.

The two Head Start studies reviewed in Section 3 (Currie and Thomas 1995, Garces et al. 2002) did not give benefit-cost ratios and were not comprehensive, quantitative early childhood education program evaluations, although they provided valuable insights about preschool outcomes, particularly during K–12.

The other multi-study review from Section 4 (besides Aos et al. 2004), Barnett (1995) reviewed 36 programs for cognitive and school outcomes, such as IQ, standardized

Table 1
Benefit-Cost Results for Preschool Impact Studies of Three Programs and a Meta-Analysis
3 percent discount rate, 2014 dollars⁵

Pre-K Program ⁶	Benefit-Cost Ratio ⁷	Program Cost per Child	Lifetime Benefits per Child	Source
Abecedarian, North Carolina	2.7 ⁸	\$47,200 ⁹	\$178,400	Temple and Reynolds (2007)
	2.5	\$83,500	\$208,300	Barnett and Masse (2007)
Chicago CPC, Illinois	7.1	\$9,700	\$69,400 ¹⁰	Reynolds et al. (2002)
	6.9 ¹¹	\$9,700	\$98,700	Temple and Reynolds (2007)
HighScope Perry, Michigan	16.2	\$20,300	\$328,200	Pianta et al. (2009)
	6.6–12.2 ¹²	\$20,900	\$179,400 ¹³	Heckman et al. (2010a)
Meta-analysis, various places ¹⁴	2.4	\$9,400	\$22,100	Aos et al. (2004)

test scores, grades, grade retention, special education placement, and high school graduation. Program costs and lifetime benefits per child were not reported.

Two statewide pre-K studies for Michigan, reviewed in some detail in Section 5 (Chase et al. 2009), also did not report benefit-cost ratios. Chase et al. (2009) estimated the aggregated dollar impact in 2009 of 25 years of preschool spending in Michigan.¹⁵ Lacking the data to evaluate the benefits of Michigan preschool participation based on student outcomes follow-up with a control group, Chase and Diaz (2011) considered what it may be worth to have another child ready for kindergarten—an estimated \$34,823¹⁶—including similar types of benefits as the 2009 study.

1. Leading longitudinal pre-K program studies' validity in Utah

How relevant to Utah are outcomes from pre-kindergarten programs evaluated in key studies on the long-term benefits of early childhood education elsewhere? The three programs addressed in this section—HighScope Perry, Carolina Abecedarian and Chicago Child-Parent Centers (CPC)—were active in the 1960s, 1970s, and/or 1980s.¹⁷ Several comparability issues merit attention, such as demographics and culture. The Appendix lists detailed characteristics for these three studies' programs and public preschool in Utah.

The programs evaluated operated in inner-city Chicago (CPC), a mid-sized city near Ann Arbor, Michigan (Perry), and a small city outside of Durham, North Carolina (Abecedarian). Participants were considered at-risk by measures such as socioeconomic status (all three) and IQ (Perry). Utah preschools likewise enroll children who are at-risk in terms of parental income and other characteristics. Households generally self-select for child preschool enrollment, rather than being selected by schools based on any criteria. However, by waiving tuition based on a sliding scale tied to household income, public preschools in Utah may attract a disproportionate share of low-income students. Even if absolute or relative socioeconomic characteristics of Utah children do not closely match those of the children participating in the three model programs, while the impact of preschool attendance on lifetime educational outcomes is greater for "disadvantaged" children, significant gains are generally present for "nondisadvantaged" children (Pianta et al. 2009).

Participants in all three studies were predominantly African American, 94 percent or more. In contrast, only 2

percent of Granite School District's population under 18 is African American. About one-fourth of Utah's school-aged children belong to a minority, and about 40 percent of Granite School District students are Hispanic, Black, Asian or Pacific Islander, American Indian or Alaska Native, or of two or more races.¹⁸ Based on short-term cognitive outcomes for children who attended preschool in Tulsa, Oklahoma, compared to African American students, white children improved somewhat less and Hispanic children improved somewhat more on performance tests, although all groups showed statistically significant improvement in at least two of the three areas tested (Gormley 2010).¹⁹ Two longer-term nationwide studies²⁰ that controlled for household sociodemographic characteristics found that persistent gains in children's test scores, a reduced likelihood of grade repetition, and higher rates of high school completion associated with Head Start attendance were statistically significant for white children, but not for African American children (Currie and Thomas 1995, Garces et al. 2002). If race is a factor along these lines, it is possible that Utah's population will benefit *more* from preschool than the participants in the three studies discussed in this section. However, the Tulsa IQ studies suggested otherwise. Additional research would be needed to consider the impact of race and ethnicity in combination with other socioeconomic and family characteristics that affect students' responsiveness to preschool intervention.

At twelve hours a week during the school year, Granite School District's half-day preschool program for four-year-olds is fairly similar in hours to the Perry and Chicago programs, whereas the Abecedarian program was full-day and year-round from infancy. On the other hand, at six hours a week, preschool for three-year-olds in the Granite district is more limited than any of the three programs, which offered at least fourteen hours a week at that age. Public preschools in Utah do not offer weekly home visits like the Perry program, nor do they provide extensive parental support and school benefits through third grade like Chicago Child-Parent Centers.

The 1960s study (HighScope Perry) is capable of the longest follow-up period, through age 40, whereas the others reach into adulthood, with the last follow-ups to date coming at ages 21 or 26. All provide a wealth of information from interviews, surveys, school records and background checks. Apparently, the earliest group of Utah public preschool pupils that has been studied in even a limited way in the years following preschool attendance has yet to complete elementary school. Public preschool in

the Granite School District, which is the state's pioneer in establishing mainstream pre-K services, apparently began in the mid- to late-1990s and expanded since the middle of the next decade. Granite School District or the State Office of Education would likely be able to provide more follow-up data for preschool participants as time passes.

Per-pupil funding levels are likely to have some bearing on the quality and impact of pre-K in Utah. At less than \$2,500 in spending per pupil over two years, Utah's Granite School District preschool is funded at approximately 3 percent, 12 percent and 26 percent of the spending by programs identified in this section.²¹ Perhaps related to cost advantages here, the education credentials of teachers in Utah preschools appear to be lower than those of teachers in the three studies. In general, the quality of the two model programs (Perry and Abecedarian) would be higher than that of a large, public program (Chicago CPC) (Barnett 1995). Chicago CPC appears to be most like Utah in terms of funding and teacher qualifications.

Two small studies (Perry and Abecedarian) achieved nearly random assignment to treatment and control groups, while the other developed a quasi-experimental comparison group (Chicago). In these cases, programs selected children on the basis of living in particular neighborhoods and being perceived by program directors as at-risk. High rates of participation characterized those invited to free pre-K programs. Preschool participation in Utah, on the other hand, is driven by parent interest. Self-selection by households confounds the impact of the preschool treatment with the effect of a child belonging to a family that manifestly takes initiative to find, and perhaps pay for, the child's preschool opportunity. In Granite School District, tuition charges of up to \$160 per month are waived for children living in Title 1 school boundaries and are reduced for children with parents who have limited income or volunteer enough at school. The variable tuition acts as a financial incentive favoring households with (1) more need based on their low income or residence in low-income neighborhoods and (2) more parental time and inclination to be involved with their children's education. Tuition policies may frame the voluntary enrollment option more favorably for at-risk children. Regardless, participants largely self-select at the household level.

To pursue this point a moment longer, effects observed in studies of programs with a minimal role for parental initiative in child enrollment may not apply to Utah preschools with voluntary enrollment. Those studies may lead us to overstate expected gains from preschool in Utah, if participating children's better outcomes in school and life

are partially attributable to the quality of their upbringing. Even if some future longitudinal study of Utah children were to reveal a marked advantage for those who attend preschool comparable to or exceeding what we find in the literature, it would be difficult to know that the advantage came from preschool, not family influences.

