

Estimating the Cost-Effectiveness of a National Program that Impacts High School Graduation  
and Postsecondary Enrollment.

Alyshia Brooks Bowden

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## ABSTRACT

### Estimating the Cost-Effectiveness of a National Program that Impacts High School Graduation and Postsecondary Enrollment

Alyshia Brooks Bowden

This dissertation was designed to provide an example of an application of the ingredients method of cost-effectiveness analysis of Talent Search, a nation-wide federally-funded program that targets low-income students who promise to be the first generation in their families to attend college. The program serves students in grades 6 to 12 to increase the rates of high school graduation and postsecondary enrollment. Because Talent Search is a multi-site and a multi-output program, the analyses allowed for the exploration of two complexities in conducting cost-effectiveness analyses: site-level variation within a program and combining multiple outcomes to evaluate a program's efficiency.

My results show that variation in costs, cost-effectiveness ratios, and benefit-cost ratios was wide across sites. This suggests that future work should include site-level analyses to provide a range for a program's costs and cost-effectiveness and to provide policy relevant site-level examples of the resources utilized to implement a program. Because the outcomes of Talent Search have monetary values in the labor market, I combined the program's impacts on high school completion and postsecondary enrollment to estimate the additional income generated by the program. These findings suggest that the benefits of Talent Search outweigh the costs on average. However, the variability I find across sites illustrates that more investigation and development is needed to improve the productivity of the program and to reduce inequities across sites.

Four important contributions were made with this work: it provides an in depth example of applying the ingredients method to a complex program, it suggests that future work should include site-level analyses, it indicates that retrospective work is limited and future work should be devoted to incorporating the ingredients method contemporaneously into impact evaluations, and it informs policymakers about the cost-effectiveness of Talent Search and the ways in which cost-effectiveness varies across sites.

Estimating the Cost-Effectiveness of a National Program that Impacts High School Graduation  
and Postsecondary Enrollment

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## Dedication

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## **Chapter 1. Demonstrating the Ingredients Method through a Cost-Effectiveness Analysis of Talent Search**

The United States spent \$638 billion on elementary and secondary education in 2010 (U.S. Department of Education, 2013a). The total public expenditure on education was estimated to be 5% of the annual GDP in 2010 (World Bank, 2014). Public officials are charged with the responsibility of allocating public funds efficiently in order to educate the nation's children while avoiding waste. Policymakers value information on the efficiency and costs of programs to aid in the decision making process (Monk, 1995). Yet, the research community in education has largely focused on providing estimates of effectiveness through program evaluations. While impact evaluations are important and needed to establish what works in education, the ability of policymakers to select programs and policies that are efficient is limited when the studies lack information about costs (McEwan, 2002).

Cost-effectiveness analysis is a tool that is used to evaluate program performance and to aid in decision making. By relating a program's costs to its effects, a cost-effectiveness analysis allows for programs to be compared based on their relative efficiency at producing a shared outcome of interest (Levin & McEwan, 2001: Ch. 1, p.10). This tool is especially important in education evaluation as many of the outcomes valued by society and policymakers are not easily converted into monetary values, which is a necessary condition to utilize cost-benefit analysis. Cost-effectiveness analysis, as described in Chapter 2, was developed after cost-benefit analysis to allow policymakers to examine the relative efficiency of various reforms for sectors, such as education, where the outcomes are not easily translated into monetary values but it is necessary to consider costs in addition to outcomes of each alternative (Levin, 2013). In order to conduct a cost-effectiveness analysis, the program's costs must be rigorously estimated in addition to the

program's effects (Levin, 1975). Cost-effectiveness analysis is important as it allows policymakers to examine the trade-offs between alternative options at producing an outcome of interest (Coombs & Hallak, 1987). By including costs in our evaluations of education programs and policies, we are able to improve our understanding of what works in education (Ross, Barkaoui, & Scott, 2007).

### The Ingredients Method and Cost-Effectiveness Analysis

*The ingredients method* was developed by Henry Levin to provide a straightforward method to conduct cost-effectiveness analyses in education and other public sectors (Levin, 1975; Levin, 2001; Levin, 2013). The ingredients method outlines and describes all of the ingredients used to implement a policy or program. The analysis is intended to provide detailed information about all of the ingredients required to replicate an implementation of a program. The method is consistent with both the economic concept of opportunity cost and standard practices for cost accounting (Levin, 1975). In addition, the ingredients method provides a consistent approach to assessing the cost of each ingredient and calculating the cost per student so that interventions can be compared for their relative efficiency at achieving a comparable educational result.

There are four main steps in the ingredients method. First, each ingredient, generally in the categories of personnel, facilities, supplies, and other resources, is listed with descriptive data outlining the ingredient's quantity and qualitative features. Based on the descriptions, each ingredient is valued according to its cost, typically using a national market price or a shadow price (Levin & McEwan, 2001: Ch. 4, p.60-61). The program's total cost and cost per student are then calculated. Next, the costs are distributed across various contributing agencies or constituencies to outline how the program was financed or to include cash payments. Finally, if

effectiveness data are available, costs of alternative interventions are paired with effects to estimate cost-effectiveness ratios.

Estimating effectiveness has been the major focus of program evaluation while costs have largely been ignored (Levin, 2001; Harris, 2009; Levin, 2013). The Institute of Education Sciences (IES hereinafter), the research branch of the U.S. Department of Education, developed the What Works Clearinghouse (WWC hereinafter) in 2002 to establish standards for rigorous impact evaluations and to provide a source for information about what programs in education have been found to be effective. The WWC focuses on effectiveness and provides rank orders of programs by topic area based on the level of impact and the rigor of the evaluation. Occasionally, the purchase price of a program or, in the case of Talent Search, the funding for a program will be included in the WWC write up, but these typically underestimate the true costs because many costs are not captured in budgets or in a market price or its equivalent (e.g., facilities needed to provide the program, additional staff or staff time to recruit students and to implement the program, and goods or time contributed to the program in kind). Though evaluations by the WWC of the effectiveness are based upon systematic scrutiny of evidence, virtually no attention is devoted to rigorous estimates of costs.

#### Need for Applications of the Ingredients Method

Since 2012, the demand for cost-effectiveness analyses using the ingredients method has increased. The U.S. Office of Management and Budget (OMB hereinafter) is housed within the U.S. White House and is tasked with carrying out the President's vision and managing the various agencies that fall under the executive branch. In 2012, OMB disseminated a memo to department heads, including the U.S. Secretary of Education Arne Duncan, requiring that evaluations become more innovative and include cost-effectiveness calculations (Sparks, 2012).

More recently, IES has funded cost-effectiveness studies and has published requests for proposals to train researchers in the method (U.S. Department of Education, 2013b). This dissertation stems from an IES funded project to conduct cost-effectiveness analyses of programs listed by the WWC as having positive or potentially positive impacts.

As the demand for cost-effectiveness studies is increasing, it is important to increase the number of high quality demonstrations of the ingredients method of cost-effectiveness analysis available to guide future work and to continue to develop the method to overcome common challenges in cost-effectiveness analysis. This dissertation aims to contribute to both gaps by demonstrating the ingredients method and the complexities of estimating the cost-effectiveness of a national program that has multiple sites and multiple outcomes.

### Talent Search

Talent Search is a nation-wide program provided to *low-income first-generation* (LIFG hereinafter) students who aspire to attend college. Low-income status is generally based on student's free or reduced price lunch status. In addition to targeting students living in low-income households, the program also targets students who aspire to be the first generation in his or her family to attend college. The program is federally funded through the Higher Education Act and was designed to compliment the federal financial aid program that assists students in financing postsecondary education (Maxfield, Cahalan, Silva, Humphrey, & Thomas, 2000). Talent Search project sites are directly grant-funded by the U.S. Department of Education to target middle and high school students from grades 6 to 12.

Generally, the purpose of the program is to encourage students to stay in school, to provide support for students to stay on track for college, and to inform and assist students through the college application and financial aid process. To meet these goals, Talent Search

project sites provide a range of services to prepare students to graduate from high school and attend college, such as counseling; informing students of career options; financial awareness training; taking students on cultural trips and college tours; assisting students and families with the Free Application for Federal Student Aid (FAFSA); preparation or tutoring for college entrance exams; and assistance in selecting, applying to, and enrolling in college.

With project sites all across the country, Talent Search as a grant-funded program is adaptable to the needs of the local population as determined by the host organization in the application for funding. Some sites provide services at targeted middle and high schools by pulling students out of class, while others provide services at the Talent Search site office outside of the targeted schools. The grade levels of participating students can range from 6th to 12th grade. While all sites target high school students, some sites design their program to focus more on middle school students than others. The number of schools targeted also varies by site and can be related to the population density of the locale. One site may serve many students at a few rural schools while another may serve small clusters of students in over 30 schools.

In 2006, Mathematica Policy Research was commissioned by the Department of Education to conduct a study of the effectiveness of Talent Search (Constantine, Seftor, Martin, Silva, & Meyers, 2006). The evaluation used a propensity score matching method to estimate the impact of Talent Search on high school completion, applying for financial aid, enrolling in postsecondary education, and enrolling in a four-year versus a two-year institution. Talent Search participants outperformed the comparison group across all outcomes. The impact of Talent Search on high school completion and postsecondary enrollment, the outcomes considered in this dissertation, were estimated using administrative data from two states: Texas with ten sites, and

Florida with five sites (Constantine, et al., 2006). A description of the impact evaluation and the results reported therein are discussed in Chapter 3.

#### WWC Review of Talent Search Evaluation

The WWC identified Talent Search as a dropout prevention program with potentially positive impacts on high school completion (U.S. Department of Education, 2006). The Constantine et al. (2006) evaluation included three states. However, the WWC intervention report found that only the analyses conducted in Texas and Florida met WWC standards with reservations because those analyses examined the program's impacts on high school completion, while the analysis in Indiana did not (U.S. Department of Education, 2006). The impact evaluation did not meet the evaluation standards without reservations because the evaluation used a propensity score matching model that could have been subject to selection bias because the participants selected to participate in the program and/or they were selectively recruited to participate rather than being randomly assigned. Thus, important non-observable differences between the treatment and comparison groups may have existed that could have contributed to the impact found. Even though these limitations exist in the design of the evaluation, the WWC review determined that the results met their evaluation standards with reservations, a high ranking.

The impact evaluation by Constantine et al (2006) is included here as the source of the effectiveness data for Talent Search. While Talent Search has been in operation for about 47 years, there has never been a rigorous examination of the program's costs or cost-effectiveness. Therefore, the costs must be addressed to investigate the cost-effectiveness of the program.

## Complexities of Estimating the Cost-Effectiveness of Talent Search

Given its long history, large scale, and variation in implementation, a rigorous cost analysis of Talent Search is merited. While we know from the Constantine et al. (2006) evaluation and the WWC review that Talent Search is effective, the costs of the program must be estimated. While the implementation report (Cahalan, Silva, Humphrey, Thomas, & Cunningham, 2004) was useful in understanding how Talent Search operated and the impact evaluation (Constantine et al., 2006) estimated the impacts of the program, the two reports did not provide adequate detail on the ingredients used to implement the program at the time of the evaluation. These data are required to conduct a rigorous analysis of the costs of the program. Thus, Talent Search offers an excellent opportunity to apply the ingredients method to estimate the costs of a federally funded nation-wide program that has multiple sites and multiple outputs if the data can be obtained.

Talent Search is composed of 463 grant funded project sites, 15 of which were included in the impact evaluation. The program is designed to vary based on the needs of the local population and the hosting organization's interests and resources. The variation in the program design is noted in the implementation report (Cahalan et al., 2004) and in the impacts found by Constantine et al. (2006). Because variation in the program's design and effects were previously established, this dissertation includes site-level ingredients data to capture the variation in costs of Talent Search.

As noted above, Talent Search was found to positively impact two outcomes: high school completion and postsecondary enrollment. Other outcomes that are not addressed here were intermediary to or overlapping with high school completion and postsecondary enrollment. This dissertation begins by examining the cost-effectiveness of Talent Search on high school

completion. This is the primary result of the program and its evaluation, and the evidence on effectiveness for high school completion was reviewed by the WWC. The secondary outcome, postsecondary enrollment, is no less important though as the legislation to authorize Talent Search was written to increase the number of students from disadvantaged backgrounds who enroll in college. Thus, this dissertation is devoted to examining both high school completion and postsecondary enrollment in a cost-effectiveness evaluation of Talent Search.

### Applying the Ingredients Method to Talent Search

There are three aims of this dissertation: to demonstrate a thorough application of the ingredients method, to provide a cost-effectiveness analysis of Talent Search, and to illuminate and discuss challenges in estimating the cost-effectiveness of a national program that has multiple sites and multiple outputs. The analyses of this dissertation follow two research questions:

1. What is the cost of Talent Search? What is the cost-effectiveness of Talent Search? How do these estimates vary by site? How does the variability in site-level costs relate to the variability in effects?
2. When a program impacts more than one outcome of interest, how can multiple weighting schemes be used to provide policy-relevant results within a cost-effectiveness framework?

To estimate the costs of Talent Search, I apply all four steps of the ingredients method as described in Chapter 4. I conducted detailed interviews with site-level personnel at 9 of the 15 project sites that were included in the impact evaluation conducted by Constantine et al. (2006). I calculated the total cost per site and the cost per student per site using national prices for all ingredients in 2010 prices, discounted to age 18 using a 3% interest rate to account for the

multiple years of participation. I utilize three levels of data to estimate the cost-effectiveness of Talent Search on high school completion: overall, state-level, and site-level. The cost-effectiveness results become more precise as the cost estimates more closely reflect the implementation that contributed to the effects estimates.

The first research question is also designed to provide additional context to the site-level cost-effectiveness results. I am unable to predict which specific ingredients are more effective in increasing rates of high school completion and postsecondary enrollment due to data limitations. However, the rich contextual data obtained during interviews provide for addressing these dimensions in future studies.

The second research question incorporates both policy relevant outcomes of Talent Search, high school completion and postsecondary enrollment, in a more comprehensive analysis of the program's cost-effectiveness. This question examines four options to weight the two outcomes to provide stakeholders the flexibility to evaluate the program with varying weighting schemes when considering both outcomes produced from the program's cost.

### Outline of Dissertation

This chapter introduced the motivation and topic of this dissertation. In what follows, I provide a review of cost-effectiveness literature in education, a description of Talent Search and the impact evaluation by Constantine et al. (2006), and chapters devoted to my methods and results. The dissertation ends with a discussion of my findings, the implications of this research, recommendations for future study, and concluding remarks about this work.

This dissertation applies and attempts to refine the ingredients method on a longstanding federally funded national program that has multiple sites and multiple outcomes and that has not been examined for cost-effectiveness. My results show that it is possible to utilize the ingredients

method to examine the costs at varied sites that make up the Talent Search program. I show that conducting sensitivity analyses and documenting variation across sites are effective ways to capture the potential range of cost-effectiveness. While I am unable to model or predict what determines differential success at any particular site, my analyses serve to initiate a methodological discussion about the potential use of ingredients data to examine the potential relationships between costs, effects, and efficiency. It also suggests that an average cost-effectiveness (or effectiveness measure) may be highly misleading when site differences are not taken into account. Finally, this dissertation provides an evaluation and discussion of the cost-effectiveness of Talent Search in increasing high school completion, postsecondary enrollment, the additional years of schooling from both outcomes, as well as an estimate of the additional income earned by participants of the program.

Based on the limitations of conducting a retrospective cost-effectiveness analysis using effectiveness results that were previously published, I conclude by recommending that future efforts be devoted to including cost analyses as standard practice within educational evaluations. The inclusion of the ingredients method in impact evaluations would increase the precision of the cost estimates because the data for effects and costs would reflect the same implementation and be less prone to error due to the passage of time. Program evaluations that estimate both costs and effects would provide policymakers with more nearly complete information to aid decision making.

## **Chapter 2. Cost-Effectiveness Analysis in Education**

Cost-effectiveness is an economic tool used for decision-making. While health policy has utilized cost-effectiveness analyses frequently since the method's inception, cost-effectiveness analysis has only rarely been applied to education (Levin, 2013). It is an attempt to compare the costs and results of programs to measure their efficiency in resource use and to aid in determining which program is best suited for a specific setting in terms of the value of its effectiveness. The ingredients method is a rigorous approach to estimating a program's costs and in conducting cost-effectiveness analysis. This dissertation is intended to apply the ingredients method and to identify and analyze some complexities that arise in conducting cost-effectiveness analyses. This chapter reviews literature on cost-effectiveness analysis in education, the ingredients method, and guidelines for procedures in conducting cost-effectiveness analyses. Across all of the sections below, the literature points to a true need for rigorous and systematic cost analyses in education. Yet, such studies are rare. Through further exploration of what has been established regarding cost-effectiveness analysis in education, this chapter illustrates many of the gaps or issues that exist in the use of cost-effectiveness in education and the areas in which the field requires additional contribution.

### What is Cost-Effectiveness Analysis?

Cost-effectiveness analysis compares the relative efficiency of programs that share similar goals and a common measure of effectiveness (Levin & McEwan, 2001: Ch. 1, p.10). The analysis compares ratios of costs to effects, or the cost per unit of effectiveness produced by each program. By calculating and comparing cost-effectiveness ratios, a cost-effectiveness analysis aids in maximizing output for a given budget or cost constraint.

Cost-effectiveness analysis is one of two major branches of cost analysis. The other main cost analysis approach is benefit-cost analysis. Benefit-cost analysis differs from cost-effectiveness analysis in that the outcomes, or benefits, of a program are translated into monetary values in addition to the costs. The benefit-cost ratio is the amount of benefits received by society or by treated individuals from investing a dollar in the program. Benefit-cost analysis can also include other metrics besides the benefit-cost ratio such as the net present value or rate of return (Nas, 1996: Chapter 6; Levin & McEwan, 2001: Chapter 7). For the purposes of this chapter, it is best to distinguish benefit-cost analyses from cost-effectiveness analysis by stating that the two types of cost analyses both require an estimate of a program's cost, but are different in the valuation of the outcome. Benefit-cost analysis is used when a program's outcome can be translated into monetary benefits, and cost-effectiveness analysis is an especially useful tool when the effect of a program is not easily converted to monetary values. Cost-effectiveness analysis is the subject of this dissertation.

#### Why is Cost-Effectiveness Analysis Important?

Policymakers are charged with allocating limited resources to improve social welfare. When faced with such problems, policymakers must determine how to best overcome a challenge with a program or policy or combination of strategies (Levin, 1975). Due to the nature of finite resources and very limited budgets, it is imperative that efficient decisions are made to avoid waste. It is clear that policymakers value information regarding costs and comparative efficiency (Monk, 1995). Yet, the research in education is largely focused on effectiveness. By limiting the research produced to effectiveness of alternatives, we are restricting the ability of policymakers to select programs and policies that are efficient and appropriate for their contexts (McEwan, 2002). Therefore, cost-effectiveness analysis is important as it allows policymakers to

examine the trade-offs between alternative options at producing a particular output (Coombs & Hallak, 1987). By including costs in our evaluations of education programs and policies, we are able to improve our understanding of what works in education (Ross, Barkaoui, & Scott, 2007).

**Effectiveness is necessary but not sufficient.** Over the last decade, the rigor of policy and program evaluation in education has received a lot of attention, especially from the Department of Education’s Institute of Education Sciences (hereinafter IES). IES developed rigorous evaluation standards and prioritized funding for policy and program evaluations that met those standards. IES prioritized randomized control trial (hereinafter RCT) impact evaluations and labeled them the “gold standard” in evaluation research (US Department of Education, 2003). IES has funded more than 40 large scale RCTs since its inception in 2002 (US Department of Education, 2012). In addition, IES created the What Works Clearinghouse (hereinafter WWC) in 2002 to evaluate the quality of evidence provided by published impact evaluations. Its intent is to provide the education community with a rich database of information about which programs, policies, and practices are effective.

The WWC produces intervention reports that review evaluations of an educational intervention for methodological rigor in identifying the effects of the intervention and for the reliability of those results. The WWC groups these intervention reports into topic areas where users can rank order interventions based on impact and level of evidence. The WWC also reviews the methodological rigor of single studies (reports or publications) that have been widely publicized in education. Similarly, if the WWC receives requests for a review that is needed quickly, they can also produce a quick review, which is a shorter review than the intervention report or the single study review. In addition to reviewing the quality of evidence for a particular intervention or study, the WWC also provides practice guides around a specific topic in

education to summarize themes across interventions and evaluations within a specific topic area. The methodological criteria used by the WWC to evaluate the causal evidence of effectiveness favor RCT evaluations over other quasi-experimental methods because of the higher likelihood of having internal validity by establishing a casual relationship between providing the treatment and the measured results (U.S. Department of Education, 2013c).

With this emphasis on RCTs and on causal methods of estimating a program's impact, IES established standards for rigorous program and policy impact evaluations within the educational community. While this shift towards more rigorous methodology in evaluating education policy was beneficial in identifying the causal evidence of effects, it was not sufficient for policy decisions because it ignored the information regarding costs required for efficient use of resources in selecting programs or designating education reform. The focus of IES and the WWC on identifying causal effects and providing a clearinghouse of educational program evaluations founded solely on impacts gives the inaccurate impression that the program with the largest average impact is the best program, regardless of the program's costs, differential effects, or resource requirements. Future efforts should be devoted by promoters of education research, such as IES and the WWC, to support the inclusion of rigorous cost and cost-effectiveness analyses within impact evaluations so that the education research produced is more useful to policymakers by allowing them to review the comparative efficiency of educational alternatives.

**Cost-effectiveness analysis is a tool for policymakers.** Just as effects are not enough to make sound decisions, cost-effectiveness comparisons are not intended to be used in isolation from contextual information about the feasibility of implementation (Levin, 1975; Clune, 2002). Cost-effectiveness results provide important information for policymakers to use in conjunction with knowledge of local needs and expertise to allocate limited resources.

Even if an intervention shows a high cost-effectiveness rating at one location, it may not be the best choice for another. A classic example of the importance of both the resources needed for a reform and the local context of that reform is class-size reduction. In Tennessee, Project STAR was implemented in 1985 and was found to have positive impacts on student performance (Finn & Achilles, 1990; Mosteller, 1995; Krueger, 1999). Based on this finding, many locations and government officials began espousing the benefits of a class-size reduction policy (Levin & McEwan, 2001: Ch.1, p. 24-25). When a class-size reduction reform was later implemented in California, it did not attain the level of impacts found in Tennessee (Jepsen & Rivkin, 2002; Jepsen & Rivkin, 2009). While the reforms in the two states were not the same, the failure to achieve the desired outcome in California was in part due to a lack of understanding of the resources required to implement the reform successfully and due to not accounting for the local context. One way that cost-effectiveness studies can contribute to this knowledge gap is through the identification of the resources, or ingredients, necessary to implement a given reform. However, policymakers must then evaluate this information against their local context and the resources available. While cost-effectiveness analysis aids in decision-making, the results do not supplant the judgment of policymakers regarding the feasibility of the programs in their jurisdictions.

#### What are the origins of CEA in education?

Cost-effectiveness analysis was developed following World War II and used in the 1960s by the U.S. military as a way to compare weapons systems that had similar goals but outcomes that were not easily translated into monetary values (Levin, 2001; 2013). In the following decade, Henry Levin began to apply the new evaluation method of cost-effectiveness analysis to education (Levin, 1970a; 1975). Education was similar to defense in that most of the outcomes

sought were not translatable to monetary benefits. Thus, benefit-cost analysis was not applicable, making cost-effectiveness analysis the most appropriate method of evaluating the efficiency of program alternatives.

Levin first utilized cost-effectiveness analysis to show that selecting teachers with higher verbal test achievement was more cost-effective than hiring teachers with more experience (Levin, 1970a). He followed this application by developing a method for doing cost-effectiveness comparisons in education and other public services which he termed *the ingredients method* (Levin, 1975). His method was founded on the economic definition of costs as opportunity costs, which values all resources utilized by an intervention according to the next best use of each resource, or “ingredient” (Levin, 1975). The method also was designed to be straightforward so that evaluators could easily incorporate cost evaluations into their work (Levin, 2001). Levin went on to publish two textbooks, and many articles on the ingredients method, as well as teaching courses and workshops and publishing demonstrations of the method, all of which have informed and built the foundation for this dissertation (for books see Levin, 1983; Levin & McEwan 2001; 2002).

**The ingredients method.** The ingredients method provides a consistent approach to assessing the costs and cost-effectiveness of a program or policy so that legitimate alternatives can be compared for their relative efficiency at achieving an educational goal. The method is composed of four main steps: listing all ingredients, pairing all ingredients with market prices, estimating the total and average costs, and pairing costs and effects to calculate cost-effectiveness ratios (Levin & McEwan, 2001: Chapter 4).

The first step is to identify all ingredients required to replicate a specific implementation of a program. Each ingredient must be accounted for in both the quantity and characteristics

needed to precisely cost the program or policy and to better understand the implementation. It is important to include all ingredients when analyzing a program, regardless of who financed the ingredient. For example, if an after school program requires the use of volunteers to provide tutoring to students, the volunteer must be included as an ingredient as it is required to replicate the program.

The second step of the ingredients method is to determine for each ingredient its monetary value or cost by using market prices. When market prices are not available for an ingredient, shadow prices (value of the ingredient as though a market existed) can be used (Levin & McEwan, 2001: Chapter 4, p.60-61). Levin recommends the use of national prices to rule out problems of local market variability for general comparisons of interventions, although local or regional prices can be used when limited to those regions, such as cities or states (for early examples see Levin, Leitner, & Meister, 1986; Levin, Glass, & Meister, 1987; for discussion see Levin & Belfield, 2013). Without using national prices to estimate costs, it would be impossible to compare with uniformity a program implemented in Chicago to one in North Carolina, or to cost a program that has sites all over the nation.

The third step is dedicated to estimating the total program cost and the cost per student. The estimates are adjusted for the general price level in order to gain comparability in a given year or discounted for projects being compared for multiple years of treatment. Costs can also be allocated to the entities providing the ingredients or subsidizing them through financial transfers. Sensitivity analyses are utilized to test the robustness of the estimates to alternative assumptions.

The fourth step matches costs to the associated measures of effectiveness of each intervention through the calculation of the cost-effectiveness ratios. The ratio provides the cost per additional unit of output produced by the program. In the case of Talent Search, the ratio is

interpreted as the cost per additional high school completer. The cost-effectiveness ratios then provide information about the relative efficiency of the programs at producing the outcome of interest.

**Ingredients method versus budget data.** Overall, there are relatively few cost-effectiveness studies in education and even fewer that measure costs properly using the ingredients method. Many studies or reports of costs rely on budgetary data or the quoted price for a program that is available for sale. Budgets are designed to monitor expenditures rather than to estimate efficiency (Coombs & Hallak, 1987: pg. 46). Educational budgets are not designed to provide accurate information on program costs. For example, a program that requires computers may utilize computers that the school purchased the year before the program was implemented, which would not appear in the same annual budget as the program. However, the computers are necessary for the program to operate, and while the participants are using the computers the computers are not available for any other purpose. Thus, the time allocated to the program for computer use should be included to accurately reflect the costs associated with the program. If a policymaker in another location were interested in replicating the program a cost estimate based on budget data would not reflect the needed ingredients and the true cost of the program. Thus, the cost estimate would not provide the new location with adequate information regarding the specific resources or their costs that were necessary to implement the program successfully.

Other reports, such as those previously produced by the What Works Clearinghouse, report the quoted sale price of an intervention from the vendor as the cost of the intervention, ignoring the costs of all resources provided by the school to implement the intervention such as personnel. Similar to budget data, the quoted price for a program is not the same as the cost to implement the program. For example, the cost of educational software that is quoted by

educational vendors does not include personnel costs, space, staff training, and other requirements to establish and operate the program.

There is some recent recognition of the inadequacies of using vendor prices or budgets. The What Works Clearinghouse has recently adapted their reporting strategy to list some ingredients under the costs section rather than the program's quoted price (U.S. Department of Education, 2013d). But, referring to budgetary expenditures or "an inquiry to the business office" is not an adequate method for identifying accurately the comparable costs of an intervention.

### Applications of Cost-Effectiveness Analysis in Education

**Initial applications.** The first example of cost-effectiveness analysis in education, which was also the first application of the ingredients method before it was named as such, showed that selecting teachers with higher verbal scores was more cost-effective than hiring teachers with more experience (Levin, 1970a). After further development of the ingredients method, computer-assisted instruction was examined for costs and later compared for relative efficiency to peer tutoring, class size reduction, and increased instructional time in increasing reading and math skills (Levin & Woo, 1981; Levin, Glass, & Meister, 1987). The study found peer tutoring to be the most cost-effective method of increasing math scores and peer tutoring or computer-assisted instruction to be the most efficient options for increasing reading scores (Levin, Glass, & Meister, 1987). These initial cost-effectiveness studies in the field appear to have had little impact on policy in education as class size reduction and lengthening the school day continue to be favored reforms in education and teacher pay continues to be based on experience.

**Recent use of the ingredients method.** Since the 1987 study on computer assisted instruction, there have been a handful of applications of the ingredients method. The noteworthy finding that exists in different forms across these recent studies is difficulty establishing

comparability: comparability of programs, comparability of outcomes, and comparability of costs.

In an examination of adolescent literacy, the authors found vast variability in ingredients use and costs across sites within one program (Levin, Caitlin, & Elson, 2007). Such within-program variation of costs makes it difficult to easily compare the program to an alternative in a cost-effectiveness analysis because of the uncertainty of the average cost estimate. If a program has a wide range of costs or cost-effectiveness, how useful or accurate is it to present an average estimate to compare the program to an alternative?

A similar finding of substantial variability in costs, as well as effects, was reported in a demonstration analysis of programs that target high school completion (Levin et al., 2012). That report documented the difficulty of establishing true programmatic alternatives due to differences in the purposes of the programs and the populations targeted by the programs. One program targeted students who were in school while others targeted youth who had already dropped out. The third difficulty noted by Levin et al. (2012) was the non-comparability of outcomes across programs due to measurement. All programs combined the number of students who earned high school diplomas with the number of students who passed the general education development (hereinafter GED) assessment for a certificate of high school equivalency completion. Combining different forms of high school completion by mixing graduates and GED completers is not ideal because the two results are not equivalent in the labor market (Heckman, Humphries, & Mader, 2011, Section 3). The program that targeted students who were in school was much more likely to result in high school graduates whereas the programs for dropouts were intended to result in GED completion. While all programs impacted “high school completion” generally, they did so by targeting different populations and impacting different outcomes. These

two issues coupled with the vast variation found in costs and effects within the programs made it impossible to compare the cost-effectiveness results obtained in the study for a policy audience.

These findings were echoed through another demonstration analysis that focused on interventions that impacted early literacy outcomes (Hollands et al., 2013). The authors show that even when the outcome of interest appears to be similar across two programs (“early literacy”), the effects may not be comparable due to differences in populations or differences in the way the outcome was measured. Some programs targeted struggling readers while other programs were provided to the entire class. Programs also targeted different grade and skill levels of students. Additionally, early literacy encompasses multiple outcomes, such as alphabets, fluency, and reading comprehension, and those “outcomes” are in fact composed of many smaller outcomes, such as letter knowledge, print awareness, phonics, etc. Each of those smaller outcomes or larger domains may be measured differently, with some measures being correlated with larger increases in scores because the measure was highly specific or created by the program’s developer.

Overall, this recent work highlights methodological considerations in conducting cost-effectiveness analyses more so than providing true cost-effectiveness comparisons. These studies illustrate difficulties in constructing a cost-effectiveness analysis: identifying true alternatives that impact the same outcome and documenting variability in costs and effects. Future work could be beneficial to further develop guidance for researchers to construct cost-effectiveness analyses that truly compare program alternatives for a policy context.

#### Cost-Effectiveness Analysis in Education: Recommendations and Critiques of the Method

The ingredients method established a rigorous approach to cost-effectiveness analysis for education researchers. Several scholars have contributed suggestions for the application and

improvement of cost-effectiveness analysis in education. Some recommendations mirror the writings of Levin while others hone in on areas of the method that need careful examination and adoption.

**Basic criteria.** Patrick McEwan listed seven criteria for a minimally competent cost-effectiveness analysis (McEwan, 2002: p. 38-41). While these criteria largely reflect the writings of Levin and the ingredients method, the list itself provides the community with a succinct list of checks for completeness when conducting a cost-effectiveness study. The criteria include: identifying and describing alternatives for comparison, establishing and relying on casually estimated impacts, utilizing a systematic approach to estimating costs that includes opportunity costs, adjusting costs and effects for differential timing, distributing costs and effects across individuals, calculating cost-effectiveness ratios, and accounting for uncertainty through the inclusion of sensitivity tests.

McEwan's first criterion is to fully describe the alternatives considered in a cost-effectiveness analysis (McEwan, 2002: see Table 3.1 on pg. 41). The descriptions allow others to take an informed approach to reviewing the ingredients included in the study, any assumptions made by the researchers, and the cross-program comparisons included. The descriptions also allow for easier replication of the programs included and application of the findings to other settings.

The second criterion is to establish causal relationships between the receipt of the programs of interest and the estimated effects to examine the comparative efficiency of each program in improving the outcome of interest. The researcher must provide evidence that the effects being used have internal validity, which means that the results accurately reflect that effects were caused by the intervention. In a retrospective cost-effectiveness analysis, this can be

difficult as the effects were usually estimated by another party and often several years prior to the cost-effectiveness analysis (Levin et al., 2012). In addition to causality, the outcome of interest must be the same for each alternative and the measure of the outcome must be equivalent across programs. (Levin & McEwan, 2001: p. 10 & 109).

McEwan set the third criterion as establishing costs through systematically identifying all ingredients and valuing each ingredient at its opportunity cost. While all of these criteria describe the ingredients method of conducting a cost-effectiveness analysis, this criterion is devoted to the heart of the method: producing a cost estimate based on opportunity costs.

The fourth criterion then requires that if an intervention is longer than one year or if the outcomes are in the future, that the costs and effects be discounted to their present value. Individuals prefer to receive benefits sooner rather than later (McEwan, 2002: p. 39). A benefit could be having a cost delayed by a year or more and being able to earn interest on the funds or having a highly valued outcome occur sooner in time rather than later. This step controls for this uneven distribution across time by transforming costs and effects into the same time period, for all interventions included in a cost-effectiveness analysis. Levin & McEwan provide an excellent illustration of costs occurring in different years across three program alternatives in their 2001 textbook (Levin & McEwan, 2001: Ch. 5, p. 91).