Next, we turn to crime outcomes associated with preschool participation. The reduced incidence of crime evident for the Ypsilanti (Perry) and Chicago (CPC) programs may not apply equally to Utah, depending on the composition of those crimes. At least for 1995 and 2014, *violent* crime rates were low in Utah compared with Michigan, Illinois and the other states. However Utah's *property* crime rates in those years were higher than the median of other states.²² Further review would be needed to assess the relative importance of violent crime and property crime in terms of preschool effects and costs for victims and the criminal justice system.

A significant reduction in crime did not occur for the Abecedarian program in Chapel Hill, which was a low-crime area compared to Chicago and Ypsilanti, Michigan. In that regard, there may be less room for improvement in Utah than in Chicago during the 1960s, for example. A nationwide longitudinal study of Head Start students found the reduction in crime from preschool participation was most significant for African American students (Garces et al. 2002). A Michigan study estimated lifetime cost savings per child from school readiness for Detroit (\$99,732) and the entire state of Michigan (\$39,473). Fully 92.7 percent of the \$60,259 difference in impacts (before adjusting for out-migration) was attributed to greater crime reduction in the city compared to the state (Chase and Diaz 2011).

Reduced health care spending made up 11 percent of the estimated benefits from Abecedarian preschool attendance. That result was based primarily on an adult smoking effect that was only slightly larger (16 percent versus 13 percent) than that observed in the HighScope Perry study, which also noted reduced substance abuse.²³ Though measured at different ages (21 and 40), both control groups had smoking rates of 55 percent. The prevalence of tobacco use in the U.S. has declined markedly in recent decades.²⁴ By comparison, 55 percent is 20 points higher than the 1980 percentage of adults who smoked and nearly five times the 2011 percentage of Utah adults who smoked. Whereas reduced healthcare costs from avoiding smoking may not be as large a benefit in Utah as it was in the Abecedarian or Perry cases, other health care benefits may be substantial in Utah, if they could be reliably measured or inferred.²⁵

Special education is another area where Utah pre-K may not compare cleanly with the Abecedarian, Chicago CPC, or Perry programs. The reduction in special education placement rates for the first cohort in Utah's Granite School District was 28 percent, which is larger than the reductions achieved by those three programs (10 percent to 23 percent).²⁶ To estimate which children might have needed special education services but for attending Granite's preschool, standardized test scores were used in place of IQ scores and in the absence of actual student outcomes for a control group.²⁷ For the other three programs, the lowest special education placement rate for children attending preschool was 12 percent, compared to the remarkable 2.3 percent placement rate achieved by Granite School District through third grade for the first cohort.²⁸ Based only on special education savings, Dubno (2010) implies a pre-K benefit-cost ratio²⁹ of as low as 0.57, for only the two to four years following preschool that children in the three cohorts were tracked, or as high as 2.98 for the first cohort, assuming placement by the third grade with no return through graduation³⁰—which can be roughly compared to the range of 0.14 to 0.73 for the most prominent studies, which considered special education and grade retention cost avoidance throughout K–12.³¹

Instead of applying *outcomes* from other preschool programs, one could attempt to incorporate the *methods* used to evaluate those programs. A carefully constructed comparison group like Chicago CPC would be more feasible in Utah than the Abecedarian or HighScope Perry designs. However, a longitudinal study of preschool in Utah likely would not extend much beyond the scope of a study documenting special education placement and third grade test scores of preschool participants in Granite School District (Dubno 2010). Available Utah data does not link preschool attendance to educational attainment, earnings, crime, welfare use, etc. through adulthood.

A more conservative research approach is demonstrated in a recent education report addressing preschool policy in the state (Utah Foundation 2013). The study briefly reviews the preschool impact literature and describes the features and funding of preschool programs in peer or benchmark states, among which are Colorado, Massachusetts, Minnesota, New Jersey and North Dakota. Outcomes reported for those states include grade school test scores and students' emotional maturity and social development. The purpose of the report is to identify best practices in public education.

2. Findings and methods— HighScope Perry, Abecedarian, and Chicago CPC studies

This section provides some explanation of data sources and estimation methods used in cost-benefit analyses of the three benchmark programs discussed in Section 1. Tables 2 and 3 summarize benefit-cost ratios and other findings from the Perry, Abecedarian and Chicago programs. These preschool programs provided quantifiable benefits well in excess of program costs.

The Abecedarian program has the highest percentage of participants who later attended college, as reflected in its high postsecondary education costs compared to the Chicago and Perry studies. This is particularly striking since the Abecedarian program followed participants only through age 21, a shorter time than the other studies. Other substantial differences in program outcomes also suggest that time, place, and program characteristics make extrapolation problematic.

For the HighScope Perry program, Heckman et al. (2010a) provide a wide range of benefit-cost ratio results based on a variety of estimation methods, generally from 7 to 12 given a 3 percent discount rate, considerably lower than the result in Pianta et al. (see Table 3). Total benefits are also much lower in the more robust Heckman study, under some specifications more than 50 percent lower, mostly due to careful crime and earnings estimates. Heckman's internal rate of return was 7 percent to 10 percent, depending on the estimation method.

The actions or processes described below give an overview of estimation methods in the Heckman study, the most reliable of various benefit-cost studies over the years for the HighScope Perry program. Estimation methods in Heckman et al. (2010a) include:

- Obtaining education spending figures for grades K–12, GED completion, special education, vocational training and college attendance
- Imputing and extrapolating earnings between and beyond the few years for which earnings are known from participant interviews, based on the National Longitudinal Survey of Youth (NLSY) and the Panel Survey of Income Dynamics
- Looking up juvenile and adult arrests and convictions for a variety of crimes in multiple jurisdictions

Table 2
Findings from Three Pre-K Evaluations

Variable	Abecedarian	Chicago CPC	HighScope Perry
Increased IQ, short term	Yes	Not collected	Yes
Increased IQ, long term	Yes	Not collected	No
Increased achievement, long term	Yes	Yes	Yes
Special education	25% vs. 48%	14% vs. 25%	37% vs. 50%
Retained in grade	31% vs. 55%	23% vs. 38%	35% vs. 40%
High school graduation	67% vs. 51%	62% vs. 51%	65% vs. 45%
Ever arrested as juvenile	45% vs. 41%	17% vs. 25%	16% vs. 25%
Mean number of adult arrests	1.7 vs. 1.5 (age 21)	Not collected	2.3 vs. 4.6 (age 27)
Adult smoker	39% vs. 55% (age 21)	Not collected	42% vs. 55% (age 40)

Source: Pianta et al. (2009, p. 64, Table 1)

Table 3
Cost-Benefit Results from Three Pre-K Evaluations
3 percent discount rate, 2014 dollars³²

Variable	Abecedarian	Chicago CPC	HighScope Perry
Cost	\$83,091	\$9,709	\$20,321
Child care	\$36,156	\$2,394	\$1,214
Maternal earnings	\$89,966	\$0	\$0
K-12 cost savings	\$11,566	\$7,038	\$10,655
Postsecondary education cost	-\$10,639	-\$805	-\$907
Abuse and neglect cost savings	Not estimated	\$1,086	Not estimated
Crime cost savings	\$0	\$48,305	\$229,757
Welfare cost savings	\$256	Not estimated	\$986
Health cost savings	\$23,275	Not estimated	Not estimated
Earnings	\$49,129	\$40,106	\$86,459
Second generation earnings	\$7,490	Not estimated	Not estimated
Total benefits	\$207,200	\$98,627	\$328,163
Benefit-cost ratio	2.5	10.2	16.2

Source: Pianta et al. (2009, p. 64, Table 1)

- Amplifying crime counts with national estimates of unreported crime, the Uniform Crime Report and National Crime Victimization Survey
- Determining costs to the criminal justice system and victims for a variety of crimes, including the value of life in the case of murder
- Approximating income tax rates and the deadweight loss associated with taxation
- Counting and valuing various cash and in-kind welfare benefits received and extrapolating incidence and duration of their use to extend what is known from participant interviews, based on NLSY and the Survey of Income and Program Participation
- Relying on earlier analysis for Perry preschool program costs per pupil, including overhead
- Discounting costs and benefits with rates ranging from 0 percent to 7 percent

The Carolina Abecedarian program has a somewhat more limited longitudinal dataset than the Perry program, since age 21 is the last follow-up point for the former. Barnett and Masse (2007) conducted one of the leading benefit-cost studies on this program. Below are some comments regarding data sources and estimation methods they employed in eight principal areas.