After establishing the costs and effects of each alternative, the fifth criterion is that the analysis considers the distribution of costs and effects. The costs of a program may be borne solely by one individual or agency, but in many cases in education some ingredients are provided by different levels of government, private donations, or contributed in-kind by volunteers. Likewise, the effects may differ based on student characteristics or location.

The last two criteria are to calculate the cost-effectiveness ratio for each intervention and to include sensitivity tests for any uncertain parameters within the evaluation. McEwan prefers that multiple methods of sensitivity testing be utilized to best illustrate the robustness of the results of the analysis.

McEwan stressed that for cost-effectiveness analyses to be useful, they must be rigorous and have as much attention applied to them as is given to estimating unbiased estimates of effectiveness (McEwan, 2002: p. 47). These criteria show that the entire analysis from conceptualization to comparison is important and methodological transparency is critical. Together, the list serves to provide a guide to researchers conducting cost-effectiveness analyses and to those stakeholders reviewing and utilizing the results. There have also been other recommendations beyond these basic criteria that focus more in-depth on particular aspects of the ingredients method or cost-effectiveness analysis. The section below addresses some of the recommendations.

**Deeper exploration of basic criteria.** The following recommendations provide further guidance and attention to specific aspects of the ingredients method and cost-effectiveness analysis.

*Specify ingredients in detail.* It is not enough to list all of the ingredients necessary for a program to have the observed impact on the outcome of interest. Each ingredient must be specified sufficiently to accurately value the item using a market or shadow price, and the level of detail provided for each ingredient should be proportionate to the overall contribution of the ingredient to the program's total cost (Levin & McEwan, 2002: Ch. 1; Levin & McEwan, 2001: Ch. 3, p. 53). This guidance aids in the efficiency of data collection so that researchers do not spend hours interviewing program staff regarding the details on office supplies and instead focus

on larger issues such as the qualifications of the individuals providing the treatment. More specifically, all ingredients are listed and described, but the most costly ingredients, such as the personnel or volunteers providing the intervention services, should be a main focus during interviews and data collection. By gaining precision on the most costly inputs, the chance for error in the estimation of the total cost of the program is reduced.

*Focus on replication.* The ingredients data collected provide valuable information for future replications of the program. A cost study contributes a detailed list the ingredients used in a particular implementation that would be necessary to replicate the program's resource use (Levin, 1983: Chapter 3, p. 52). The assumption implicit in the method's applicability for future replication is that the costs and effects were estimated from the same implementation.

Unfortunately, this approach does not appear to have been systematically incorporated into cost-effectiveness research. This could be due to the difficulties associated with collecting accurate ingredients data retrospectively. When the ingredients are not noted at the time of implementation, the data must be collected from archival documents and interviews that rely upon individuals to recollect what resources were utilized, which could be prone to error especially as time passes.

When paired with implementation details of a program evaluation, such as specifying the detailed operations of the program, the resource and demographic environment of the evaluation, and any additional features that characterize the replication, the two types of data together can provide rich information about the context of the implementation of the program and the resources required. This information can aid in determining if a particular program is a good fit for the needs of the population and if the resources are available.

*Sensitivity analysis to provide upper and lower bounds.* Sensitivity analyses are typically employed when addressing assumptions that are subject to discretion or different opinions such as the discount rate used for multiple year programs. In Levin's original chapter describing the ingredients method, he encouraged researchers to include upper and lower bounds when there is uncertainty or the potential for large margins of error in the estimation of cost (Levin, 1975). In his text with McEwan, this recommendation is echoed as a way to test the sensitivity of an uncertain cost parameter (Levin & McEwan, 2002: Ch.1).

Monte Carlo Simulation has also been suggested as a method to test the robustness of the cost-effectiveness ratio (Levin & McEwan, 2001: Ch.6, p. 149-150; Levin & McEwan, 2002: Ch.1). After setting the parameters of the distribution for the costs and effects, random values for the costs and effects are simulated. These values can be combined to estimate many potential combinations of the cost-effectiveness ratio. If the simulation produces tightly clustered cost-effectiveness ratios, then the uncertainty that exists does not alter the conclusions in a substantively important way. Another approach to bounding, is to include uncertainty regarding the effectiveness of a program by calculating the cost-effectiveness ratio with the upper and lower bounds of the impact estimate (Dhaliwal, Duflo, Glennerster, & Caitlin, 2012).

This dissertation is largely focused on extending the application of this recommendation to include upper and lower bounds in sensitivity testing by examining the variation that occurs across sites in both costs and effects in estimating the cost-effectiveness of a program.

*Incremental approach to costing.* Throughout the process of establishing the costs and cost-effectiveness of a program, transparency is key to the success of the analysis and of the utility of the results. One area that is often misunderstood about the ingredients method is the approach to listing ingredients. All ingredients required to achieve the impact in relation to the

control group (the incremental ingredients) are necessary for a cost-effectiveness analysis (Levin et al., 2012). Take, for example, an evaluation of an after school science program where the treatment group receives the science program and the control group does not. If both the treatment and control groups receive the same standard science curriculum and other classes during the school day, it is not necessary to include the costs of schooling when estimating the costs of the program of interest because the school day is not impacted by the after school program being evaluated. If the children receiving the treatment are transported to school and would have been regardless of the existence of the science program, the transportation costs are not an incremental cost of the program and should not be included. Further, even if the cost of transportation was included, it would be cancelled out because the control group is receiving that service as well.

Another way this discussion has been framed is to determine the decision point of consideration for using the analysis and basing the program and the necessary ingredients to replicate the program on that perspective (Dhaliwal et al., 2012, p. 23). The most commonly agreed upon perspective is that of a policymaker who is allocating resources between alternative programs (Dhaliwal et al., 2012; also used frequently in the work of Levin, see Levin & McEwan, 2001: p. 48). Thus, if a program is designed to be implemented beyond the conventional program, the ingredients utilized in the conventional program do not apply in the comparison. However, it could be the case that an intervention's relative efficiency in a cost-effectiveness analysis could be a function of the quality or characteristics of the conventional program. This should be considered in future research.

*Cost and effect correspondence.* The costs and effects used to calculate the cost-effectiveness ratio for an intervention should be collected from the same implementation - at the

same sites with the same students - for each intervention included in the cost-effectiveness analysis (Harris, 2008). By estimating the costs and effects of a particular implementation, the resulting cost-effectiveness estimate provides the efficiency of an adoptable or replicable intervention. Otherwise, if the costs are estimated based on one implementation of a program and the effects are from another implementation of the same program, there is no way to have any confidence that the two different implementations were related and that they could serve as substitutes for one another in an analysis. In this instance, the cost-effectiveness ratio is not applicable to any stakeholder in education as it is not representative of an actual implementation of the program being analyzed.

Based on this review, it appears that the research community has paid little heed to this recommendation. In two recent studies of early literacy, both reports have at least one instance of failing to attend to this requirement (Simon, 2011; Hollands et al., 2013). Rather than excluding a program from the study because it was not possible to cost the implementation that was previously used to estimate the effectiveness of the program, these studies pair costs from interviews with program personnel about the program generally with the effects from specific interventions.

These studies illustrate a serious limitation of conducting cost-effectiveness analyses retrospectively. When a program's impact was estimated in the past it can be very difficult to obtain accurate cost data regarding the same implementation. The researcher is then left with a difficult decision to include or exclude the program from the analysis. This issue is a justification for conducting evaluations of costs and effects simultaneously (Levin et al., 2012). This dissertation echoes this perspective as it is a retrospective analysis with limitations due to the lapse in time between the measurement of the costs and effects.

**Proposed extensions to the method.** In addition to suggesting that researchers pay more attention to careful application of the ingredients method, recommendations also encompass ways in which the method should be expanded. These recommendations are discussed below.

*Discuss and analyze displaced activities and outcomes.* In education, many programs are implemented in school and during the school day. While some programs replace a particular curriculum for the whole class and do not require any adjustment of the rest of the school day, other programs are pull-out programs or add-on programs that are provided in addition to the conventional curriculum which displace the time available for other activities. The repercussions for excluding displaced activities during the school day from a cost-effectiveness analysis are wide ranging and are not easily captured through the measurement of one outcome (Levin, 2002: p. 6).

For example, if a pull-out tutoring program is administered to small groups of struggling readers during the school day in addition to the standard reading curriculum, it is important to know if there are any side-effects. If the students miss mathematics their math skills may not develop adequately. If the program replaces physical education, the students may have trouble staying motivated or focused during the school day which may impact many educational outcomes. Additionally, the nature of pulling a student out of class publicly identifies that student's status as a struggling reader and may impact the student socio-emotionally.

The main issue appears to be a lack of transparency regarding what is displaced by the implementation of a new program. In the recent study of early literacy, the authors note that the evaluations of pull-out or add-on programs do not include any information on what is sacrificed (Hollands et al., 2013). This problem is especially predominant when conducting retrospective cost-effectiveness analysis using prior impact estimates because the data often do not exist on

what was displaced nor do the impact evaluations measure side effects of the program on other outcomes. This leaves the policymaker in the difficult position of selecting an add-on program without any knowledge of what the repercussions might be on other educational outputs.

*Incorporate the distribution of outcomes.* The effects of a program can vary in empirically and practically important ways. Our reliance on the mean effect is based on two key assumptions: (1) increasing an outcome on average will increase general welfare, and (2) the distribution of the effect is not important (Heckman, Smith, & Clements, 1997). However, the population within a policymaker's jurisdiction may not be interested in average increases in an outcome, prioritizing instead targeted outcomes for a specific group (Heckman, Smith, & Clements, 1997). Some methodologists have attempted to alter impact estimation models by using a quantile regression approach to estimate the "Quantile Treatment Effect", or how the effect differs across the sample being studied (Abadie, Angrist, Imbens, 2002). The research in this area indicates that average impacts may fail to adequately represent the heterogeneity of the impacts (Bitler, Gelbach, Hoynes, 2006). Other methodologists break down the average impact estimate across different groups or samples within an evaluation to see if the effect is modified or if the average impact is adequate.

Overall, research has shown that the estimated effects or magnitude of effects of a program can depend on the grade level of the students, the demographic characteristics of students and teachers, the test used to measure impacts, and the method used to identify the effect (Hill, Bloom, Black, & Lipsey, 2007). More specifically, program effects can vary due to differences in the program, differences in the sample, or differences in context (Weiss, Bloom, Brock, 2013). It seems that the next step in estimating the impact of a program is to also study the variability of that impact.

Cost methodologists have also discussed the importance of examining heterogeneity. Grissmer argued that such differentiated outcomes must be addressed in a cost-effectiveness analysis to provide more thorough information regarding a program's efficiency and comparability to alternatives (2002). The valuation of impacts across groups could be different across jurisdictions because of local contextual environments and needs of the population, which provides support for including the distribution of outcomes and efficiency in program evaluations. Similar to impact evaluation, it does not appear that cost-effectiveness analyses have incorporated this guidance yet. This could be because impact studies do not often report differentiated results.

I illustrate in this dissertation that the ingredients method lends itself well to this effort as it provides many details about the resources used to implement a program and can be designed to capture how those resources varied at different sites or for different student groups. Thus, this is an area where both sides of an evaluation, effectiveness and costs, could benefit from expanding beyond just estimating the average impact and costs to include a study of variation.

*Incorporate impacts on multiple outcomes.* It is rare in education to come across a program that targets and impacts only one outcome of interest (Rice, 1997). High school completion seems like an exception; however even those studies often also examine progression in school, attendance, credits earned, grade point average, high school graduation, general education diploma, advanced diploma, advanced placement or dual enrollment coursework, applications to college, and enrollment in a 2-year or 4-year college (Levin et al., 2012; Constantine et al., 2006; Stern, Dayton, Paik, & Weisberg, 1989).

Comprehensive impact evaluations attempt to capture multiple outcomes by increasing the number of hypothesis tests included in the evaluation to provide a more accurate estimate of

a program's impact, as well as to better understand how a program works. Because increasing the number of hypotheses tested increases the chance of wrongly reporting an impact where none exists, methodologists have written about the need to correct for testing for multiple comparisons across outcomes or across subgroups (Schochet, 2008). This issue should be considered when conducting cost-effectiveness analyses of programs that impact multiple outcomes.

Evaluations may include more than one outcome to capture more information about the impact within a specific topic area (such as phonics and fluency) or the additional outcome may be in another domains to better understand the breadth of the impact of the program (such as math and science). Longitudinal studies are particularly able to study a wide range of outcomes because of the additional time to collect data. For example, a study of the impact of a preschool program may also provide impacts on adult outcomes such as college, criminal activity, or income (Belfield, Nores, Barnett, Schweinhart, 2006).

Regardless of the type of outcomes impacted, if policymakers value the secondary outcome(s), it is important for researchers to attempt to account for a program's multiple outcomes when conducting a cost-effectiveness analysis. If only one outcome is presented and the program has another outcome that is not impacted in the same proportions as the outcome that is included, the study will inaccurately attribute all of the costs to the production of only one outcome and implicitly value all other outcomes at zero (Levin, 1975). Simon (2011) used cost-effectiveness analysis to compare early reading programs using a weighting scheme based on a panel of reading specialists who reported the relative utility (value) of the outcomes. From this, she created an effectiveness index to capture programmatic impacts across multiple domains in early reading. Simon's work was notable in that she calculated the utility based on specialists' opinions. While useful, it could be that such a weighting scheme may not provide similar results

where other audiences (parents, administrators, teachers) or where other values may drive policy consideration.

In an examination of the same topic area, the most recent report on early literacy from the Center for Benefit-Cost Studies on Education took a slightly different approach to incorporating the multiple outcomes of alphabets, fluency, and reading comprehension (Hollands et al., 2013). Instead of combining the outcomes into one effect, the report divides the cost of each program by the time spent focusing on a particular outcome of interest as judged by the developers and presents cost-effectiveness ratios for each of the three outcomes. One way this type of comparative analysis in early literacy is further complicated is that the three main outcomes presented are composed of other more intermediate outcomes such as phonological awareness, phonics, letter knowledge, sight words, print awareness, and vocabulary. This complexity of outcomes makes it very difficult to disentangle results to establish comparability across programs when each evaluation measures the results differently.

The approach taken in the cost-effectiveness analysis of dividing costs by intended skills targeted is interesting, but it is not without limitation. It is not difficult to believe that a developer has unique knowledge about a program's intended outcomes or target skills. However, these individuals are far from objective, especially when a comparative analysis is being done of their program against competitors. Also, a program may have outcomes that were not targeted by the intervention. Are those outcomes free of cost? Not likely. It is likely not possible for a policymaker to purchase part of a program that impacts a specific skill. Even if costs are clearly divisible across domains it is unclear how they may interact (Dhaliwal, Duflo, Glennerster, Tulloch, 2012). Thus, this strategy of dividing costs across outcomes does not seem useful for a policy context.

This research, while not free of challenges, has certainly begun to address the issue of multiple outcomes in cost-effectiveness analysis. However, it is clear that the field has room to develop substantially in this area. This dissertation explores the combination of two outcomes: high school completion and postsecondary enrollment. One major difference between this dissertation and the prior work on multiple outcomes is that the two outcomes in my analyses have market values or can be assessed by additional years of education, well-established outputs of education. This also suggests the feasibility of a benefit-cost evaluation.

*Examine site-level variation in costs.* In early studies of institutional or organizational variation in program implementation and impacts, reports emerged on how little past reforms had impacted the operation of schools and the ways in which schools were organized and structured to educate students (Tyack & Cuban, 1995). It appeared that schools were remaining largely unchanged after the implementation of interventions. Researchers then began investigating what contributed to successful reform implementation, which was later termed the “implementation problem” in education (McLaughlin, 2005). The most notable study was conducted by Rand, which found that the organizational structure and local context of implementation impacted programs more than the behavior and practices within schools (McLaughlin, 1990). It has been suggested that programs that allow for site-level adaptations may be more successful (King, 1994). Presumably, this is because better implementation results in better outcomes (Durlak & DuPre, 2008).

Methodological advancements in evaluation have been proposed to incorporate this knowledge regarding the influential relationship between context and program impacts (Lipsey, Puzio, Yun, Hebert, Steinka-Fry, Cole, Roberts, Anthony, & Busick, 2012). In an article presenting a new perspective on estimating the effectiveness of schools, Levin suggested that

results can be biased due to variability across school sites (Levin, 1970b). Because of site-level differences, the average impact of a program may not apply to any particular school or location and thus providing a range of effects or a range of efficiency may be helpful for policymakers (Levin, 1971; Rice, 1997). In fact, one contributing factor to the usefulness (or lack thereof) of research may be the inclusion of contextual information (Levin, 1978). One way to include such contextual information is to discuss results from evaluations of similar programs or to compare the results of the study to external impact standards (Lipsey et al., 2012).