- Elementary and secondary education cost savings were derived from school records for study participants regarding grade repetition and special education placements.
 - Maternal earnings for ages 26–40 were higher for those whose children participated in Abecedarian preschool. This effect of about \$4,000 annually (in 2014 dollars) was separate and subsequent to the benefit of child care that mothers received during their child's enrollment period. Outside data was used to fill in gaps in maternal earnings before age 40, and to project earnings thereafter through age 60.
 - Lifetime earnings of preschool participants were extrapolated from Census data based on age, race, gender and educational attainment, with no information available regarding actual participant earnings past age 21. Presumably the preschool treatment effect is embodied in educational attainment at age 21. Heckman et al. (2010a) noted the heavy reliance on extrapolation for this large piece of the Abecedarian benefit-cost estimation.
 - Earnings of future generations are based on elasticities (0.15 to 0.35), estimated in other studies, to capture the impact of an increase in the earnings of preschool participants on the next generation.
 - Reduced healthcare cost estimates are based solely on whether study participants were smokers as adults, which was less likely (though not significantly so) for those who attended preschool. Other studies supplied figures for the economic value of a person living and working longer and the lower life expectancy of smokers compared to non-smokers.
 - Higher education costs are based on educational attainment through age 21 and exclude vocational or other adult training.
 - Welfare use can be documented for participants only with respect to Aid to Families with Dependent Children (AFDC), but a study by the Committee on Ways and Means on participation in other programs was used to predict participation in those programs conditioned on participation in AFDC. Assumptions on the duration of involvement with each program were necessary. A welfare transfer was not counted as a net cost to society, but the associated administration expense of collecting taxes and running programs was considered a social cost.
 - There was scarcely any crime in the treatment or control groups, insufficient to warrant an estimate of a benefit in this area, in contrast to the Perry and Chicago programs.
- Next we review data sources and estimation techniques for the Chicago CPC study (Reynolds et al. 2002). Separate per-pupil dollar benefit and cost outcomes are given for the preschool program, apart from the school-age and extended programs provided by the Child-Parent Centers (Table 5, pp. 283–284). Results are also categorized by measured and projected effects, and by public and private benefits.
- Itemized program expenses are totaled for the preschool and school-aged programs (Table 3, p. 275), divided by years of child participation.
 - K–12 education costs avoided from reduced retention and special education needs are estimated for Chicago schools, at \$4,494 and \$7,791, respectively, apparently in 1995 or 1997 dollars. Grade retention is valued at the cost of an additional year of enrollment at age 19.
 - Lifetime earnings and compensation are projected from Census and BLS data based on earnings by race and gender, as well as educational attainment, which is known at least through age 21 for Chicago CPC participants. This is the largest dollar benefit from preschool attendance, and in addition. Taxes are estimated at about 35 percent of earnings.
 - Reduced crime is the second largest benefit from preschool participation. The incidence of juvenile crime is known for participants, and adult crime is predicted based on the incidence of juvenile crime. A rate of adjudication for juvenile crimes from the literature is employed to help estimate criminal justice expenditures. Costs of imprisonment, probation and treatment are from the Illinois Department of Corrections. Crime victim costs are based on tangible expenses without pain and suffering.
 - Costs from child abuse and neglect include judicial administration, foster care and other child services brought to bear for substantiated cases, with estimates from the U.S. Department of Health and Human Services, the Illinois Department of Child and Family Services, and the National Institute of Justice. A victim cost figure from the literature is employed to capture health care, emergency services and lost productivity of adults attributable to child abuse.

- The value of child care is calculated as what one parent could earn at the 1986 minimum wage by working 15 hours a week, corresponding to the hours the parent's child attended Chicago CPC preschool.
- The cost of higher education is taken from an average of three large public university systems. The cost was one-third tuition and two-thirds public funding.
- As with the other two studies, a discount rate is needed to convert subsequent costs and benefits to present values. The Reynolds et al. appendix applies rates besides 3 percent, the authors' preferred one based on a recommendation from the literature, with dramatic variations in outcome from the sensitivity analysis.

By learning about methods and assumptions associated with evaluations for three well-researched pre-K programs, we become better equipped to assess the robustness, weaknesses and complexities of studies that would be likely sources for any Utah preschool impact study.

3. Short-term and long-run impacts of Head Start preschool

Begun in 1964, Head Start includes a federally funded preschool program, in addition to other child care services for which low-income households are eligible. Existing data sources do not allow as comprehensive a cost-benefit analysis for Head Start as was achieved for the programs presented in the previous section (Pianta et al. 2009). A randomized, longitudinal study starting in 2002 consistently showed child development outcomes from Head Start participation, but documented cognitive, social-emotional and health gains had faded by the third grade (Puma et al. 2012). In this section, we will review two studies from the *American Economic Review* which estimate the impact of Head Start on those who attended during the 1970s and 1980s, discerning effects for the prevalence of various outcomes through adulthood without assigning dollar values.

Each uses a well-known longitudinal survey that asked, up to twenty years retrospectively, whether an individual attended Head Start preschool or another preschool as a child. After such a lapse of time, recall error is possible. Also, one may wonder whether children who attended Head Start preschool also qualified for other government assistance programs at a higher rate than those attending other preschools or no preschools. Both studies control for household income and other characteristics commonly

used as eligibility criteria. One such assistance program, Early Head Start (free daycare before age three), did not commence until the mid-1990s.

One nationwide evaluation of Head Start and other preschools, Garces et al. (2002), is based on the Panel Study of Income Dynamics, which asks 2,355 individuals ages 18–30 about their preschool education. The study design compares siblings and introduces a variety of controls in multiple model specifications to filter potentially confounding sociodemographic characteristics.

Head Start attendance seems to cause a 20 percent or greater increase in high school completion and college attendance for whites, as well as a 12 percent reduction in African Americans being booked or charged with crime, but no significant gain in age 23–25 earnings for most groups and model specifications (see Table 2, p. 1,007).

At \$5,400 annually per pupil in 1971 (\$31,565 in 2014 dollars), spending on Head Start appears to be higher than per-pupil spending in Granite School District and Chicago CPC preschools and lower than HighScope Perry and Abecedarian preschool costs.

A second study, by Currie and Thomas (1995), employs a different nationwide data source to estimate education and health effects during grade school associated with preschool attendance, again with various specifications. The sample represents sizeable low-income and race groups with about 5,000 children from the National Longitudinal Survey of Youth, including the National Longitudinal Survey's Child-Mother file (NLSCM), which reveals mothers' and households' circumstances. Currie' and Thomas's dependent variables are the Picture Peabody Vocabulary Test (PPVT) score, the probability of never repeating a grade, the probability of measles immunization, and "height for age" as a percent of the median.

Principal findings in Currie and Thomas (1995) are that white children's test score gains from Head Start persist, while those for African American children are quickly lost. Head Start reduces the likelihood of grade repetition for whites. The significant benefits of Head Start to African American children are health-related. Head Start provides information on health care and nutrition, as well as some meals and health care access, along with early childhood education.