These recommendations apply to evaluating costs as well as effects. Research has shown that implementation variation in resource use within what is characterized as the same program occurs across sites causing the cost of a program to vary substantially (Levin, Catlin, & Elson, 2007). This finding was based on a study of a program with a highly specified curriculum, READ 180, a program provided by a commercial publisher, Scholastic Inc. Such specification may have been intended as a way to get around the “implementation problem” by giving each site detailed instructions regarding the implementation of the program in the hopes of standardizing practice and outcomes. However, it was shown that implementation variation is related to the organizational contexts of school, resource constraint, and other dynamics. The variability in how reforms are adopted is also driven by the differential allocation and employment of resources across sites. Because the program was highly specified, the authors concluded that the variability was not attributable to the program itself; rather, this was likely a systemic issue that could be found within any program (Levin, Catlin, & Elson, 2007). By presenting an average cost for a program, such site-level variability (which can be substantial) is masked and makes it unclear what actual resources and costs are required for effective implementation at any particular site. Thus, generic claims regarding a program’s average cost-

effectiveness may be a misleading way to convey a program's actual costs and to relate them to differential effectiveness (Levin, 2013).

This dissertation builds upon these advancements to pair cost analyses across different sites with effectiveness data to illustrate the degree of variability in cost-effectiveness across sites within one program. The program examined here, Talent Search, is nationally provided and designed to build upon differences in local context and needs. This dissertation illustrates the benefit of the ingredients method of providing costs, ingredients, and resource variation across sites. By applying the method to multiple sites within one program, we are able to potentially increase our understanding of how one site varies from another in efficiency.

*Evaluate typically operating programs.* Cost-effectiveness analysis is most useful when it is used to evaluate a program that is operating as a typical replication, rather than as a demonstration project or for the sole purposes of evaluation (Levin, 2002). Programs that are being demonstrated or implemented for the purpose of evaluation may not operate similarly to a typical implementation because of the involvement of evaluators and developers. In a recent cost-effectiveness study of early literacy programs, the ingredients lists included observations by researchers because the time spent by the evaluators observing the program was not trivial and could have contributed to the program's impact (Hollands et al., 2013). Further investigation is needed to determine the ways in which the ingredients method can capture an environment that is altered due to the presence of an evaluation.

*Predicting successful implementation.* As discussed above, the "implementation problem" in education has been the subject of many studies to determine why some implementations are successful and others are not (McLaughlin, 2005). It seems that there is a debate in the literature about what predicts the successful implementation of a program so that it

generates positive benefits to the community: is it close adherence to program design with oversight to measure fidelity or it is allowing for flexibility across some dimensions to increase the likelihood of buy-in and adoption? Better outcomes are produced by implementation fidelity, yet implementation is most successful when local factors are allowed to contribute to the application or execution of a program (Durlak & DuPre, 2008). Thus, it does not appear that the existing research on implementation has reached a consensus about the importance of specifically following one set of program implementation guidelines versus allowing room for local adaptation.

Impact evaluation research has begun to advance in this area by examining characteristics of a program that are related to or predict positive impacts. Bloom, Hill, and Riccio (2003) examined data from three large, multi-site randomized control trial studies of welfare-to-work programs to determine what led to success, if any aspects were related to quicker attainment of outcomes, and if the outcomes varied by population characteristics. Some studies accomplish this through a meta-analysis of a large body of literature on a topic (Wilson, Lipsey, & Derzon, 2003). While this research provides insights into predictors of successful implementation and of positive impacts on an outcome from a program or a type of programs, there is very little information about how different patterns of resource use, as measured by the ingredients method, may contribute to success.

Resource use is an historic issue in the economics of education that is largely characterized by Hanushek's (1997) argument that the amount of spending in education does not generally matter. However, it is important to make clear that even Hanushek believes how money is spent makes a difference, a focus that can be uncovered by the ingredients method. Cost-effectiveness analysis is distinctly different from the debate of whether overall spending

makes a difference in that it examines the costs of specific alternatives in their impacts on producing changes in the outcomes of interest (Ross, Barakaoui, & Scott, 2007).

From a survey of the applications of cost-effectiveness analysis in education, it does not appear that the relationship between resource use and outcomes has been explored. Thus, it appears that there is much left to learn about the role resources play in producing outcomes successfully. This dissertation begins a discussion of this issue by providing a basic analysis of the variability in resource use, effects, and cost-effectiveness across sites.

### Current Issues

**Rarity of cost-effectiveness analyses.** The development, application, and extensions of the ingredients method have made cost-effectiveness analysis more accessible to researchers to evaluate the comparative efficiency of program alternatives at achieving similar goals. Oddly, cost-effectiveness analyses are rarely done in education. The terminology “cost-effective” is often used anecdotally as a descriptor to indicate the idea that the program is considered by the author to be attractive and of good value (Levin, 2001; Clune, 2002). Levin identified three possible reasons for the rarity of cost-effectiveness analyses in education: a lack of rigorous studies that have found positive impacts, little or no training or understanding of cost-effectiveness by decision-makers and researchers, and a lack of demand by education policymakers and funders of educational research for the inclusion of cost analyses in evaluations of programs and policies (Levin, 2001; Levin, 2013).

Each of these three potential reasons is currently being addressed by the U.S. Department of Education’s Institute of Education Sciences (IES). IES was created in 2001 as the research branch of the Department of Education to advance research in the field and to build a stronger foundation regarding what works in education. This mission ultimately led to many funded

studies that utilized the strictest causal impact methods, as well as the development of training programs in causal methods. This approach both increased the capacity of the field to conduct rigorous causal impact evaluations and the demand (and funding) for such research.

Recently, IES has started to identify costs and cost-effectiveness as important aspects of program evaluation. Now that IES has established causality as a paramount objective in evaluating the impact of a program, it is logical that costs have come into focus as both causal impacts and costs help to provide more complete evaluations for policymakers. In 2012, the Office of Management and Budget disseminated a memo to department heads, including the U.S. Secretary of Education Arne Duncan, requiring that evaluations become more innovative and include cost-effectiveness calculations (Sparks, 2012). In its request for proposals for funding in fiscal year 2014, IES included the opportunity for academic institutions to provide training in cost-effectiveness for students obtaining a Ph.D. and existing researchers in the field (U.S. Department of Education, 2013b). Even prior to this new push for project proposals to include cost-effectiveness analysis, IES has provided support to develop the method further in education. This dissertation is based on an IES funded project that demonstrated cost-effectiveness analysis and the ingredients method to provide guidance to researchers on how to incorporate the method into evaluations of educational programs.

As it appears that the demand for cost-effectiveness analysis is increasing and the supply of researchers who are trained in the method is likely to increase, there are two elements that will be crucial for the development and use of the method: 1) high quality examples or demonstrations of the ingredients method in carrying out cost-effectiveness analysis and 2) further discussion of complications in cost-effectiveness analysis that can provide recommendations for improving evaluations. This dissertation aims to contribute to both gaps by

demonstrating the ingredients method and by exploring site-level variation, relationships between ingredients and outcomes, and by including two outcomes within one cost-effectiveness analysis.

**Quality of cost-effectiveness analyses.** Embedded within the issue that few cost-effectiveness analyses are done is the secondary issue of low-quality. Ross, Barkaoui, and Scott (2007) examined cost studies in education to determine the quality of the extant literature. They reviewed 643 abstracts and 102 studies. Of those, 30 met minimal criteria that were more lenient than McEwan's basic criteria discussed above. Only five studies were rated as high-quality. The scope of this particular study examines many types of studies on costs or financial related issues in education. Yet, of the five high quality studies, four were cost-benefit studies and one was an evaluation of a single program using a cost-utility and cost-effectiveness approach. What is most surprising regarding this finding is that, as shown above, many scholars have written about cost-effectiveness analysis and provided guidance to researchers on the method. Yet, in the almost 40 years since the introduction of the ingredients method, very few of those same scholars have applied the methods themselves to demonstrate how to carry out a high-quality cost-effectiveness analysis.

This dissertation, while not without flaw or imperfection, seeks to address this issue. Although this is a study of a single program with comparison among sites of replication, this dissertation is designed to meet comparability standards and attempts to meet every other criterion described here that is not related to costing multiple programs. In so doing, it is my hope that this work paves the way for further rigorous applications of cost-effectiveness analysis in education.

### **Chapter 3. Talent Search: An Original TRIO Program**

Almost fifty years ago, in 1965, Congress passed the Higher Education Act as the initial legislation authorizing the national TRIO programs. The purpose of the legislation was to diversify the college population and to create more equitable opportunities for students regardless of family income. While the legislation changed slightly with each reauthorization, the original goal is still the driving mission of the program today. TRIO was intended to complement financial assistance, to directly serve disadvantaged students, and to inspire states and local agencies to develop and provide similar services to improve disadvantaged students' preparation for college and success once enrolled (Maxfield, Cahalan, Silva, Humphrey, & Thomas, 2000). There were three original TRIO programs: Talent Search, Upward Bound, and Student Support Services. One of those, Talent Search, is the focus of this dissertation.

#### Purpose of Talent Search

Talent Search is intended to help students who have interest in attending and the potential to go on to college but who come from disadvantaged backgrounds that may not have adequately prepared them for the demands of completing high school, enrolling in postsecondary school, and obtaining higher education qualifications. More specifically, the program targets students who would be the first generation in their families to attend college and who are from impoverished households. This subgroup of students is termed, *low-income first generation* (hereinafter LIFG). At least 2/3 of the students served by each Talent Search program site must qualify as LIFG. The other 1/3 of participating students can be students who are in need of assistance, such as children in the foster care system, those who have lost a parent, or students from homes where English is not the language used. Once students are recruited to participate,

the Talent Search program provides a range of services to increase rates of high school graduation and postsecondary enrollment and to increase awareness of financial aid and knowledge of money management. The theory is that targeted assistance that provides instruction and guidance regarding career opportunities, as well as clear information about the requirements for college, will enable students to be better prepared to complete school and will be more likely to apply for financial aid and to enroll in postsecondary education.

### Funding History

Talent Search began in 1967 with 45 sites and providing \$241 (2010 \$) per participant (Cahalan et al., 2004). The program grew to 510 sites in 2006 and by 2012 there were 454 sites. In 2000, the funding per participant was approximately \$400 (2010 \$) per student. Based on publicly available data from the U.S. Department of Education, I found that the funding has fluctuated from year to year since 2000 but has largely remained close to \$400 per student (See Table 3.1). The number of participants served since 2000 has also varied from year to year with a range from 320,000 to 390,000 students across the country. Because the program serves many students, the total funding for the program sites from the U.S. Department of Education was approximately \$142 million in 2010, which is about 0.2% of the department's total funding, 2% of the postsecondary funding, and 17% of the funds awarded to TRIO programs.

### Program Operations

Talent Search is federally funded and operates as a 5-year grant program. Post-secondary institutions and community organizations are eligible to apply to receive funding to serve local middle and high school students through the Talent Search program. In the grant application, each institution or organization identifies a target area and proposes how Talent Search will

operate at that site based on the demographics and needs of the targeted population. The site proposal selects schools within that area to be targeted by the program and describes the student populations in those schools and the prevalence of LIFG students. Thus, each site sponsor has the opportunity to design aspects of the Talent Search program in a way that best suits their population's needs and the resources available to the site so that the main program goals of high school completion and post-secondary enrollment are impacted.

Sites are evaluated annually and at the end of the grant cycle by the federal Talent Search office that is housed within the TRIO office at the U.S. Department of Education. Each site is required to submit an annual report that lists how many students were served and to provide progress on programmatic goals. Sites are required to serve the number of students they are funded to serve and to ensure that at least two-thirds of those students meet LIFG eligibility. The sites set out objectives with the department's approval. In 2007-2008, the objectives included percent of secondary students promoted, percent of students who graduate, percent of students who apply for financial aid, percent of students who apply for postsecondary, percent of students who enroll in postsecondary, and serving at least 85% of participants. Historically, each site established the percentage of students required to meet each objective individually. If a site failed to meet these requirements and objectives, the site was not recommended for future funding. I do not have statistics on the frequency or percentage of site turnover. For this dissertation, I attempted to contact 15 sites that were included in an impact evaluation of the program (discussed below). Of those sites, three were no longer in operation. Of the sites I was able to interview, only one had been open since the program started in the late 60s.

Talent Search counselors and staff at the targeted schools recruit students to participate in the program. Students fill out a questionnaire and submit parental approval. The students then

begin to receive services that are aimed at informing them and preparing them for the financial literacy skills necessary to navigate postsecondary education and living independently. The specific services and the amount of time spent with Talent Search counselors varies by site but all services are intended to impact the main objectives of the program (grade progression, high school graduation, applying for financial aid and postsecondary, enrolling in postsecondary).

The services provided by a Talent Search include: counseling; informing students of career options; financial awareness training; taking students on cultural trips and college tours; assisting students and families with the Free Application for Federal Student Aid; preparation or tutoring for college entrance exams; and assistance in selecting, applying to, and enrolling in college. Some sites provide these services at schools by pulling students out of class, while others provide services at the Talent Search site office outside of school.

Sites can serve students who are in the 6th to 12th grade. While all sites target high school students, some sites design their program to focus more on middle school students. The number of schools targeted by a site also varies and can be related to the population density of the locale. One site may serve students at a few rural schools while another may serve students in clusters of over 30 schools. It is also up to the site to serve youth who have dropped out of school or students who are temporarily relocated to a school that is not a target school for the site (for example a school for pregnant students).

While the overall Talent Search program has unified goals and is run by one federal office, the program is designed to allow some flexibility at the site level to specifically address the needs of the local population. One example where program sites can vary is the demographic characteristics of the population of students served. The grade level and ages served at one site may differ from another. In addition, the needs of the students served may vary as each site has

the authority to determine whom to serve to comprise the 1/3 who do not need to qualify as LIFG. The students can also range in age and participate in the program for differing numbers of years. Some sites also enforce a participation criterion based on grades earned in school (such as requiring a 2.5 GPA to enroll). The services provided, the way in which services are provided, and the location of service provision are other examples of ways in which the Talent Search program can vary among locations. One site may offer after-school tutoring from a tutor at the library while another site may not offer tutoring at all. The sites are also able to determine the organization, qualifications, and responsibilities of personnel. Some directors are responsible for a caseload of students, while other focus solely on managing the program. Some sites employ an assistant director while others do not.

In summary, Talent Search is a site-based program that allows each site organization to mold the design of the program to fit the contours of their sponsoring organization and the needs of the targeted population. These site-level differences make it difficult to define the program with specific details such as the amount of time students receive instruction on financial aid or the amount of time spent discussing career options and the postsecondary education that is required for various careers. There is also the matter of whether some students or groups of students received more or different services than others. These issues could only be accounted for by a detailed study in itself. At this time, it is unclear if these differences allow the program to serve students better or if the lack of specification leads to inefficiency. Additionally, if the program sites provide different experiences to the participants, it could be difficult to define the program as providing one treatment in a program evaluation.

## Evaluation of Talent Search

In the early 1990s, Congress requested that the Department of Education evaluate the impacts of Talent Search. Responding in 1992, the Department of Education invited scholars to develop proposals to examine the impact of Talent Search (Maxfield, et al., 2000). This initiative led to a contract to evaluate the program between the U.S. Department of Education Planning and Evaluation Service and Mathematica Policy Research. In 2000, Mathematica published a feasibility report that presented three potential study designs for the first study of the impacts of Talent Search (Maxfield, et al., 2000). Mathematica surveyed Talent Search Directors, interviewed experts in the field of education policy, and conducted 14 case studies to determine what data were available and to make recommendations regarding the best approach to conducting the evaluation. The selected design was a state-level impact study that used a propensity score matching model to estimate the impacts of Talent Search on high school graduation and postsecondary enrollment in Texas, Indiana, Florida, Massachusetts, and North Carolina.

**Evaluating the impacts of Talent Search.** Prior to publishing the final report, Mathematica produced an interim report describing Talent Search (Cahalan, Silva, Humphrey, Thomas, & Cunningham, 2004). The interim report notes that Talent Search has always been a low-intensity program, serving many students on a low per student budget by providing a small amount of programming compared to that required by the many hours of schooling. When Talent Search began, there were no specific criteria required to participate. By the 1980s, the Department of Education required that  $\frac{2}{3}$  of the students served by the sites must qualify as LIFG and must be at least 11 years old. The report also noted that project sites offer different services from one another and serve a wide range of individuals.

The final report, the impact evaluation, was published in 2006 (Constantine, Seftor, Martin, Silva, & Myers, 2006). The evaluation examined the impacts of Talent Search in Florida, Indiana, and Texas on high school completion, applying for financial aid, enrolling in postsecondary education, and enrolling in a four-year versus a two-year institution. The study required that states provide longitudinal administrative data for students who were in the 9<sup>th</sup> grade in 1995 – 1996 so that they could be tracked through high school completion and entry into college. The study also utilized data reported from Talent Search sites and federal financial aid data. When available, the data drew upon records from 1993 to capture middle school participation (the student's 7<sup>th</sup> grade year). The study also included an additional year beyond high school age (and in some cases two) of data for students to complete high school and to enroll in a postsecondary institution. While the goal was to include the entire population of Talent Search participants in each state, not all sites participated. The final report lists that 60% of sites in the three states participated in the study (Constantine et al, 2006, p. 8).

*Constructing a dataset.* After identifying the students who participated in Talent Search, the evaluators built a dataset for each state so that two comparison groups could be identified to estimate the impact of Talent Search. The first group (listed as the authors as the preferred group) comprised students attending schools within the same districts as the participants but not within the same high schools, who had persisted in school for the same amount of time as the participants, and who had similar demographic, socioeconomic, and academic characteristics. The second comparison group (used in reporting of results) were students from the same high schools who did not participate in the program, who persisted in school for the same amount of time as the participants, and who had similar characteristics. While analyses were run using both comparison groups, the authors state that the results were not dependent on the comparison

group that was chosen, so the results from the comparison group from the same high school were reported.

The evaluation team had three criteria in constructing the dataset: 1) available data for students within the same district as the participating students, but who attended different high schools, as well as non-participating students within the same high school; 2) data on persistence in school; 3) observations of student characteristics such as gender, economic status, and academic performance in high school. All three states did not have sufficient data to meet the three criteria to create the two comparison groups. Texas and Florida had available data for participating and non-participating students, data on persistence in school, data on student characteristics, participation data, and data on the two primary outcomes of interest (high school completion and postsecondary enrollment). Therefore, this dissertation is limited to the results from Talent Search project sites in Texas and Florida.

*Identifying the comparison group.* After constructing the dataset, the evaluation team used a propensity score matching model, described below, to identify the comparison group (Constantine et al., 2006, Section 2, p. 11-14). The propensity score, or the predicted probability of participation, was estimated using an unweighted logit model for all students in the dataset, where the outcome equaled 1 for participants and 0 for nonparticipants. Specific propensity score models were used for each state based on the available data for the state. Generally, the confounding covariates, or variables that may predict participation and the outcomes, included in the logit models were gender, race, language spoken at home, age in ninth grade, enrolled in a gifted program, and disability status. The report did not list LIFG status in their model descriptions. I review the data available in each state below.

Based on the results of the logit model, each participant was paired with all non-participants that had a similar likelihood of participating (propensity score). This means that some non-participants were matched to participants multiple times, a technique called *matching with replacement*. The comparison group included all non-participants who were matched to one or more participants. The sample size was then weighted by the number of matches each participant received so that the sample size of the comparison group was equal to the treatment group.

The authors tested several caliper ranges for the distance between the propensity scores of each participant and non-participant to identify suitable matches (Constantine et al., 2006, p. 12). The more narrow the range, the better the match, but more of the sample is left unmatched. The caliper range selected was associated with the fewest statistically significant differences in the confounding covariates but with the largest portion of the treatment sample matched. The report states that 95% of participants were successfully matched and the remaining participants who did not have a suitable match were dropped from the sample. The models were able to control for persistence and on observable characteristics. The matching was not successful for students within the same district, but who did not attend the same high school. Thus, the comparison group selected were students who attended the same high schools as the treatment sample, but who did not receive Talent Search services.

*Estimating effects.* The impacts of Talent Search were estimated with an ordinary least squares regression model with robust standard errors to account for clustering of students by project site (Constantine et al., 2006, p. 14-15). The model, shown below, allowed the authors to adjust for any remaining differences in observable characteristics between the treatment and comparison groups:

$$y_i = \beta_0 + \beta_1 P_i + \beta_2 X_i + \varepsilon_i,$$

where  $y_i$  is high school completion or postsecondary enrollment;  $P_i$  equals 1 if the student participated in Talent Search and 0 if the student did not participate in the program;  $X_i$  is a vector of student characteristics; and  $\varepsilon_i$  is a random error term that captures the effects of unobserved factors that influence the outcome. The impact of participating in Talent Search is shown by  $\beta_1$ .

*Texas.* The evaluation of Talent Search in Texas included 10 sites that served 4,177 students during secondary school (Constantine et al., 2006, Table III.1, p. 19). The data for the study were provided from multiple sources: the Texas Education Agency (student identifiers; enrollment status, grade level, and high school exit status for each year between 1996 – 1999; standardized test scores in reading and math from 8<sup>th</sup> grade), Talent Search sites (lists of students and years served), the Office of Postsecondary Education at the U.S. Department of Education (first time applicants for financial aid), and the Texas Higher Education Coordinating Board (postsecondary enrollment, credits, and type of institution from 1999 – 2002). The study also obtained student-level data from the fall of 9<sup>th</sup> grade in 1995 on demographic characteristics (such as gender, race, eligibility for free or reduced-price lunch, and language spoken at home) and academic characteristics (enrolled in gifted and talented, at risk for dropping out of school, economically disadvantaged, limited English proficiency, special education services, enrolled in vocational or technical courses or programs).

When the sample was sufficiently large, the treatment and comparison groups were divided into different time periods to account for the varied length of participation across participants. For participants who joined the program in 1996 and 1997, an early cohort was created. The comparison group for the early cohort was required to have persisted in school until 1996. The later cohort joined Talent Search in 1998 and later. The comparison group for the later

cohort was required to persist in school until 1998. In some cases, the participants were not split into cohorts or there were three cohorts.

The two comparison groups described above (within school and within district) were composed, but only the group based on non-participants from within target high schools could be successfully matched to the treatment group on the observed characteristics available in the data. The authors report that on average the treatment group and comparison group were well matched as there were no statistically significant differences between groups on any of the observed characteristics (Constantine et al., 2006, p. 27-28). Table 3.2 shows the balance between the treatment and comparison groups pre- and post-matching.

The effects were estimated using the OLS model described above controlling for the confounding covariates that were used in the propensity score matching model in the categories of student characteristics, academic characteristics, and academic performance listed in Table 3.2. Impacts were estimated on high school completion, first-time application for federal financial aid, and postsecondary enrollment (Constantine, et al., 2006, p. 31). The high school completion outcome variable in Texas was not clearly defined in the report. The WWC intervention report states that the outcome variable included both GED completion and high school diplomas (U.S. Department of Education, 2006, p. 3). Postsecondary enrollment was enrollment in public 2- and 4-year institutions within Texas after completing high school.

As shown in Figure 3.1, Talent Search had positive impacts on both high school completion and postsecondary enrollment in Texas. The evaluation found that Talent Search participants had a completion rate of 86% while the comparison group's high school completion rate was 77%. Talent Search had a larger impact on postsecondary enrollment rates with 58% of

the treatment group enrolled and 40% of the comparison group enrolled within 3 years of completing high school.

The authors noted that the impacts of Talent Search varied across program sites. They conducted site-level analyses to determine if the impact was driven by a particular site or if the result was representative of a more uniform impact. These results are illustrated in Tables 3.3 & 3.4. In high school completion, the site-level impacts ranged from  $-9.2$  percentage points to  $+18.9$  percentage points. This means that in some instances the impact estimate was negative, indicating that the program was contributing to the dropout rate rather than increasing the completion rate. The range of impacts on postsecondary enrollment was larger, but more positive, with a range of  $-0.7$  percentage points to  $+29.7$  percentage points. However, the authors note that at 4 out of the 10 sites the impact on postsecondary enrollment was small or nonexistent.

*Florida.* The evaluation included five Talent Search sites in Florida that served a total of 908 students who were in the ninth grade in 1995-1996. Student-level data were provided by the Florida Department of Education (age, race, gender, language spoken at home, citizenship status, disability status, eligibility for free or reduced-price lunch, enrolled in a gifted program, enrolled in a dropout prevention program), Talent Search sites (lists of students and years served), and the Office of Postsecondary Education at the U.S. Department of Education (first time applicants for financial aid). Unlike Texas, the Florida data did not include test scores.

Depending on the number of students served at each site, the authors divided students at each site into groups based on participating in Talent Search early in high school or late in high school. These groups were then used to match on persistence in school. The report did not

provide the specific persistence requirements for Florida, but it does say that the strategy was similar to the one used in Texas (Constantine et al., 2006, p. 79).

The two comparison groups described above were drawn: one from the same target high schools as participants and another from the within the same district but not the same high school as participants. Similar to the analysis of Talent Search in Texas, the comparison group drawn from within the same high school resulted in a closer match on observable characteristics to the treatment group than the comparison group drawn from within district. The results presented and utilized here are from the within school comparison group. The authors reported that the treatment group and comparison group were well matched on all observable characteristics except for a small difference (1.2% of treatment versus 1.9% of comparison) in speaking a primary language at home other than English or Spanish (Constantine et al., 2006, p. 77). The difference was statistically significant at the 10% level. Table 3.5 shows the balance between the treatment and comparison groups pre- and post-matching.

The effects were estimated using the OLS model described above controlling for the confounding covariates that were used in the propensity score matching model in the categories of student characteristics and academic characteristics listed in Table 3.5. Impacts were estimated on high school completion, first-time application for federal financial aid, and postsecondary enrollment. The high school completion outcome variable was defined as high school diploma or GED (Constantine et al., 2006, p. 104).

In Florida, Talent Search had positive impacts on high school completion and postsecondary enrollment, shown in Figure 3.2. By 2000, 84% of Talent Search participants had completed high school compared to a high school completion rate of 70% among non-participating students. Talent Search participants had a postsecondary enrollment rate of 51%

compared to 36% of non-participants during the school year following on-time high school completion (1999-2000). If the time frame is extended to 2003, the difference in postsecondary enrollment rates between the treatment and comparison groups is one percentage point higher, while the rates of both groups are higher (participants 73%, non-participants 57%).

As shown in Tables 3.6 & 3.7, the magnitude of impacts found varied substantially across Talent Search sites within Florida. The difference in high school completion rates ranged from -5.9 percentage points to +27.3 percentage points. Similar to Texas, the range of the impact on postsecondary enrollment rates was larger than high school completion but not as negative, -2.2 percentage points to +35 percentage points.

**Review of the impact evaluation.** The evaluation was planned methodically with the input of program officials and experts. The evaluation was approved after exploring several designs and the history of the program. The planning process leading to the evaluation took 14 years from the time of the legislation requesting it to the time of the 2006 publication. One of the strengths of the study, as noted by the authors, was the dataset that was amassed, which could largely be attributed to the planning process. The authors built longitudinal student-level data sets within each state for students who were in the 9<sup>th</sup> grade in 1995 by merging data from the Talent Search program, the state departments of education and higher education, and the federal financial aid database. By utilizing extant data, the evaluation placed very little burden on the Talent Search program sites. The resulting data provided variables on the cohort's demographic and academic characteristics, persistence and completion of school, and transition into postsecondary school within Texas and Florida (as shown in Tables 3.2 and 3.5).

*Estimating treatment effects.* The authors built the dataset to provide as much information as possible about the treated and untreated students in order to estimate the impacts of the

program. Evaluations that estimate the impact of a program are based on the fundamental question of what changed due to the program that would not have changed if the program had not been introduced (Holland, 1986). In the case of Talent Search, there are two primary outcomes of interest: high school graduation and postsecondary enrollment. Evaluations are unable to measure both a participant's response to a treatment and that same participant's response to no treatment within the same time period. Evaluations rely, then, on research methods (or causal estimation models) to assign or create equivalent, experimental groups to approximate the impact of a program compared to what would have happened had the program not been implemented.

In a randomized control trial (RCT) experiment, participants are randomly assigned to the treatment group or to the control group in order to create comparable groups that are equal on all characteristics so that the fundamental question of impact can be estimated (Cook, Shadish, & Wong, 2008). While IES and the WWC consider the RCT method of impact evaluation to be the gold standard in estimating causal impacts (as discussed in Chapter 2; US Department of Education, 2003), it is not always possible to randomly assign students to groups. The evaluation of Talent Search utilized a quasi-experimental method, propensity score matching, to estimate the program's impact on high school graduation rates and postsecondary enrollment rates.

*Propensity score matching.* Propensity score matching is a quasi-experimental method that is analogous to an RCT study in that an evaluation utilizing a propensity score matching model is designed without prior knowledge of the outcomes measured (Rubin, 2001). The method is used retrospectively, or after the intervention of interest was implemented, to create a comparison group to determine what would have happened had the intervention not been implemented. Matching is necessary because the treatment was implemented without

experimental control where the students who participated in the program chose to do so or were selected by program staff; thus they may be very different from those who chose not to participate and who were not selected.

The students who participated in the program were matched to students who did not participate in the program based on observable characteristics called confounding covariates that are related to participation as well as to the outcome. Variables such as gender, race, socioeconomic status, and prior achievement are often used as confounding covariates in this type of study. The theory is that if all of the confounding covariates are known and controlled for in the estimation of the impact, the two groups are similar enough to approximate a randomly assigned study (Rubin & Thomas, 2000). There could be many possible variables that qualify as confounding covariates, which can make estimation difficult. The solution is to utilize one score, the propensity score, that summarizes all of the confounding covariates included (Angrist & Pischke, 2009: p. 80; Hill, 2009).

In the case of Talent Search, the evaluators used a logit model that used the variability in the confounding covariates (Tables 3.2 & 3.5) to predict the variability in participation. The study utilized data from all non-participating students within the same schools as the participants to identify a comparison group. While the dataset was built for the design and the list of confounding covariates was long, the analyses are limited largely by the assumptions required to causally estimate impacts using a propensity score model.

*Assumptions of propensity score matching.* There are two major assumptions involved in the propensity score matching method of estimating impacts. The *Stable Unit Treatment Value Assumption* (SUTVA) is the first assumption that must be met. SUTVA requires that the outcome measured from one unit of analysis (student, class, school) must not depend on the

treatment assignment or participation of any other unit (Rubin, 1990). Otherwise, there would be multiple treatments rather than one, which would also mean a single average treatment effect would not be applicable.

Within the context of Constantine et al. (2006), we must assume that one student's participation in the program did not influence other students' outcomes. It is doubtful that a student's participation within one school would impact another student's outcomes in a different school within the same district. However, this assumption is not as easily met when the comparison group is drawn from the same target high school as participants due to peer effects. It could be the case that a student participates in Talent Search and shares the acquired knowledge with her or his peers, which could change the peers' behavior, biasing the results downward.

Another issue related to SUTVA is that the treatment itself is designed to vary across locations to meet local needs. This site-level variation could be a violation of SUTVA making the average treatment effect an average of different treatments rather than an average effect of the Talent Search program.

The second assumption that must be met is that the treatment assignment is ignorable based on the confounding covariates included in the model (Hill, 2009). This means that after controlling for variables that are related to participation in the treatment and to the outcomes measured, the treatment can be considered randomly assigned. Without satisfying this assumption, there is selection bias present and the impact estimate would not accurately reflect the effect of the program (Rosenbaum & Rubin, 1985).

Within the context of the Talent Search impact evaluation, this means that given the controls included in the model, participation in Talent Search could be considered randomly

assigned. In this study, the treatment group participated by self selection and/or program selection, a bias that is not easily addressed in quasi-experimental studies. As described above, propensity score matching uses observed characteristics to match participants to non-participants to create comparable groups. Unobserved characteristics, such as motivation, aspirations, and mental health, could be confounding covariates that contribute to an individuals' likelihood of participating in the program as well as predictors of the outcomes measured. While the evaluation utilized as much data as were available, this issue is not resolved. If participating students were more motivated or driven to succeed than the comparison group, the impact estimate could inaccurately attribute the difference in outcomes to Talent Search.

*Time of confounding covariate measurement.* One key aspect of conducting a propensity score match is the time at which the observed characteristics were measured. All confounding covariates used in the model must have occurred prior to receipt of the treatment or the covariates may not truly reflect that individual's characteristics prior to participating (thus they are technically considered outcomes). Some of the variables included in the evaluation (such as being enrolled in a gifted or technical academic program in 9<sup>th</sup> grade, 8<sup>th</sup> grade test scores, being at-risk for dropping out, receiving special education services, participating in dropout reduction programs, grade level at 9<sup>th</sup> grade, and persisting in school) could violate this principle. While the authors note that many participants in their sample did not join the program and receive services until their junior or senior year, Talent Search begins serving students at some sites as early as 6<sup>th</sup> grade. Often, the services provided target performance in school, course taking in school, test preparation, tutoring, and referrals for other types of assistance or counseling. Thus, capturing a student's characteristics in 8<sup>th</sup> or 9<sup>th</sup> grade may not truly reflect pre-treatment status. Persistence in school may also be an outcome of the program via peer

effects or school effects of providing Talent Search. It is plausible that a student may persist in school longer than they would have based on knowledge learned from participating peers or with the goal of participating themselves in the coming year.

*Missing information.* There are some areas of the report where additional information would be beneficial to better understand the analyses. First, it appears that most of the students in the treatment group were successfully matched to non-participants. It would be beneficial to know more about the treated students (5% of the sample) who were dropped and if they could have altered the impact estimates had they been included. The report provided some indications that the matched sample was slightly different from the original sample. For example, the report indicated that the matched treatment group in Texas was less high-achieving on average and more low-achieving on average than the unmatched treatment group (Constantine et al., 2006, p. 28). In Florida, the matched treatment group was slightly less gifted (Constantine et al., 2006, p. 78). Thus, it appears that the students who were dropped from the analysis in Texas and Florida may have been from the upper end of the achievement distribution or students who were gifted.

The evaluation authors were interested in examining the role of dosage in the effect of Talent Search on high school completion and postsecondary enrollment. Dosage is important to understanding how Talent Search functions and to identify improvements for the program. Students could participate at any time from 6<sup>th</sup> to 12<sup>th</sup> grade, which means that students could participate earlier or later and for varying lengths of time. The strategy they utilized was to split the treatment sample into early and late cohorts (or sometimes three cohorts) when the sample size allowed. Each site had differing numbers of participants; so some sites were not split into cohorts, some sites had two cohorts, and a few sites had three cohorts. This makes the results difficult to interpret and leaves the question of the importance of time of participation or length

of participation unanswered. It would have been beneficial to know the authors' justifications for splitting the groups, given the limitations and how the estimates may have been impacted.