The Currie and Thomas (1995) study also compares outcomes from Head Start preschool and other preschools, which are more expensive than Head Start, and addresses the favored-child selection issue that appears in a matched sibling design.³³ The percent increase in the likelihood of

favorable outcomes was greater for children who had attended Head Start than for children who attended some other preschool, perhaps because families and children relying on Head Start have more need. Attending non-Head Start preschools did not produce significant effects on test scores or grade repetition. This makes a loud statement regarding differences in preschool programs and the need for caution in assuming any respectable program will accrue all of the substantial benefits observed for participants in prominent benchmark pre-K programs.³⁴

4. Multi-study reviews

Several papers in the past two decades have broadly surveyed the literature on pre-K program evaluations. This section will primarily discuss Barnett (1995) and Aos et al. (2004).³⁵

Barnett (1995) reviewed 36 studies of the long-term effects of early childhood programs, focusing on the outcomes of test scores, grade retention and special education needs. This sample represented 15 small, model pre-K programs (including HighScope Perry and Abecedarian) and 21 large-scale public programs (including Chicago CPC). Most model programs offered home visits, and many provided extensive parent support. Often created for demonstration purposes, they were generally of higher quality than large-scale programs, with better teacher-pupil ratios, more highly-qualified teachers and staff, greater financial resources, and closer oversight by experts. On the other hand, the large-scale programs are more realistic and boast higher sample sizes.

A primary methodological concern identified by Barnett (1995) was that, except for three model programs, studies were not randomized. Namely, besides the HighScope Perry and Abecedarian programs, only the Early Training Project had randomized treatment and control groups. The Early Training Project of the 1960s in the upper South evaluated the impact of regular home visits and summer preschool with follow-up through about age 18. Although this is fairly different from Utah’s part-day school-year public preschool scenario, further investigation of this study would likely yield important insights. Other recurring methodological concerns were an inadequate comparison group, high rates of attrition and bias in pre- and post-tests.

The study concludes that “evidence for effects on grade retention and special education is overwhelming.... Evidence for effects on high school graduation and

delinquency is strong but based on a smaller number of studies” (43). The survey did not extend to other outcomes like adult earnings or health outcomes.

In further commentary from Barnett (1995), “the best predictor of the size of program effects may be the size of the gap between the program and home as learning environments, rather than whether a child is a member of a particular group” defined by income or race (43). The difference in learning environments is a fuzzy but perceptive criterion for predicting child outcomes from preschool.

A more recent multi-study review, Aos et al. (2004), was conducted by the Washington State Institute for Public Policy to evaluate rates of return on a wide-ranging variety of government programs, including “early childhood education for low-income 3- and 4-year-olds,” as well as the state’s Infant Health and Development Program, Big Brothers/Big Sisters, Adolescent Sibling Pregnancy Prevention Project, and Scared Straight, to name a few of the 60 programs encompassed. The early childhood education portion is a meta-analysis of 53 studies, yielding estimates of the net benefit and benefit- cost ratio associated with preschool program participation.

Table 4 indicates those outcomes and estimated effects. Compared with the outcomes evaluated in two or more of the HighScope Perry, Abecedarian and Chicago CPC studies, Aos et al. (2004) appear to entirely omit lifetime earnings, IQ test results, childcare savings, and postsecondary education costs. On the other hand, teen

Table 4
Preschool Effect Size Estimates from
Meta-Analysis regarding Early Childhood
Education for Low Income 3- and 4-Year-Olds

Outcome	Number of Effect Sizes Included	Adjusted Effect Size (Weighted-Average Mean)
High School Graduation	10	+ 12.5%
K–12 Special Education	23	– 13.0%
K–12 Grade Repetition	24	– 18.0%
Crime	8	– 16.2%
Public Assistance	3	0.0%
Teen Births/Pregnancy (under age 18)	4	0.0%
Child Abuse and Neglect	1	– 20.7%
Test Scores	33	+ 8.0%

Source: Aos et al. (2004), Appendix Table C.1a

births are absent from the HighScope Perry, Abecedarian and Chicago CPC studies, but Aos et al. (2004) rate the effect of preschool attendance on teen births at zero after including it. Public assistance was also found to be statistically unaffected by preschool attendance, not surprising considering the small impact found for the Perry and Abecedarian programs. The effect of preschool participation on the incidence of child abuse and neglect was based on only one study, whereas the weighted average of the test score effect was based on 33 studies.

For the early childhood education meta-analysis, effects from each of the 53 studies were weighted based on design quality: 100 percent for studies with random assignment in design and implementation, 75 percent for quasi-experimental designs with well-matched comparison groups that control for selection bias, 50 percent for reasonably well-matched comparison groups without an experimental design, and 0 percent for studies that lacked credibility and were therefore omitted. The names and number of the 53 studies corresponding to each weight category were not clearly reported, but at the very least, 33 studies were included in calculating the weighted average of effect sizes for outcome components of the cost-benefit analysis.

Fully 34 percent of total dollar benefits from preschool attendance are attributed to test scores by Aos et al. (2004), without an explanation in the main study or appendix as to the reason for associating a dollar benefit with test scores. Perhaps earnings, otherwise missing from the estimation and a leading component in the literature, are captured on the test scores (or high school graduation) lines.

The costs of providing preschool Aos et al. (2004) employed for their benefit-cost ratios apparently were not based on meta-analysis or Washington state estimates, but rather on the expenses of one program, Chicago CPC, as reported by Reynolds et al. (2002).

In conclusion, the Aos et al. (2004) meta-analysis does not appear to align fully with standard cost-benefit categories from the preschool impacts literature. There is insufficient methodology explanation to foster full confidence in its results. And again, preschool is one of sixty programs for which the study undertakes to systematically estimate a benefit-cost ratio.

5. Statewide pre-K economic impact studies—Michigan case study

Statewide pre-K evaluations generally apply results from the literature in the absence of sound data regarding whether those outcomes actually occurred in the state under consideration. The bulleted list below is by no means comprehensive of long-term economic impact or cost avoidance studies for state preschool systems. The following were found via Wilder Research or NIEER, recommended by Janis Dubno and Andrea Rorrer, respectively. No such state preschool evaluations were found in peer-reviewed academic literature.

- Arkansas, 2006, Pre-K Now, “An Economic Analysis of Pre-K in Arkansas”³⁶
- California, 2005, RAND Corporation, “The Economics of Investing in Universal Preschool Education in California”
- Illinois, 2011, Wilder Research, “Cost Savings Analysis of School Readiness in Illinois”
- Michigan, 2009, Wilder Research, “Cost Savings Analysis of School Readiness in Michigan”
- Minnesota, 2008, Wilder Research, “The Cost Burden to Minnesota K–12 when Children Are Unprepared for Kindergarten”
- New Mexico, 2009, National Institute for Early Education Research (NIEER), “The New Mexico PreK Evaluation: Results from the Initial Four Years of a New State Preschool Initiative”³⁷

A careful evaluation of these studies would be illuminating, time permitting. For the present we explore two Michigan studies by the Amherst H. Wilder Foundation, which provides programs and research to address community issues. This Minnesota organization is prominent among those undertaking statewide studies, and Voices for Utah Children recommended its work.

Wilder Research’s preschool impact estimates for Michigan rely heavily, and in some sense precariously, on cross-sectional data results, such as current earnings or crime rates by educational attainment. The studies imply causality over time, suggesting, for example, that simply improving an individual’s educational attainment will result in a change in lifetime earnings or the propensity to commit crime similar to that observed in cross-sectional data.

Chase et al. (2009) and Chase and Diaz (2011) do not indicate from what sources each impact estimate is drawn. Vague references to “previous research” and the “literature” are given to explain crucial intermediate estimates and final results given. Additional information would be necessary to determine whether effects and costs from other studies can be extrapolated or generalized for Michigan.