The third source of missing information that would be useful is from Texas. The Texas dataset and analyses include a variable that indicates if a student was at-risk for dropping out of school. It would be helpful to have more information about this variable such as the time it was created, what information was used to create it, and if program sites were given this information prior to enrolling students so that it may have influenced participation or program selection.

Another area where additional information could have been useful is about the grant cycle and the target high schools. The period of study includes more than one grant cycle. It would be helpful if the authors discussed any changes that may have occurred during this time, including the schools targeted, the schools served, and the students served. If a site served students who were not at the target high school, it is not clear how they were included in the analyses. Some sites may serve middle schools that are not feeders into the target high schools or high schools that serve students from non-targeted middle schools. The sites may have continued to serve the middle schoolers, even though they did not attend the target high school. Also, a site may have continued to serve students who left the target high school for an alternative school for pregnant students or for GED receipt.

**WWC review of the evaluation.** While these limitations exist, and there are some areas where more information would have been beneficial, the study is the most rigorous evaluation of the program to date, and it provides useful information about the impacts of Talent Search. The U.S. Department of Education's What Works Clearinghouse (WWC) reviewed the study under the high school completion domain in the topic of dropout prevention (U.S. Department of Education, 2006). The WWC found that the evaluation met their standards with reservations. The

study did not meet their standards without reservations because the study did not randomly assign eligible students to the treatment. The effects of Talent Search were rated as “potentially positive” because the quasi-experimental study found statistically significant positive impacts in two states (considered by the WWC as two studies), and that no studies of Talent Search found statistically significant or substantively important negative impacts.

Based on the high school completion impacts published in Mathematica’s impact evaluation and illustrated here in Table 3.8, the WWC intervention report includes WWC calculated effect sizes and improvement indices for each state and for the program overall. The effect size for Texas is listed as 0.37 standard deviations and 0.49 standard deviations for Florida, which averaged to 0.43 standard deviations. Educational interventions are often considered successful if an effect size of 0.2 is reported, so these effects are substantively important.

One metric that the WWC commonly provides in an intervention report is an improvement index. The improvement index is calculated by the WWC to show how much the average student who participated in the program improved in the outcome relative to the average student in the comparison group. The improvement index for Texas was +14 and +19 in Florida, for an average of +17. Of the 13 programs reviewed by the WWC, Talent Search had the second highest impacts on high school completion (National Guard Youth Challenge was ranked first with an improvement index of +22).

### Cost of Talent Search

The impact evaluation by Mathematica and the WWC endorsement of the study indicate that the program improves high school completion rates. It is not known, however, how much the program costs or the resources required to successfully produce additional graduates. It is

important to relate the effects to costs to better understand the program and to compare it to other programs that impact high school completion and postsecondary enrollment.

**No cost study.** In the 47 years since Talent Search began, there has not been a rigorous cost study of the program. A cost study is needed to determine the resources necessary to implement the program to generate the positive impacts that were identified and to evaluate the program's efficiency.

Recently, a cost-effectiveness analysis was published to provide information regarding programs that increase access to higher education and the cost of Talent Search was referenced (Harris, 2013). Harris uses the average amount of per student funding in 2009 (\$392) allocated by the federal government to approximate the costs of Talent Search. But, since such allocations are not adjusted for the costs of resources at different sites and do not include the resources provided by the sponsoring organization, the allocation cannot provide an accurate picture of the true costs (Levin & McEwan, 2001, p. 45). The funding provided to the program does not accurately reflect the costs of the program because it does not include the opportunity costs of resources that were contributed to the program by the host organizations or the schools targeted by the program, and dollar allocations to each site must be adjusted for prices of resources to be comparable.

The WWC Intervention Report of Talent Search has a section devoted to cost (U.S. Department of Education, 2006). The report discusses the funding for the program and that some sites utilize additional resources. However, the WWC report does not provide any additional details or the estimate of the program's costs.

**Estimating the Cost-Effectiveness of Talent Search.** This dissertation applies a prominent method, the *ingredients method*, to rigorously estimate the costs of Talent Search. The

results fill a gap in the literature about the costs of Talent Search by providing information regarding the resources needed to implement the program successfully - as documented by the Constantine et al. (2006) impact evaluation. Because Talent Search is designed to be adaptable to local needs, the dissertation includes an examination of the costs of the program at the site-level. The dissertation incorporates the impact evaluation results presented here in a cost-effectiveness analysis of the program. The analysis compares the overall cost-effectiveness estimate of the program to the cost-effectiveness estimates from the state- and site-level. Talent Search, as noted above, has two policy relevant outcomes: high school completion and postsecondary enrollment. This dissertation provides four weighting options for evaluating the cost-effectiveness of Talent Search at producing both outcomes. The next chapter, Chapter 4, presents the methods used in this dissertation to conduct these analyses.

Chapter 3 Figures

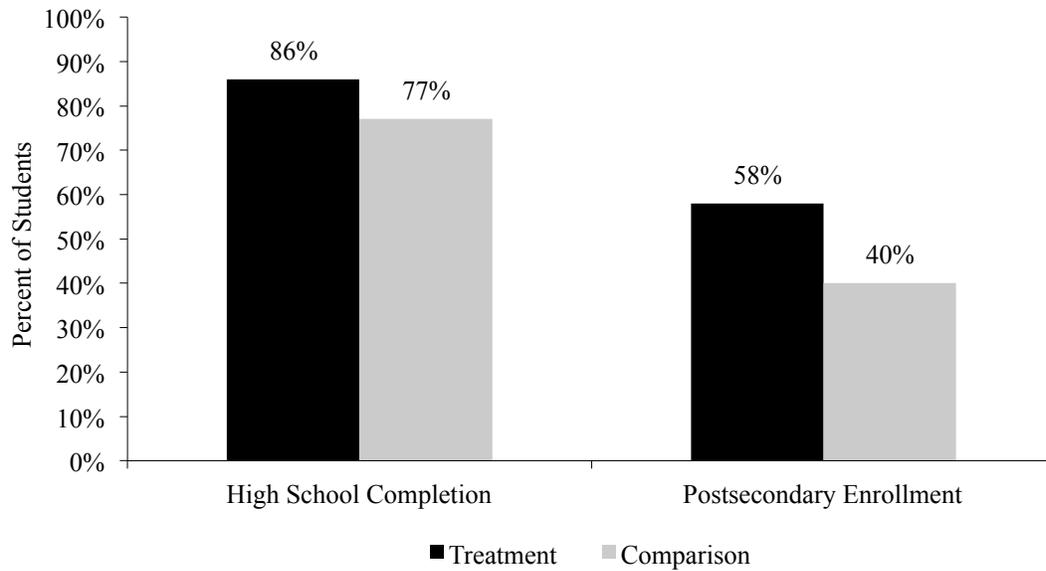


Figure 3.1: High school completion and postsecondary enrollment in Texas

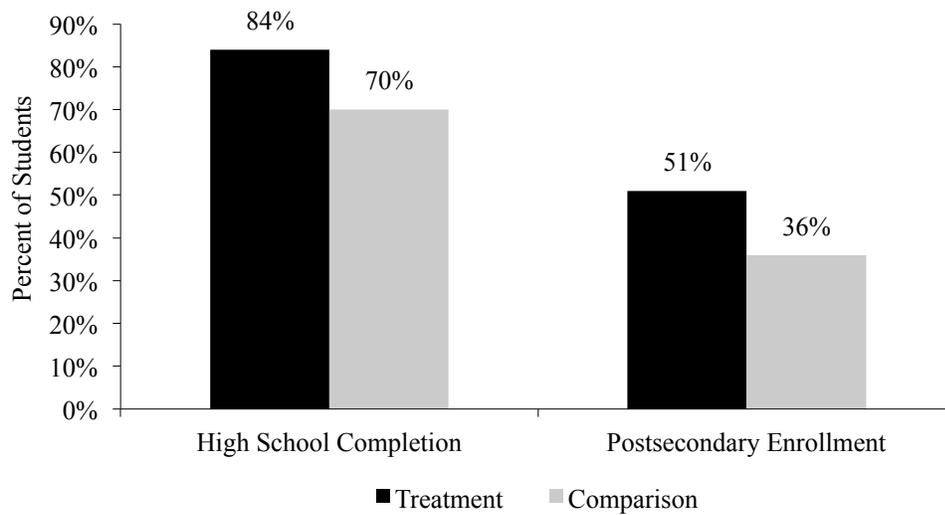


Figure 3.2: High school completion and postsecondary enrollment in Florida

## Chapter 3 Tables

*Table 3.1. Talent Search funding over time.*

Fiscal Year	Total Funding (millions)	No. Participants	No. Sites	Average \$ per student	Total Funding (2010 \$ millions)	Average \$ per student (2010 \$)
1967			45			\$240.60
1980			170			
1990			200			\$219.07
1999		307,451	361			
2000	\$100.54	320,854	360	\$313	\$127.32	\$396.81
2001	\$109.96	320,854	360	\$343	\$135.39	\$421.97
2002	\$143.51	389,454	475	\$368	\$173.94	\$446.63
2003	\$144.81	386,241	471	\$375	\$171.61	\$444.32
2004	\$144.23	382,541	469	\$377	\$166.49	\$435.23
2005	\$144.65	384,588	468	\$376	\$161.50	\$419.94
2006	\$149.63	392,743	510	\$381	\$161.84	\$412.08
2007	\$142.88	366,330	471	\$390	\$150.27	\$410.20
2008	\$142.74	363,300	466	\$393	\$144.57	\$397.93
2009	\$141.51	360,940	464	\$392	\$143.83	\$398.49
2010	\$141.65	359,740	463	\$394	\$141.65	\$393.75
2011	\$138.66	319,678	461	\$434	\$134.42	\$420.47
2012	\$135.97	313,641	454	\$434		

*Note: Prices adjusted to 2010 using CPI-U. Talent Search annual funding data from: <http://www2.ed.gov/programs/triotalent/awards.html>*

Table 3.2. Balance between treatment and comparison groups on observable characteristics in Texas.

Variable	Full Sample		Matched Sample	
	Treatment	Comparison	Treatment	Comparison
<i>Demographic Characteristics</i>				
Male	38.2	54.0	38.7	38.6
White	27.1	30.2	27.4	27.3
Black	25.4	17.8	25.1	24.3
Hispanic	46.8	51.0	46.9	46.9
Home language Spanish	14.2	15.9	14.2	14.1
Age in 9 <sup>th</sup> grade (average in years)	14.8	15.0	14.8	14.8
Overage in 9 <sup>th</sup> grade	15.3	28.3	15.4	15.3
<i>Academic Characteristics</i>				
Enrolled in gifted and talented program	11.1	6.3	10.6	10.3
At risk for dropping out	46.6	54.4	46.9	46.9
Economically disadvantaged	50.9	50.2	50.6	50.6
Limited English Proficient	6.3	11.2	6.3	6.2
Special education services	5.5	13.3	5.6	5.5
Enrolled in vocational or technical course	45.0	39.1	45.0	45.4
Enrolled in vocational or technical program	8.1	9.5	8.1	7.8
<i>8<sup>th</sup> Grade Test Scores</i>				
Math raw score (number correct)	36.7	30.5	36.6	36.6
Math top 25% in state	24.2	16.8	23.9	23.7
Math bottom 20% in state	26.9	42.8	27.1	26.9
Reading raw score (number correct)	33.8	28.0	33.7	33.7
Reading top 25% in state	24.9	17.4	24.6	24.6
Reading bottom 25% in state	25.5	42.4	25.6	25.4
Essay score	2.4	1.9	2.3	2.4
Missing test scores	7.0	15.7	7.0	6.9
<b>Number of Students</b>	<b>4,112</b>	<b>46,810</b>	<b>4,027</b>	<b>30,842</b>

Note: From Constantine et al., 2006, Table III.4, p. 28

Table 3.3 Site-level High School Completion Impacts in Texas

	Treatment	Comparison	Difference
<b>Project 1</b>			
1993-1997	74.2	56.4	17.7***
1998-2000	93.2	82.6	10.6***
<b>Project 2</b>			
1998	87.1	68.2	18.9***
1999-2000	94.2	78.7	15.5***
<b>Project 3</b>			
1993-1997	79.3	71.4	7.9**
1998	88.5	78.2	10.3***
1999-2000	97.1	92.2	4.9***
<b>Project 4</b>			
1993-1996	61.2	55.9	5.3**
1997-2000	65.5	66.6	-1.1
<b>Project 5</b>			
1994-1998	72.7	61.2	11.5***
1999-2000	91.5	88.4	3.2
<b>Project 6</b>			
1997-2000	90.4	81.4	9.1**
<b>Project 7</b>			
1997	77.7	75.5	2.2
1998-2000	76.8	86.0	-9.2**
<b>Project 8</b>			
1996-1997	77.4	63.5	13.9***
1998-2000	77.8	72.5	5.3
<b>Project 9</b>			
1993-1998	70.4	53.6	16.7***
1999-2000	98.0	91.2	6.8***
<b>Project 10</b>			
1995-1996	76.3	66.2	10.1***
1997-2000	59.7	64.4	-4.7

Note: From Constantine et al., 2006, Table III.6, p. 33.

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$

Table 3.4 Site-level Postsecondary Enrollment Impacts in Texas

	Treatment	Comparison	Difference
<b>Project 1</b>			
1993-1997	48.3	34.4	14.0***
1998-2000	70.3	51.0	19.2***
<b>Project 2</b>			
1998	49.8	32.7	17.0***
1999-2000	56.3	36.1	20.1***
<b>Project 3</b>			
1993-1997	52.8	38.4	14.5***
1998	52.9	38.5	14.4***
1999-2000	66.9	47.3	19.6***
<b>Project 4</b>			
1993-1996	33.7	30.5	3.1
1997-2000	50.0	38.7	11.3***
<b>Project 5</b>			
1994-1998	44.1	38.5	5.6
1999-2000	68.6	55.0	13.7***
<b>Project 6</b>			
1997-2000	49.3	42.1	7.2
<b>Project 7</b>			
1997	56.2	49.6	6.6
1998-2000	57.1	54.0	3.2
<b>Project 8</b>			
1996-1997	49.2	42.4	6.8*
1998-2000	44.4	45.2	-0.7
<b>Project 9</b>			
1993-1998	35.5	20.5	15.0***
1999-2000	72.9	43.2	29.7***
<b>Project 10</b>			
1995-1996	50.9	44.4	6.5
1997-2000	50.8	43.3	7.5*

Note: From Constantine et al., 2006, Table III.8, p. 38.

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$

Table 3.5. Balance between treatment and comparison groups on observable characteristics in Florida.

Variable	Full Sample		Matched Sample	
	Treatment	Comparison	Treatment	Comparison
<i>Demographic Characteristics</i>				
Male	33.9	52.3	34.2	34.0
White	44.6	60.3	45.0	44.2
Black	45.6	24.8	45.3	45.6
Hispanic	4.5	11.1	4.3	5.1
All other races	5.3	3.9	5.3	5.2
Home language English	96.9	91.9	97.0	96.2
Home language Spanish	1.9	5.9	1.8	1.9
Home language Other	1.2	2.2	1.2	1.9
U.S. Citizen	94.7	88.2	94.8	94.7
Economically disadvantaged	63.1	36.3	62.9	63.6
Age in 9 <sup>th</sup> grade (average in years)	14.6	14.8	14.6	14.6
Overage in 9 <sup>th</sup> grade	9.7	19.1	9.8	10.7
<i>Academic Characteristics</i>				
Gifted	4.1	4.5	3.7	4.2
Any dropout prevention program	17.2	23.7	17.2	19.7
Dropout prevention for disruptive students	2.5	4.2	2.6	2.8
Dropout prevention for alternative students	13.1	15.1	13.1	13.3
Dropout prevention for Dept. of Juvenile Justice	5.0	8.2	5.0	6.1
Emotionally or physically disabled	5.8	8.3	5.8	5.8
Learning disabled	3.6	8.8	3.7	4.2
<b>Number of Students</b>	<b>908</b>	<b>67,049</b>	<b>900</b>	<b>42,514</b>

Note: From Constantine et al., 2006, Table V.4, p. 78

*Table 3.6 Site-level High School Completion Impacts in Florida*

	<b>Treatment</b>	<b>Comparison</b>	<b>Difference</b>
<b>Project 1</b>			
1993-1996	76.9	68.9	8.0***
1997-1999	93.1	76.4	16.7***
<b>Project 2</b>			
1996-2000	71.1	59.8	11.2***
<b>Project 3</b>			
1993-1998	76.5	63.5	13.0***
1999-2000	79.7	85.6	-5.9
<b>Project 4</b>			
1993-1995	84.5	65.6	18.9***
1996-1999	96.7	71.9	24.8***
<b>Project 5</b>			
1995-1999	96.7	69.4	27.3***

*Note: From Constantine et al., 2006, Table V.6, p. 83.*

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$

*Table 3.7 Site-level Postsecondary Enrollment Impacts in Florida*

	<b>Treatment</b>	<b>Comparison</b>	<b>Difference</b>
<b>Project 1</b>			
1993-1996	40.6	37.4	3.2
1997-1999	48.5	38.8	9.7**
<b>Project 2</b>			
1996-2000	42.2	28.0	14.2***
<b>Project 3</b>			
1993-1998	49.4	40.6	8.8*
1999-2000	50.4	52.6	-2.2
<b>Project 4</b>			
1993-1995	51.7	31.8	19.9***
1996-1999	63.7	36.0	27.8***
<b>Project 5</b>			
1995-1999	64.2	29.2	35.0***

*Note: From Constantine et al., 2006, Table V.8, p. 86.*

\*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$

*Table 3.8 What Works Clearinghouse High School Completion Calculations*

	Treatment	Control	Difference	Effect Size	Improvement Index
Texas	86%	77%	9%	0.37**	+14
Florida	84%	70%	14%	0.49**	+19
WWC Average				0.43**	+17

*Notes: From WWC Intervention Report, U.S. Department of Education (2006).*

\*\*  $p \leq 0.05$

## **Chapter 4. Utilizing the Ingredients Method to Estimate the Cost-Effectiveness of Talent Search**

Ideally, a cost-effectiveness analysis compares programs that are alternatives for one another and that impact equivalent outcomes. In a study of the cost-effectiveness of programs that impact high school completion, the Center for Benefit-Cost Studies of Education at Teachers College, Columbia University found that the 15 interventions listed by the What Works Clearinghouse (hereinafter WWC) under the dropout prevention topic area were not comparable because the populations targeted were not similar, the purpose of the programs were different, and the outcomes measured were not equivalent (Levin, Belfield, Hollands, Bowden, Cheng, Shand, Pan, & Hanisch-Cerda, 2012). As described in Chapter 3, Talent Search was one of the programs listed by the WWC as positively impacting high school completion. The program has been in operation since 1967 and serves almost 500,000 students across the U.S. (TRIO, 2012). Even though the WWC does not include a comparable alternative, the Talent Search program provides an interesting case to study two challenges that are commonly ignored in cost-effectiveness analysis: examining site-level variation in costs and cost-effectiveness and incorporating multiple policy relevant outcomes. By examining the cost-effectiveness of Talent Search, other programs that are genuine alternatives could be identified and studied to determine the program's comparative efficiency.

The analyses of this dissertation are divided across two research questions that aim to ascertain the cost of Talent Search in producing additional high school completers, to examine the variability in the program's costs, and to provide a more comprehensive analysis that incorporates the program's impact on postsecondary enrollment in addition to high school completion. The overall goal is to examine cost-effectiveness estimates when site-level

variability exists in costs and effects and to initiate discussion around other methodological complexities in cost-effectiveness analysis, such as examining the relationship between costs and effects and incorporating impacts on more than one outcome of interest. This chapter lists two research questions, describes the effectiveness data and costs data utilized in this dissertation, and outlines the analytic approach for each research question.

### Research Questions

1. What is the cost of Talent Search? What is the cost-effectiveness of Talent Search? How do these estimates vary by site? How does the variability in site-level costs relate to the variability in effects?
2. When a program impacts more than one outcome of interest, how can multiple weighting schemes be used to provide policy-relevant results within a cost-effectiveness framework?

### Data

This dissertation is composed of two main types of data, those for effectiveness and those for costs. I present information below for each classification of data. I also list limitations of the data and my plan to mitigate those weaknesses.

**Effectiveness Data.** As described in Chapter 3, Constantine et al. (2006) evaluated the impact of Talent Search on the outcomes of high school completion, applying for financial aid, enrolling in postsecondary education, and enrollment in a 2-year versus a 4-year institution. I utilize their impact estimates on high school completion for my primary analyses in research question 1. I also include the impact estimates on postsecondary enrollment in my secondary analyses (research question 2). I do not examine the program's impacts on financial aid

applications or on the enrollment patterns of participants in 2-year vs. 4-year colleges because those outcomes are intermediate outcomes for and related to the program's impact on postsecondary enrollment.

The impact estimates of Talent Search on the outcome of high school completion is the primary outcome of interest for this dissertation for three reasons. First, the project originating this work was focused on the WWC's topic area of Dropout Prevention, which includes high school completion as an outcome. Second, I begin this dissertation by focusing solely on this outcome because it is the first or primary outcome of the program. Third, and most importantly, high school completion is the most policy relevant outcome of this program as it has direct implications for the students and for the labor market.

The second outcome included in this dissertation is postsecondary enrollment in a public in-state institution. This outcome is important to include because it was the intended goal of the program as it was designed and funded by legislation. Constantine et al. (2006) note that this outcome may be more reliably measured than high school completion. The analyses were limited to only in-state public colleges, however, so the results may not accurately reflect the true rates of enrollment. High achieving students or students who are gifted in a particular area of study may elect to attend a prestigious private university or one that is not in state. If this is the case, the impacts estimated by Constantine et al (2006) could be downwardly biased resulting in a lower enrollment rate due to the program than actually occurred. The data used to measure postsecondary enrollment included different time periods for the two states: enrollment was measured for three years post graduation in Texas and two years post graduation in Florida. For these reasons, I include postsecondary enrollment as the second outcome in my analyses, which is included in research question 2.

The impact evaluation is discussed thoroughly in Chapter 3. I review the findings here for the purpose of describing the data used in this dissertation. Constantine et al. (2006) estimated the impact of Talent Search in Texas, Florida, and Indiana. The report did not analyze the program's impact on high school completion in Indiana. Because high school completion was the outcome of interest for the WWC review, the analyses done on the program sites in Indiana did not meet the WWC's evaluation standards and are therefore not included in this dissertation. There were 15 program sites, in Texas and Florida, included in the impact evaluation. The sites included were those that were operating in 1999 that provided project records to the authors. The study sample included the majority of the sites that were operating in both states at that time. The authors relied on existing longitudinal data for the cohort of students who were in the 9th grade in 1995. The effectiveness data described below are presented in Table 4.1.

*High school completion.* The impact evaluation utilized data from 1999 and 2000 to measure high school completion. The year 2000 was included to allow students an extra year to graduate or for GED attainment. In Texas, 86% of the Talent Search participants completed high school compared to 77% in the comparison group, a 9 percentage point difference. In Florida, 84% of the Talent Search participants completed high school compared to 70% in the comparison group, producing a larger difference in completion rates at 14 percentage points. The authors noted high variability in the impact on high school completion rates across sites ranging from -9.2 to +18.9 percentage points in Texas and -5.9 to +27.3 percentage points in Florida.

*Postsecondary enrollment.* Constantine et al. (2006) measured the postsecondary enrollment rates among the 1995 Talent Search cohort in Texas and Florida to estimate the impact of Talent Search. In Texas, postsecondary enrollment was measured in 1999, 2000, and 2001, to allow the students additional time after high school completion to enroll. The authors

report that in Texas, 58% of participants enrolled in a postsecondary institution compared to 40% of the comparison group, indicating a large difference of 18 percentage points. The findings were similar in Florida. Postsecondary enrollment was measured in Florida in 1999 and 2000. The participants had an enrollment rate of 51% and the comparison group had an enrollment rate of 36%, a 15 percentage point difference. The authors extended the time frame for the measurement of postsecondary enrollment in Florida to 2003. The initial enrollment rates from 1999 and 2000 from Florida are more similar temporally to the estimates from Texas, which were measured in 1999, 2000, and 2001. Therefore, this dissertation utilizes the enrollment rates in Florida from 1999 and 2000. While both the treatment and comparison groups had increased rates of enrollment, the difference between the groups was only slightly higher than in 2000 at 16 percentage points. Similar to high school completion, the impact of Talent Search on enrollment rates was not uniform across program sites. In Texas, the impact of Talent Search on enrollment rates ranged from -0.7 to +29.7 percentage points. The variability of the impact of the program across sites in Florida was even larger with a range of -2.2 to +35 percentage points.

**Costs data.** This dissertation applies the ingredients method to the evaluation of the Talent Search program to determine the cost of producing additional high school completers when site-level variation in costs and effects are present. This dissertation also examines several different schemes for including the program's impacts on postsecondary enrollment in addition to high school completion. In order to address two questions, the cost of Talent Search, as it was evaluated, must be established. The ingredients method was utilized to accomplish this task.

The ingredients method, as described in Chapter 2, consists of 4 major steps: collect descriptive data on the ingredients needed to replicate the program's impact that include quantities and qualities of each ingredient, pair each ingredient with a market price, estimate the

total cost of the program and the cost per student, and combine costs and effectiveness estimates to calculate cost-effectiveness ratios. In what follows, I describe my application of steps one through three, which involve collecting ingredients data, pricing each ingredient, and estimating the cost of the program. The fourth step, which pairs the cost of the program with the effectiveness of the program, is described in the next section: Analytic Approach.

*Step one: Ingredients data collection.* The purpose of this initial step is to identify all of the ingredients needed to implement the program successfully, or rather to replicate the implementation studied in the evaluation (Levin & McEwan, 2001, p. 47). It is necessary to determine what qualities are characteristic of each ingredient and the quantities required because both the quantity and the qualities of each ingredient have implications for the cost of the program and may also be related to the effect found (Levin & McEwan, 2001, p. 52-53). A good example of an ingredient and the details needed for Talent Search are the counselors or advisors who provide services to students. These individuals could have bachelor's degrees or master's degrees, they could have prior experience or expertise, and they may have management or leadership responsibilities. Each of these characteristics is likely to create a higher market value for that individual, which is reflected in the cost of utilizing that ingredient. Each of these characteristics may also be related to the impacts of the program as individuals with more experience or more expertise may provide higher quality services.

As Levin and McEwan illustrate, it is important to obtain data for all ingredients required, including those that were donated or provided by other entities, in order to establish the total cost of the program (Levin & McEwan, 2001, p. 47-48). In the case of Talent Search, volunteers from the community may share their experiences with students to inform them about a particular career path and the education needed to succeed in that line of work. The time these individuals

contribute to the program is valuable, which is an important cost of the program and may also be related to the program's impacts. Another example of an ingredient that contributes to the program's costs and likely to the program's impacts is student scholarships provided by the college hosting the Talent Search program site. A scholarship is valuable and could likely contribute to the program's impacts on high school completion and postsecondary enrollment rates, especially given that the population served by Talent Search is largely students who come from families living in poverty. These are two examples of many resources that are provided by entities other than the Talent Search program site that contribute to the operation of the program. These examples illustrate the importance of collecting data on all resources utilized to determine the cost of Talent Search.

I began drafting an initial ingredients list by reviewing the description of Talent Search provided by the impact evaluation and the publicly available information provided online by the U.S. Department of Education. I also visited a Talent Search site. It was evident from these sources that further information would be needed to better understand the personnel who were employed to provide services, the materials used in meetings with students, and the facilities or space used to meet with students.

I contacted the U.S. Department of Education's Talent Search office to inquire about obtaining grant application materials and annual performance reports for sites in Texas and Florida that were operating during the time of the evaluation. The Talent Search office allowed a staff member from CBCSE to photocopy the records they had on site. The applications included rich demographic data for the local area and the schools targeted by the project site. The annual performance reports provided descriptive statistics about the students served, such as gender and race, and data on outcomes such as the number of students who graduated high school. While

these two types of administrative data were very helpful in understanding how each site tailored the program to fit the needs of the local population, the documents did not depict what happened during the time of the evaluation in order to achieve the results in Constantine et al. (2006).

Interviews were needed to collect ingredients data and I planned to contact as many sites as possible to try to better understand if and how the program differed in operations and in resource use across sites. Based on the ingredients obtained from the resources I described above, I created an interview protocol with the help of the CBCSE team and filed for IRB approval. After obtaining IRB approval, I used publicly available information and contacted 24 Talent Search project sites that were open in 1999 in Texas and Florida to invite them to participate. Each site was called to introduce the study and to ask if the materials should be delivered via email or mail. When possible, I spoke with each site's director because that individual would be the most familiar with the qualifications of staff and the operations of the site, as well as to be respectful of that individual's role as the head of the project site. Most sites were very receptive to the study and looked forward to participating. The Department of Education assisted in recruitment by providing a list of 15 sites to contact from the impact evaluation as well as sending a letter about the study to each site's director. I followed up with each site many times via phone or email to explain the study and to schedule interviews (each site was contacted between one and seven times for recruitment). In total, I interviewed personnel at 11 Talent Search project sites, 9 of which were sites from the impact evaluation.

As I conducted interviews, I adapted the protocol as needed based on the information obtained from each site, as well as how the interviews progressed. The protocol is attached in Appendix A. I asked respondents to describe the program first and then followed with very specific questions about personnel, materials, facilities, and other inputs. This method worked

well. It allowed the participant to share some of their story and aspects that they feel make their site special prior to getting into qualities of ingredients. This allowed me to establish rapport with most interviewees and it gave me context of the program at that site to ensure that I did not overlook any major ingredients used. I tried asking questions in a different order to try to reduce the time needed for the interview. This did not make a difference. The most important first step seemed to be establishing the participant's trust and to learn about the site's program more generally prior to asking questions about each specific ingredient.

Most of the questions during the interviews were easily answered. However, almost all participants struggled with describing the facilities of their offices and the facilities used at each target school. Many participants also did not particularly enjoy the questions about the materials because of specificity (i.e., the number of sheets of paper in a flyer). All of the interviews were quite informative and they were time intensive, lasting 1.5 to 2.5 hours each. When the interview began to take more than an hour or two, I followed up with the respondent via email to reduce the burden of participating. In some cases, I also followed up by email to clarify my data.

The individuals I interviewed had been working for Talent Search for 2 to 24 years, and in some cases more years were worked as counselors or through other TRIO programs. Some directors were served by the program when they were in school. I was impressed by the respondents' commitment to and belief in the program. Almost all individuals commented about how they found it impressive that the program could operate on such little funding (and expressed an interest in having more funding available).

I followed each interview with an email to express my gratitude for their participation. I also provided my contact information again in the event they wished to contact me with questions. Many participants requested that I share my dissertation with them upon completion

of the work. Without the generosity of these individuals, I would not have been able to thoroughly examine the variation across sites in resource use, as well as to explore potential relationships between ingredients and outcomes.

All of the data collected were entered into a spreadsheet in the Microsoft Excel program (for a standard example, please see Levin & McEwan, 2001, Table 5.2, p. 86). A complete list of ingredients is provided in Appendix B. I organized the data to mirror the interviews and to reflect the larger ingredient categories of personnel, materials, facilities, and other inputs. Ingredients that were identified in the interviews as contributed or donated to the program by entities other than the Talent Search program site (such as the target schools, the host college, other colleges, the College Board, and individuals in the community) were identified in the dataset as “contributed” in order to estimate the contributed cost separate from the cost to the Talent Search program site directly. The data were organized as follows: Talent Search Site Information, Personnel (Talent Search Staff, Staff at School Sites, and Volunteers), Professional Development, Facilities (Talent Search Site, School Site, and Overnight), Materials and Equipment (Talent Search Provided and Contributed), Other Inputs (Transportation, Other Inputs Talent Search Provided, Other In Kind Inputs), Evolution of Implementation, and Additional Notes. Columns provided data on ingredient quantities, descriptions for values and notes, value per unit, assumptions/sources/value specifications, and ingredient costs. I utilized a new spreadsheet within the same workbook for each site interviewed. The result was one database “workbook” Excel file that held all of my site level data. This same file was also used to conduct all of my analyses.

After entering interview data for each site, I quantified the ingredients based on the qualitative responses provided by each site. The data entry, quality checks, and quantification

process often took longer than the interviews, lasting about 3 hours each. Some ingredients were straight forward quantify, such as having one director and two Talent Search counselors. Some ingredients were much more difficult to quantify due to unclear interview responses or due to the nature of the ingredient.

Determining facilities was particularly difficult for interviewees, for example the square footage of office space, square footage of space used at the host college for events, and square footage used for student meetings at the local schools. If any space was utilized by Talent Search only, I assigned the total square footage per year to the ingredient (office space at Talent Search site, office space at a school site, or storage space at the schools). If the space was shared or considered flexible, which meant that any space that was available at that time was used and the space was not specified in advance, the space was quantified on an hourly bases based on the number of students included in the meetings (lunchroom corner, hallway, or small space in guidance counselor's office).

The ingredients data for the materials and equipment category were laborious for two reasons. One was that individuals did not generally enjoy specifying numbers of computers, printers, and telephones used by the program. The second is that due to the nature of the program, this category became quite tedious due to the program's use of paper: handouts, mailed materials, forms, flyers, and other printed materials. Food and other ingredients related to cultural and college tour trips or events held by the program site were also difficult to quantify. I was able to estimate these ingredients (for example breakfasts, lunches, snacks, and dinners) by asking if the meals were provided on trips or during events and multiplying the meal type by the number of attendees. While this process required substantial time to collect and quantify the data,

it felt necessary in order to get at site-level variation in how the program is run and what resources were used.

*Step two: Pricing ingredients.* Each ingredient was paired with a national price from a database that was built by CBCSE. Appendix C provides detailed information on the monetary valuation of each ingredient and the databases or sources of those values broken down by ingredient category. Prices are all expressed in 2010 dollars, either as reported or adjusted using an average of the CPI-U, CPI-W, Teacher Wage Index, HEPI, and HECA indices (please see Appendix C: Cost Value Source List, Adjustment for Inflation for more information on the indices used).

When a national price did not exist for a specific ingredient, I used the price of the most similar ingredient available. For example, there were no available data on the national average wages earned by Talent Search directors. The interviews produced rich qualitative descriptions of the director's position regarding highest degree earned, years of experience, responsibilities, and other related experience, which allowed me to find the most similar positions available in national wage datasets.