Where a range of effect sizes is found in the literature (e.g. special education placement effects range from around 10 percent to as high as 87 percent), Richard Chase, the lead author for all of these studies, tries to be as conservative as possible, choosing either the lower end of the range or an average. Mr. Chase did explain that Wilder Research’s clients affect how conservative are the estimates he selects from the disparate outcomes available in the literature.³⁸

The statewide Michigan studies rely most heavily on outcomes and estimates made regarding the HighScope Perry program by a variety of studies, not including any authored by James Heckman. Although it was a small-scale, model preschool program from the 1960s, the Perry school was located in the same state of Michigan, and of course seminal preschool impacts research has been built around its fairly sound experimental design. Richard Chase explained that his research is based on the gold-standard HighScope Perry, Abecedarian, and Chicago CPC studies, as well as the Aos et al. meta-analysis and a variety of other sources.³⁹

Estimation methods explained below relate to the aggregated dollar impact in 2009 of 25 years of preschool spending in Michigan based on Chase et al. (2009). Those costs are not tabulated, precluding the authors from reporting a benefit-cost ratio. However, the methodology explanations are remarkably similar to Chase and Diaz (2011), who present dollar impact results on a per-pupil basis instead. The most significant differences between the two studies regard estimating cost savings to the criminal justice system from reduced crime. Crime makes up 58 percent of total preschool benefits in Chase and Diaz (2011) and 49 percent of dollar benefits in Chase et al. (2009).

Methodology details are presented here to the extent that they are disclosed in Chase et al. (2009) and Chase and Diaz (2011). Most preschool impacts are grouped as K–12 education savings, positive fiscal impacts for Michigan, and social benefits.

K–12 education savings:

- *Fewer grades repeated (\$136 million):* Chase et al. (2009) calculate that 14,213 grade repetitions were prevented in 2009 by prior preschool attendance. For K–8 grade repetitions, effect sizes from the HighScope Perry program (n=123, 1960s, Ypsilanti, Michigan) are used. For high school grade repetition, graduation reports⁴⁰ indicate the number of people who attended more than four years of high school. Per pupil costs from 2007–2008 are \$9,380. Not included are K–12 costs from a lowered school dropout rate associated with preschool attendance.
- *Fewer special education placements (\$69 million):* The Michigan Department of Education provided counts of special education enrollment for 2008–2009 by type of non-normative disability.⁴¹ It appears Reynolds’ Chicago CPC study’s effects on special education enrollment by disability type are applied to Michigan enrollment figures. The reduction in enrollment is multiplied by corresponding per pupil costs ranging from \$2,260 to \$16,169 for each non-normative disability, cost data obtained from Minnesota (Chase et al. 2009).
- *Less teacher turnover attributed to poor student performance (\$16 million):* A survey of public school teachers who left their jobs included the reason of “student behavior and performance” (Chase et al. 2009, p. 20). A chain of causality (loosely) links preschool participation to teacher turnover in this way: preschool attendance improves school readiness; school readiness improves student behavior and performance; and student behavior and performance are one cause of teachers switching schools or professions. Chase et al. (2009) estimate a Michigan turnover rate of 9.6 percent and determine, based on one study, that the rate is 24 percent lower than it would be without public preschool programs. This amounts to 859 turnover incidents averted in 2009. Michigan public school teachers earn \$57,072 in salary and benefits. Turnover costs are considered to be 33 percent of salary plus benefits based on a BLS estimate, which yields \$18,833 per teacher in turnover costs. The cost avoidance of \$16 million equals 859 times \$18,833.

Positive fiscal impacts for Michigan:

- *Lower crime expenses to law enforcement and courts (\$308 million):*⁴² A juvenile crime rate effect from preschool participation of –33 percent was applied from the Chicago CPC study (Chase et al. 2009). The

corresponding rate reduction employed for adult crime was not given or attributed. The number of crimes presumed averted by preschool attendance is not based on Michigan crime rates. Rather crimes averted are calculated as the crime rate effects from the literature times the Michigan population that had attended preschool (based on 1986–1994 preschool participation rates) and that was juvenile-aged (12–18) or adult-aged (18 and over) in 2008. Unidentified “previous studies” put the total costs associated with arrests, court proceedings and incarceration for any offense at \$5,869 for juveniles and \$3,450 for adults, both lower bounds of the range of costs given (p. 24). Taxpayer savings results from crimes not committed by Michigan juveniles (\$214 million) and adults (\$94 million) imply, based on these costs, that Chase et al. (2009) had in mind reductions from preschool of 36,463 juvenile crimes and 27,159 adult crimes. Chase and Diaz (2011) use a different methodology for estimating cost avoidance from crime, incorporating Michigan crime rates for eight specific property and violent offenses.

- *Less state involvement needed for child abuse and neglect (\$106 million):* The savings per child that attends preschool from reduced child abuse and neglect is given at \$1,559 without a specific source. This is multiplied by a number for how many preschool participants there were in Michigan. Chase et al. (2009) do not disclose the percent reduction in the likelihood of a child becoming a victim or the number of years over which public spending occurs to address such child victimization.
- *More income and sales tax revenue, mainly from preschool students when they become adults (\$23 million):* Cross-sectional data on lifetime earnings by high school graduation status are associated with high school graduation rates for individuals who attended preschool compared with those who did not. The aggregate earnings difference is multiplied by a marginal income tax rate for Michigan, and in the absence of a similar rate for sales tax in the state, by an estimate of the sales tax incidence from Minnesota based on income, to produce the tax revenue increase attributable to preschool. While most of the tax revenue gains are from preschool participants once they enter the labor force, about 15 percent of the estimated income and sales tax revenue is from parents’ productivity gains while their children are enrolled in preschool.

- *Less dependence on government benefits—TANF, Medicaid and unemployment insurance (\$106 million):* A study based on the HighScope Perry program estimated Michigan’s costs associated with Temporary Assistance to Needy Families (TANF) based on a 38 percent administrative or economic cost to the state associated with this transfer. The estimate and source for preschool effects on TANF receipt are not named. Presumably that number is multiplied by the number of adults who attended preschool based on Michigan preschool participation rates from 1986 to 1994. As for Medicaid benefits, Chase et al. (2009) give \$2,190 as Michigan spending per recipient, which is multiplied by the reduction in the number of recipients associated with higher high school graduation rates for preschool students and lower rates of Medicaid use by high school graduates. Finally, unemployment insurance spending is based on unemployment rates being lower for high school graduates compared with dropouts, again exploiting the link in the preschool impacts literature between preschool participation and high school graduation. Not enough information is given in the paragraphs on government benefit programs to discern conscientiously the sources and methods behind the results delivered.

*Social benefits:*⁴³

- *Lower victim costs from violent and property crimes (\$259 million):* Crime victim costs are based on the Chicago CPC program outcomes and the number of preschool participants in Michigan.
- *Less alcohol and drug abuse by teenagers and adults who have attended preschool (\$14 million):* Results are based on the meta-analysis of Aos et al. (2004).
- *Higher earnings by parents while their children are in preschool (\$74 million):* Additional earnings of \$4,488 per participant are drawn from unidentified sources in the literature, which is multiplied by the number of preschool participants in Michigan.

A fourth area of benefits, fiscal (taxpayer) and earnings economic impacts, is a standalone (and somewhat overlapping) analysis based on the number of individuals aged 18 to 29 who would have been expected to drop out of high school without state school readiness spending. The number of dropouts avoided was estimated at 80,000 in a “conservative” manner barely explained by the limited disclosure of the following phrase: “based on past participation and success rates of early education programs in Michigan” (Chase et al. 2009, pp. 3, 34). An

estimation made at Northeastern University suggests a high school graduate contributes \$7,470 more per year to the state's budget from increased taxes paid and reduced dependence on public services.⁴⁴ The annual fiscal impact of about twelve years of running Michigan's early education programs for these 18- to 29-year-olds is placed at \$594 million, which is only \$3.6 million more than \$7,470 times 80,000. Earning differentials for high school graduates are given in the Northeastern study at \$8,800, leading Chase et al. (2009) to a \$700 million impact on annual earnings from twelve years of preschool (35). These fiscal and earnings impacts are added to reveal a \$1.3 billion state economic impact from preschool, which would be greater if additional college enrollment or graduation were taken into account.

For the preschool impacts that accrue to adults, particularly in the fiscal impacts and social benefits sections, the method for scaling effects from the literature to the state

of Michigan in 2009 was to multiply by the number of adults age 18 and over who had attended preschool since 1986.⁴⁵ That essentially includes adults aged 18–26⁴⁶ who attended preschool during 1986 to 1994.

Adjustment is made in Chase and Diaz (2011) for out-migration. Preschool benefit components are reduced by a smaller percentage for children and youth than for adults. Overall, about 20 percent of preschool impacts are lost due to migration outside the state (pp. 1, 20).

Based on the two Wilder Research studies on Michigan carefully reviewed here, as well as a cursory read-through of several other studies by the same author, research methods are fairly simplistic. The general approach is to locate one or more studies that address a particular element of preschool impacts and multiply the effect from the literature by the number of preschool students in Michigan.

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Utah experts in early childhood education: Several conversations provided insights about the early childhood education impact literature and information about preschool in Utah. Input received from these individuals is much appreciated.

- Nannette Barnes—Associate Director, Preschool Services, Granite School District, Sep 30, 2013
- Richard Chase—Senior Research Manager, Wilder Research, Oct 15, 2013
- Janis Dubno—Senior Policy Analyst, Voices for Utah Children, Sep 19 and Oct 2, 2013
- Mark Innocenti—Director, Early Intervention Research Institute, Utah State University, Oct 3, 2013
- Andrea Rorrer—Director, Utah Education Policy Center, University of Utah, Sep 30, 2013

Appendix

*HighScope Perry preschool program characteristics:*⁴⁷

- *Years:* 1962 to 1967, admitting pupils 1962 to 1965
- *Duration:* two years at ages 3–4 (13 students had just one year)
- *Hours:* 2.5 hours of preschool on school-year weekdays with 1.5 hour weekly home visits
- *Location:* Ypsilanti, Michigan, population 20,957 in 1960 and 29,538 in 1970, 8 miles from Ann Arbor with 1970 population of 0.1 million, 36 miles from Detroit with 1970 population of 1.5 million
- *Cost in 2014 dollars:* \$20,854 per pupil
- *Sample size:* 123 participants, 58 treatment and 65 control
- *Participant selection:* solicited participants, virtually all of whom assented, were African-American with low IQ (70-85) from disadvantaged homes in terms of parental educational attainment, parental employment, and housing density (people per room)
- *Child assignment to treatment or control group:* random except for several re-assignments made afterwards for a variety of reasons
- *Participant demographics:* 100 percent African Americans; 41.2 percent female
- *Curriculum:* three well-developed curriculum methods were used—direct instruction, active learning and nursery school
- *Teacher-student ratio:* 1:6.25 to 1:5 (4 teachers for 20–25 students)
- *Teacher credentials:* bachelor's degrees and certification in education
- *Control group experience:* no preschool or services from this program
- *Follow-up:* interviews at about ages 15, 19, 27 and 40
- *Attrition:* less than 10 percent of participants through age 40

*Carolina Abecedarian program characteristics:*⁴⁸

- *Years:* 1972 to 1985, admitting pupils 1972 to 1977
- *Duration:* five years, from infancy (mean age at entry 4.4 months) to age 5 (plus three years of home learning visits for half of treatment and control group members)

- *Hours:* 8–10 hours on weekdays year round, 250 days per year
- *Location:* Chapel Hill, North Carolina, population 32,421 in 1980, 11 miles from Durham with 1980 population of 0.1 million
- *Cost in 2014 dollars:* \$83,530 per pupil
- *Sample size:* 111 participants, 57 treatment and 54 control
- *Participant selection:* invitations extended to 122 expecting mothers considered high-risk based on an index composed of sociodemographic factors, with about a 90 percent participation rate; random assignment to treatment or control group
- *Child assignment to treatment or control group:* random
- *Participant demographics:* 98 percent African American; 53 percent female
- *Curriculum:* documented program for infant and child development beyond regular child care
- *Teacher-student ratio:* 1:3 for infants and toddlers and 1:6 for older children through age 5
- *Teacher credentials:* range of qualifications for teachers and caretakers, from childcare experience and certification to BA and MA degrees
- *Control group experience:* these participants received baby formula until 15 months and free disposable diapers until toddlers, but no daycare or preschool
- *Follow-up:* ages 8, 12, 15 and 21
- *Attrition:* 7.1 percent with the loss of 8 participants through age 21

*Chicago Child-Parent Centers (CPC) program characteristics:*⁴⁹

- *Years:* about 1983 to 1989, admitting pupils 1983 to 1984
- *Duration:* two years of preschool at ages 3–4 and up to four years for kindergarten through 3rd grade (73 percent of the treatment group participated during K–3)
- *Hours:* morning preschool for three hours on weekdays during the nine-month school year and often during a six week summer session provided at one of 24 public community centers, then full-day, six-hour kindergarten and ongoing services in grades 1 through 3

- *Location:* Chicago, Illinois, population 3.0 million in 1980 and 2.8 million in 1990
- *Cost in 2014 dollars:* \$9,717 per pupil
- *Sample size:* 1,539 participants, 989 treatment and 550 control
- *Participant selection:* representatives went door-to-door in low-income neighborhoods to recruit participants with high response rates; the reason for nonparticipation usually being the residency requirement (Title 1 neighborhoods corresponding to the 24 centers) rather than parental interest
- *Child assignment to treatment or control group:* a quasi-experimental comparison group randomly selected from the same CPC neighborhoods
- *Participant demographics:* 94 percent African-American; about 49 percent female
- *Teacher-student ratios:* 1:8.5 (2 teachers for 17 students) for preschool and 1:12.5 for kindergarten (2 teachers for 25 students)
- *Teacher credentials:* Teachers had bachelor's degrees, specialists and aides were available.
- *Curriculum:* Preschool emphasized language and school readiness skills with teacher-directed activities, small groups, field trips and play. Parent involvement was required at least one half-day per week and was invited for events and field trips. For grades 1–3 class size was 25 rather than 35-plus, and there were extra resources and activities compared with typical grade school classes in Chicago. There were health and nutrition services and home visits.
- *Control group experience:* did not receive CPC preschool but did have full-day kindergarten
- *Follow-up:* annually through 7th grade then at ages 15, 17–18, 22, and 24–26
- *Attrition:* 6.1 percent through age 24–26

*Utah Granite School District's preschool program characteristics:*⁵⁰

- *Years:* started in the 1990s⁵¹, expanded since 2003, early reading grant funded 2005 to 2009, social impact loan funding started in 2013, tracking of preschool kids' future school performance started in 2006
- *Duration:* two years of preschool at ages 3–4
- *Hours:* 3 hours a day 2 days a week for 3-year-olds; three hours a day 4 days a week for 4-year-olds; 1.5 hours a

day 2 days a week for children turning three after September 1, the birthday cutoff, until the following school year when they can enroll 3 hours a day⁵²

- *Location:* Granite School District, covering an area with a population of 0.4 million in 2010, adjacent to Salt Lake City, Utah, population 0.2 million in 2000 and 2010
- *Cost:* \$2,425 per pupil for both years based on 2012–2013 school year estimates
- *Number of pupils each year:* currently over 3,500
- *Participation:* voluntary in Utah where available (Granite and Park City school districts); open to all students current funding can accommodate; in the Granite district, preschool is free for children living in Title 1 school boundaries and generally costs \$100–\$160 per month during the 2013–2014 school year for children living in non-Title 1 neighborhoods
- *Student demographics:* The population under 18 in the Granite School District was 55.5 percent white, 31.4 percent Hispanic or Latino, 3.7 percent of two or more races, 3.1 percent Asian, 2.1 percent African American, 2.9 percent Native Hawaiian and Other Pacific Islander, 0.9 percent American Indian, and 0.3 percent some other race, according to the 2010 Census; about 25 of 45 Granite schools were Title 1 eligible, though perhaps fewer are Title 1 funded; the percentage of children receiving free or reduced lunch in the 11 lowest income schools in Granite was 74 percent for SY07–08 and 78 percent for SY08–09.
- *Teacher-student ratios:* 1:9 (a lead teacher and assistant for 18 students)
- *Teacher credentials:* no requirement in Utah... Some have high school diplomas and a Child Development Associate certificate, and others have bachelor's or master's degrees.
- *Curriculum:* Activities are teacher-directed or child-directed, small group or whole group. There is a scope and sequence, certain domains that are covered throughout the year.
- *Follow-up:* 3rd grade Criterion Reference Test (CRT) language arts and math performance scores in 2011 (end of SY10–11)
- *Attrition:* Students who attended preschool in Granite School District are not tracked if they move out-of-district. An anticipated unified student identifier convention statewide would facilitate tracking students' K–12 performance if they stay in-state.

End Notes

1. Most of the research for this report was conducted in November 2013.
2. The evaluation of state-run, voluntary pre-K in Tennessee was conducted by Vanderbilt University and published only recently (Lipsey, Farran, and Hofer 2015). While Section 3 addresses the Head Start preschool impacts research in some detail, thorough treatment of Lipsey et al.'s important findings is material for future writing on pre-K effectiveness.
3. The National Institute for Early Education Research (NIEER), RAND Corporation, and Wilder Research have each supported multiple studies. Corroborating publications in refereed, academic journals were not found. Existing statewide impact studies seem to be sponsored by major organizations whose missions relate to expanding the early childhood education system.
4. Section 1 and the Appendix discuss the applicability of results from the literature to public preschool in Utah.
5. To permit comparison in real 2014 dollars, cost and benefit amounts were converted from the year given in the source based on the Consumer Price Index for all urban consumers from the Bureau of Labor Statistics. All amounts are rounded to the nearest \$100.
6. Please refer to the appendix for characteristics of the three preschool programs presented in the Executive Summary, including location, participant demographics, survey follow-up intervals, curriculum, class size, teacher-student ratios, teacher credentials, and years of operation.
7. In contrast to the *overall* benefit-cost ratios for the first three programs of 2.5 to 16.2, as documented in the table, special education and grade placement cost avoidance *alone* results in benefit-cost ratios for Abecedarian, Chicago CPC and HighScope Perry of 0.14, 0.73 and 0.24, respectively.
8. The total benefit per dollar invested is 3.8, while 2.7 is the benefit-cost ratio that reflects only public benefits.
9. In order to focus on the cost of preschool, the Abecedarian cost estimate by Temple and Reynolds (2007) is net of spending on child care by the control group, particularly before age 3, which is why the program cost is much lower than that by Barnett and Masse (2007).
10. This amount is for the preschool program, without additional benefits estimated for those who participated in the school-age programs available after preschool enrollment in the Chicago CPC program.
11. The total benefit per dollar invested is 10.2, while 6.9 is the benefit-cost ratio that reflects only public benefits.
12. Many benefit-cost ratios are reported in Heckman et al. (2010a) based on a range of assumptions. Four representative ones are: 9.2 (adjusted for compromised randomization, low cost of murder, no deadweight loss from taxation), 6.6 (same as previous, except 50 percent deadweight loss), 12.2 (unadjusted for compromised randomization, high cost of murder, 50 percent deadweight), 7.1 (same as previous, except low cost of murder). Others could be reported to account for discount rates from 0 percent to 7 percent, to estimate crime effects without separating crime types, and to isolate the benefit-cost ratio for crime. Heckman et al. also calculated internal rates of return associated with Perry preschool spending.
13. Multiple benefits estimates are available, mostly differing by crime reduction cost savings.
14. The Aos et al. (2004) meta-analysis incorporated between 8 and 33 studies, including the first three addressed in Table 1, to estimate the benefit components added up in Table 1: high school graduation, grade repetition, K–12 special education needs, crime, and test scores (not including effects for public assistance, teen pregnancy, and child abuse and neglect based on four or fewer studies, noted in Table 4).
15. The Chase et al. (2009) result of \$1.15 billion includes savings in special education, grade retention, teacher turnover, crime, child care, child welfare, adult welfare, taxes, health, and parent earnings.
16. Chase and Diaz (2011) do not specify the year in which dollar amounts for the December 2011 study are reported. The value of \$34,823 is adjusted to 2014 dollars assuming conservatively that \$32,075 from Table 1 is in 2010 dollars.

17. Sources for all three non-Utah programs: Barnett (1995), Pianta et al. (2009), Temple and Reynolds (2007). Barnett identifies Perry and Abecedarian as the most valid studies least affected by selection bias and attrition. Pianta et al. emphasize that these three programs “provide sufficient methodological rigor, breadth of measurement, and length of follow-up to support comprehensive benefit-cost analyses” (63).
18. For the population ages 5–17 in 2010, 24.2 percent belonged to a minority for Utah, 33.3 percent for Salt Lake County (2010 Census SF1 PCT 12 tables). For Granite School District, 40.4 percent is for the 2008–2009 school year (NCES 2011).
19. The test included letter-word identification, spelling and applied problems. Cognitive outcomes after one year of preschool at age 4 may or may not closely reflect long-run outcomes like educational attainment, earnings, crime and welfare use.
20. Currie and Thomas (1995) was based on a National Longitudinal Survey of Youth sample of 4,787 children of whom 927 attended Head Start in the 1970s or 1980s. Garces et al. (2002) was based on a Panel Survey of Income Dynamics sample of 3,255, of whom 1,742 had siblings in the sample for sake of comparison, controlling for family characteristics. 489 students (15 percent of the sample) attended Head Start, about 833 (30 percent) attended some other preschool program, and about 1,933 (70 percent) did not attend preschool. These studies are discussed more in Section 3.
21. The three percentages correspond to the Abecedarian, HighScope Perry, and Chicago CPC programs, respectively. A careful review of capital and labor costs for preschool in the district would be needed to verify comparability of the cost figures on which these percentages are based. For example, it appears overhead is included in only some of the cost estimates. Cost figures are not annual per-pupil costs but apply to the total average duration of each program, whether that is two years or five years.
22. These observations are for 2014, in which year Utah had the eighth lowest violent crime rate among the states. On the other hand, Utah had a higher-than-median property crime rate, ranking 34th among the other states and the District of Columbia. In 1995, Utah had the 11th lowest violent crime rate and the 8th highest property crime rate. For 1995 and 2014, compared with Michigan and Illinois, Utah had rather high property crime rates and very low violent crime rates. Having said this, local crime rates for Ypsilanti, Chicago and Salt Lake County would yield more relevant comparisons than statewide crime statistics. The Federal Bureau of Investigation Unified Crime Reporting Program provides annual crime rates for reported violent and property offenses by state in Table 5 of the annual “Crime in the United States” available at <http://www.fbi.gov/about-us/cjis/ucr/ucr-publications#Crime>.
23. The Perry study, for example, asked about sleeping pill, marijuana and heroin use at age 40, finding lower use percentages for the treatment group than for the control group. It appears no cost-benefit analysis of the Perry program has included health care cost savings associated with such behavior (Pianta et al. 2009).
24. “Smoking and Tobacco Use: Trends in Current Cigarette Smoking Among High School Students and Adults, United States, 1965–2011,” Centers for Disease Control, online Oct 2013, http://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm.
25. For example, the Chicago study did not measure smoking, substance abuse or health outcomes associated with participation at its Child-Parent Centers, but it did cite other research supporting a positive association between educational attainment and the likelihood of having medical insurance and living a healthy lifestyle.
26. In Granite’s preschool program, of the 30.5 percent of the children considered at risk for special education in the 2006–2007 school year cohort, 2.3 percent were placed through the third grade, a 28.2 percent reduction. That cohort’s outcomes provide the best data since they are followed for longer than the subsequent two cohorts. The later cohorts had effects of –27.3 percent and –37.3 percent, the latter reflecting placement only in kindergarten and first grade.
27. Whether a student was at risk of needing special education services was based on scoring below 70 on the Picture Peabody Vocabulary Test (PPVT). While they have been used as a proxy for IQ scores, PPVT scores may underestimate the capacity of children facing English language barriers (Mark Innocenti, personal conversation, Oct 3, 2013). In Granite School District, 40.4 percent of students in the 2008–09 school year were Hispanic, Asian, Pacific Islander,

American Indian/Alaska Native, Black or of two or more races (Table A-8, NCES 2011). Data on these students' language background is not so readily available.

28. Special education placement rates for preschool treatment groups in the Chicago CPC, Perry and Abecedarian programs were 12 percent, 17 percent and 25 percent, respectively (Dubno 2010). Another source reported treatment group placement rates of 14 percent, 37 percent and 25 percent (Pianta et al. 2009). In any case, the Granite program reports outcomes below these benchmarks with a special education placement rate of 2.3 percent, and even lower for the second and third cohorts with follow-up only through first and second grade, respectively, both at 0.4 percent. It is noteworthy that the three leading studies have very high special education placement rates for their control groups: 25 percent, 48 percent, and 50 percent for Chicago CPC, Abecedarian and Perry, respectively (Pianta et al. 2009). All of them selected participant children from households with low socioeconomic status, and the Perry program selected children with low IQs. Perhaps the three leading studies are not a good comparison to the Utah pre-K population in terms of special education effects of pre-K.
29. The benefit-cost ratio of 0.57 for Granite was constructed by dividing "total state savings in K-3 special education for at-risk preschool cohorts," \$963,938 (Dubno 2010, p. 11), by the product of the cost of preschool and the number of students attending preschool in all three cohorts (\$2,300 per student *times* 737 students *equals* \$1,695,100). The benefit-cost ratio of 2.98 is implied by using the special education cost savings estimate of \$24,356, net present value, for grades 3-12 at \$3,120 per year assuming placement in the third grade with no return to the mainstream through graduation, a lower estimate than \$33,181, which reflects permanent placement from kindergarten to high school graduation (Dubno, p. 5). Next, \$24,356 times 60, the number of at-risk students in the first cohort that avoided special ed. placement, yields a benefit of \$1.5 million (Dubno 2010, p. 10). This figure divided by the \$0.5 million cost to provide preschool to all 213 students in the first cohort, yields a benefit-cost ratio from lower special ed. costs alone of 2.98. For all three cohorts, 231 likely placements were reported to have been avoided by pre-K for 737 children in the Granite district, resulting in cost avoidance of \$5.6 million from a program cost of \$1.7 million, implying a benefit-cost ratio of 3.32. Cost savings for special education from public preschool in Granite School District seem higher than cost savings for three prominent preschool programs.
30. According to Mark Innocenti, most special education placements happen by the third grade, and most children, once placed, remain in special education classes thereafter (personal conversation, October 3, 2013).
31. Benefit-cost ratios for the leading programs include special education and grade retention: 0.14 for Abecedarian (Barnett and Masse 2007), 0.24 for HighScope Perry (Heckman et al. 2010a), and 0.73 for Chicago CPC (Reynolds et al. 2002). Separate special education benefit-cost ratios are not readily available for the Abecedarian and Perry programs, but for Chicago CPC grade retention was 14.2 percent of the total benefit from special ed. and grade retention, meaning what we are working with is probably only somewhat higher than the ratios to which we would prefer to compare Granite School District outcomes (Reynolds et al. 2002).
32. To permit comparison in real 2014 dollars, cost and benefit amounts were converted from the year given in the source (2008) based on the Consumer Price Index for all urban consumers from the Bureau of Labor Statistics.
33. The sibling pairs design in Currie and Thomas (1995) controls for family characteristics and overcomes selection bias by comparing children in the same families to each other. One specification that compared children enrolled in Head Start to siblings enrolled in more expensive preschool programs showed that Head Start participation yielded larger benefits than the other preschool programs on average.
34. One literature review characterized what we know of the program's impact as follows, "Head Start... is relatively expensive compared with other programs and yet has been found to have relatively small effects in the national randomized trial. Calculations of likely economic benefits based on the evidence on the very long-term effects of Head Start suggest that its benefits may exceed costs. However... little certainty can be attached to this conclusion" (Pianta et al. 2009, p. 64).
35. See also Reynolds et al. (2010) and Pianta et al. (2009).

36. Evaluation of this study would benefit from the technical appendix requested of the author by email Sep 30 and Oct 15, 2013.
37. This study offers only brief treatment of economic impacts, focusing mostly on cognitive outcomes in grade school. More information, including a referenced model study not yet located, would be needed to understand the methodology behind the results in the four-page economic impact section.
- 38.
39. The references page for Chase et al. (2009) names 51 sources, consisting of 28 policy research institutes, advocacy organizations or university outreach projects, e.g. Center for Early Care and Education, Economic Policy Institute, and Center for Labor Market Studies at Northeastern University; 15 journals, almost all peer-reviewed, e.g. *Pediatrics*, *Educational Evaluation and Policy Analysis*, *Issue Brief*, and *Social Science Quarterly*; and 8 government sources, e.g. Treasury, Cambridge District Management Council, and IPUMS. In comparison, Chase and Diaz (2011) reference 53 sources, including two additional sources from policy research institutes.
40. It is not clear whether these reports are for Michigan or some other geography.
41. Six non-normative disability categories are given, such as speech impairment and mild cognitive disabilities. Normative disabilities include deafness, autism, physical impairment and five others not presumed to improve significantly with preschool attendance.
42. Lead author Richard Chase said he has updated his methodology for estimating crime to use local crime data and the marginal cost of imprisonment.
43. The NEU study is the principal source for fiscal and earnings impacts that make up the economic impact reported in the economy section.
44. Not going back further than 1986 reflects the 25-year time horizon for preschool investment followed in the Chase et al. (2009) study. 1986 may also coincide with when public preschool became prevalent.
45. It appears that benefits for the adult population are limited to individuals of ages 18–26 who would have received public preschool in 1986 or later, but whether each estimate is strictly for that period is not always clear.
46. Perry program sources: Schweinhart et al. (2005), Heckman et al. (2010a), Heckman et al. (2010b).
47. Carolina Abecedarian program sources: Campbell and Ramey (1994), Barnett and Masse (2007).
48. Chicago CPC program sources: Conyers et al. (2003), Reynolds et al. (2002), Temple and Reynolds (2007).
49. Sources for Granite School District preschool: Dubno (2013); phone conversations with Janis Dubno, Voices for Utah Children (Sep 19, 2013) and Nannette Barnes, Assistant Director for Granite School District preschool (Sep 30, 2013); Granite School District Preschool Services website, accessed October 2013, <http://www.graniteschools.org/preschool/>; and Kem C. Gardner Policy Institute analysis of U.S. Census 2010 data. Park City School District began mainstream public preschool in 2013, probably the only other such program in Utah.
50. A beginning date in the 1990s, probably early in the decade, is based on recollections by Granite School District secretary Debbie Larsen, who has been in the district twenty years.
51. Four or eight days of summer preschool with very small class sizes are provided to students who are referred for having special needs. Enrollment is quite limited.



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