My CBCSE colleagues and I reviewed the data published by the College and University Professional Association for Human Resources and found two positions that were similar in level of administration and in responsibilities to the two positions as described in the site-level interviews. I used an average of the reported 2010 salaries for the Director of Student Activities (\$55,608) and the Director of Student Academic Counseling (\$64,601) and added 32.3% of benefits for state and local government employees in the education industry in junior college, colleges, and universities as reported in the Bureau of Labor Statistics' National Compensation

Survey. For similar details on each ingredient, please see Appendix C: Cost Value Source List, Value of Ingredients.

*Step three: Estimating the cost of Talent Search.* After each ingredient was described, quantified, and given a cost based on the quantity described and price data available, all ingredients were summed to provide a total site-level cost per year. To ensure that this process was not dependent on my own assumptions, three additional CBCSE staff provided assistance with the pricing and cost estimation of three sites. While this process did not establish a formal inter-rater reliability estimate, the process of pricing and totaling costs for a site was not dependent on the researcher doing the pricing. This was likely due to the level of detail captured in the qualitative data describing each ingredient and that all researchers used the same database of prices.

I divided each site's total annual cost, as estimated using the ingredients method, by the total number of students served by the site in 2010. This calculation provided the average cost per student for one year of Talent Search. While the annual average cost per student is useful, Talent Search, as described previously, is a multi-year program that serves some students for up to 7 years. The program is targeted to students in middle school through high school, with the specific grades included varying by site. Therefore, I transformed the annual cost per student into a present value at age 18 to account for the program's length of treatment exceeding one year, using a continuous discounting formula and a 3% discount rate. The number of years of treatment students received was not clear from the impact evaluation. Some students received two years of treatment and others may have received many. Thus, I included a question during the interviews regarding the average number of years students participate in the program at each site in my sample. No site reported as little as 1 year and all sites reported that students typically

remained in the program after joining. Because there is some room for error in the length of participation and in the selection of discount rate, both are varied in sensitivity analyses.

In the next section, I describe my approach to analyzing these data for each research question of this dissertation.

### Analytic Approach

As stated previously, this dissertation represents an application of the ingredients method for determining costs as part of a cost-effectiveness analysis (Levin, 1975; Levin & McEwan, 2001; 2002). Question 1 asks how the cost-effectiveness estimate of a large national program may differ among constituent sites of implementation when each site has a unique set of students in the intervention as well as differences in schools, communities, school practices, and resources. To answer this question, the analyses begin with an overall program estimate of the cost-effectiveness of Talent Search in producing high school completers. This is followed by analyses that rely upon estimates at the state level and at the site level.

This question is designed to examine how closely an overall estimate of the cost-effectiveness of a program or intervention has predictability for any particular site where adoption is being considered. As it turns out, it appears that the specifics of a particular adoption at a particular site make a profound difference in results. As the cost estimates are more closely tied to the site of implementation, rather than in the aggregate, the results show that substantial variability is masked, stressing the importance of considering variability in effects and costs when evaluating a program and when comparing program alternatives for a particular context.

Within this question, I also discuss the variability found in ingredients and the potential relationships that could be investigated further in the future. The goal of this section of question 1 is to give context to the cost-effectiveness results and to begin a discussion about the

relationship between the level of resource use and resource allocation or ingredients usage and costs.

Question 2 compares the cost-effectiveness of Talent Search using two outcomes: high school completion and postsecondary enrollment. There is no single best way to combine the two outcomes of the program into a single measure, so these analyses present four different options to weight the outcomes to appeal to various policy interests. The purpose of this question is to acknowledge the importance of both outcomes of the program and to examine how the cost-effectiveness estimate changes based on the weighting scheme used.

Overall, this dissertation aims to provide a thorough example of the ingredients method and to bring forth a discussion regarding three issues in cost-effectiveness analysis: site-level variability, examining the variability in resource use, and incorporating more than two outcomes when the cost-effectiveness ratio only allows for one. This dissertation will show that through accounting for site-level variability in resource allocation, precision is gained such that a policymaker can better estimate the feasibility of implementing a program within his or her own local context, as well as better estimating the efficiency of the Talent Search program. The following section provides a description of the analyses for each research question in this dissertation. The equations for these analyses are noted below by number in parentheses and are provided in Appendix D: Analysis Plan Equations.

**Question 1: What is the cost of Talent Search? What is the cost-effectiveness of Talent Search? How do these estimates vary by site?**

This research question estimates the cost of Talent Search for producing additional high school completers. I begin by calculating the total cost to implement Talent Search using the data and ingredients method outlined above. This overall estimate would likely be the result of a

typical cost-effectiveness analysis study using what we consider the most appropriate cost method, and, thus, it is the first analysis I provide. The following state-level and site-level analyses will show that, while this analysis is typical for a program intervention, the overall estimate is problematic because it assumes that the costs and effects are representative of the same Talent Search implementation everywhere and can be generalized to the Talent Search program as a whole.

The analyses for this research question are designed to illustrate how the cost-effectiveness estimate improves in precision as data for specific applications and sites are used. The purpose of this question is to show the importance in estimating site-level costs and effects to demonstrate the range of cost-effectiveness that may exist within one program due to differences in implementation, resource allocation, or contextual factors such as population demographics, school leadership, or interactions with other programming. Below, I discuss each analysis in detail. All equations are noted by number in parenthesis and are provided in Appendix D: Analysis Plan Equations, Question 1.

**Overall Cost-Effectiveness Estimate.** The overall cost-effectiveness estimate of Talent Search uses data from 10 interviewed sites to determine the total program cost in 2010. First, I calculate a weighted average of the present value of cost per student from each site (1, 2). A weighted average allows for more weight (or mathematical importance) to be assigned to sites that served more students. This is important because it allows the estimate to represent the true average cost independent of site. Then, I estimate the total cost of Talent Search by applying that weighted average to the total number of students served by the Talent Search program nationally in 2010 (3).

It is possible to review the program in terms of direct costs to the national sponsor and costs that are contributed or donated by agencies or individuals who support, but do not sponsor the program directly. This is important because it illustrates the proportion of the total cost that is contributed by outside agencies or individuals, resources which are required for the program to operate successfully regardless of who contributes them. During interviews and data collection, participants identified if ingredients were provided or paid for by the program with federal funds or contributed by the local schools, host college, business community, or other organizations. I sum the costs of those ingredients that were contributed by an outside agency or individual and calculate the proportion of the overall cost of each site (4). I then calculate a weighted average of the proportion of the costs borne by the Talent Search program (5) and then estimate the distribution of costs per agency for the overall program (6).

I provide the average cost per additional graduate for the program overall. As shown in Table 4.2, the 2006 evaluation report lists the average rate of high school completion for the treatment and comparison groups in Texas and Florida. Similar to how the WWC calculates average treatment impacts, I estimate the program's overall impact by calculating an average high school completion rate, weighted by the treatment sample size in each state (7). I convert this percentage into the additional number of graduates produced by multiplying the average percentage point difference in graduates/completers between the treatment and comparison groups by the total number of students served nationally in 2010 (8). On the premise that the effect was indeed causally identified, this calculation estimates the additional number of students who completed high school who would not have completed high school had the program not existed. I then divide the total cost by the additional number of graduates to obtain the average

cost of producing an additional graduate or high school completer through Talent Search to society and to the Talent Search program(9, 10).

I provide additional details regarding the overall cost-effectiveness estimate by summarizing how resource allocation differs across sites in the overall amount and in the distribution across the following categories of ingredients: personnel, facilities, equipment/materials, and other inputs (11, 12, 13). The present value cost per site is presented in total and from the perspective of the talent search site (14). I calculate a weighted average of the 10 sites, based on reported site size in 2010, to estimate the average total cost per site.

**State-Level Estimates.** Both the impact evaluation by Constantine et al. (2006) and the What Works Clearinghouse report the effectiveness of Talent Search at the state level for Texas and Florida. My analyses include this level of data to align with those reports and to fully demonstrate the potential for variability in estimating the cost-effectiveness of Talent Search. I calculate the average cost per student, the number of additional graduates, and the cost per additional graduates in each state using ingredients data and effectiveness data from the 9 sites in my sample that were included in the impact evaluation. Thus, this step moves the analyses closer in the direction of having both the costs and effects represent the same implementations.

The state-level cost per student is an average of the site-level average present value per student estimates, weighted by reported site size in 2010 (15, 16). I calculate a total cost per state based on the number of students served at the 9 interviewed sites in 2010 (17). I estimate the program's impact in each state by calculating a weighted average of each site's estimated percentage point difference in high school completion rates (18). I multiply the percentage point difference between treatment and comparison groups by the reported number of students served at the 9 interviewed sites in 2010 to calculate the additional number of graduates due to Talent

Search in each state (19). I then divide the total cost per state by the additional number of graduates to estimate the cost per additional graduate (cost-effectiveness ratio) in each state (20).

**Site-Level Estimates.** Constantine et al. (2006) found that the state-level estimates of effectiveness “masked substantial variation” across sites (p. 31). This dissertation was designed with the hypothesis that variability will be considerable across program sites in costs and cost-effectiveness ratios, as well. These site-level analyses utilize ingredients data that were collected from knowledgeable staff at nine sites that were included in the impact evaluation and reported in Constantine et al. (2006). The qualitative ingredients data were categorized according to personnel, facilities, materials and equipment, and other inputs, classified as contributed or a direct cost to the program, quantified and priced to calculate a total site cost, average cost per student, and the average present value cost per student at each site. I compare the estimated cost of each Talent Search site and discuss variation in resource allocation across ingredients.

I present data regarding the portion of resources that were contributed to the operation of Talent Search (from the target public middle and high schools, the local community, or colleges) versus those that were directly born by the program site to estimate the distribution of program costs at each site (21). It could be the case that a site is more successful if the target schools are more involved and provide resources for the program or if the local community is involved in helping to educate the participating students about career options in their community. I discuss the variability in the proportion of contributed resources across sites.

Constantine et al. (2006) reported the difference in high school completion rates and the percentage point differences between the treatment and comparison groups for each site. Some sites were large enough to split the data into later and earlier cohorts with differing estimates, while other sites were not large enough to split and were given one estimate. I do not have the

sizes of the groups or the matched samples for each site, therefore I calculate an arithmetic average in the instance of multiple estimates of effectiveness for one site.

I calculate the cost per additional graduate for each Talent Search site with each site's average present value cost per student, reported number of students served in 2010, the total site-level cost, and the number of additional high school graduates. The total site-level cost is based on the number of students served in 2010 and the present value cost per student, which is calculated using the reported average number of years students participate in the program (22). The percentage point difference in high school graduation/completion rates is easier to understand when expressed as the number of additional graduates. Thus, I multiplied each site's estimated percentage point difference in effectiveness by each site's reported site size in 2010 (23). Then, I divide the total site-level cost by the number of additional graduates to estimate the cost per additional graduate at each site (24). I also provide the additional number of graduates per \$100,000 to simplify the comparative efficiency across sites (25). I also calculate a pooled estimate from these site-level data, weighted by the reported number of students served at each site in 2010 (26-32). This pooled estimate differs from the original overall cost-effectiveness estimate in that it relies only on the sample of sites for which I have both costs and effects. The overall estimate of cost-effectiveness includes a site that does not have effectiveness results and six sites that do not have cost data. Thus, the pooled estimate is representative of my sample and I am confident that the cost and effectiveness values used in the cost-effectiveness ratio are related to the same sites and at least similar implementations.

**Site-Level Comparisons.** I compare site-level estimates of the cost per additional graduate and examine site level differences in ingredients usage. I test the sensitivity of this comparison by re-estimating the cost-effectiveness ratios without the cost of facilities. The

Talent Search sites are all required to provide 8% of their funding to their host college (or organization) for overhead. Because the 8% and the cost of facilities may be double counting, I remove the estimated cost of host college facilities and recalculate the average present value cost per student for each site.

**Comparing Cost-Effectiveness Estimates from All Analyses: Testing the Sensitivity of the Overall Estimate.** After fully exploring the variation found at the state and site levels, I present all of the cost-effectiveness estimates from Question 1 to examine the sensitivity of the overall estimate of cost-effectiveness. The baseline for comparisons and sensitivity tests is the overall program estimate. I present all of my additional results from the state-level and some selected results from my site-level analyses. Because my sample is more limited than the original impact evaluation, I also include a calculation of the state-level analyses using the treatment sample sizes and reported state-level effectiveness estimates from Constantine et al. (2006). I include site-level results from the most and least cost effective sites. I provide the pooled estimate from my site-level results. I also provide this pooled estimate without the most and least efficient, the most and least costly, and most and least effective.

While all sites in my sample had at least one statistically significant estimate of effectiveness, four of the sites with multiple estimates had one estimate that was not statistically significant. Because I do not have the sample sizes used for these calculations, I am not able to report if this may be due to sample size. Three of those sites also included a negative impact of the program, two of which were not statistically significant. To test the optimal condition where all sites produce positive impacts on high school completion, I present the effectiveness from only sites with statistically significant positive results with all costs and with the associated costs of those effective sites. Again, because I do not have the sample sizes utilized in the impact

evaluation to estimate the statistical significance of the effectiveness for sites that had multiple estimates of effectiveness, I conservatively assume that any site with a non-significant result does not have a statistically significant site average estimate. However, this may be limited, so I also list sites that have a positive average impact with all costs and with associated costs of those sites.

In this section, I include the results from the sensitivity test of the site-level cost of facilities. In an attempt to estimate the wider bounds of the costs, effects, and the cost-effectiveness of the program, I also simulate the range of potential costs and effectiveness estimates using Monte Carlo simulation.

**Relating variability in ingredients use to efficiency.** I examine the data for potential relationships resource use and cost-effectiveness, and I discuss the variability in ingredients use across sites. I provide case studies of the sites with the lowest and highest cost-effectiveness ratios to report on the context of how the program operates at these sites.

My analyses do not fully explore the differentiation between sites' use of similar ingredients or the way in which students responded to particular ingredients. For example, two different may use similar materials (in quantity and in description) in meetings with students or at family events, but the impact of those materials or the usefulness of those materials to the students is not represented in the data. College visits are a similar example. Many sites take students on trips to visit colleges, but it is not clear how those visits may differ in substantively important ways across Talent Search sites. When qualitative data were available for an ingredient that described a characteristic of the ingredient that may be important to the program's impacts, I captured that in the description of the ingredient and in the valuation of the ingredient's cost when possible. For example, different sites utilize a different mix of program staff. Some sites

employ counselors with master's degrees and others do not. Some sites have counselors who have been on staff for over ten years and other sites have counselors with less experience. To distinguish these data, I classified a counselor with a master's degree as a different ingredient from a counselor with a bachelor's degree. Then, I used data from the Bureau of Labor Statistics to increase the salary price for a counselor by 3.1% based on additional years of experience up to 10 years total. For example, if a counselor had a master's degree and 10 years of experience, I increased the value of their salary by 3.1% for each year of experience over 5 years and up to 10 total. If a counselor had a bachelor's degree and 10 years experience, I increased the value of their salary for each year of experience over 3 years and up to 10.

Even though these results are limited, this research question is intended to begin a discussion about utilizing the data generated from the ingredients method to allow researchers to examine the relationship between costs, effects, and cost-effectiveness within a program. With further development, these data could potentially assist in identifying best practices for program improvement and new site adoption.

**Question 2: When a program impacts more than one outcome of interest, how can multiple weighting schemes be used to provide policy-relevant results within a cost-effectiveness framework?**

This question incorporates a second, but very important, outcome of Talent Search: postsecondary enrollment. While Talent Search must target high school completion as it is the only path to college, higher education is the true goal of the program. Thus, it is incomplete to only provide cost-effectiveness results for Talent Search's impacts on high school graduation or completion. I provide four different weighting schemes to illustrate how the results may vary depending on the method used or the metric of interest to policymaking constituents. Below, I

discuss the analysis plan used for each weighting scheme. Equations that have not been discussed earlier or that would be helpful in understanding these analyses are noted by numbers in parentheses below and provided in Appendix D: Analysis Plan Equations, Question 2.

**Weight 1: High school completion = 1, Postsecondary enrollment = 0**

A policymaker may have only one outcome of interest and may not value the other outcome. This weight is the first example of this type of weighting scheme. High school graduation is considered the outcome of interest and postsecondary enrollment is ignored or valued at zero. Thus, these analyses will be the same as those discussed in Question 1. I do not duplicate that section here, but I restate some of the results for illustrative purposes in the Question 2 section of the next chapter.

**Weight 2: Postsecondary enrollment = 1, High school completion = 0**

Postsecondary enrollment is an important milestone and may be the outcome of interest for the federal funders of the program or for the many colleges that host Talent Search programs. This weight is the opposite of Weight 1 in that the focus is solely on the outcome of postsecondary enrollment and all costs are attributed to the production of it. Constantine et al. (2006) measured college going in much the same way that they measured high school completion. They retrospectively followed the progress of the 1995 9<sup>th</sup> grade cohort to measure who enrolled in higher education and who did not. Where Constantine et al. provided multiple estimates for one site, I took an arithmetic average to have one estimate per site. I list the enrollment rates for each site in my sample and use those effectiveness data to estimate the site-level and pooled cost-effectiveness of Talent Search in producing postsecondary enrollment. The costs data are the same as those described above and utilized in Question 1 (and Weight 1). I calculate the extra number of enrollees due to the program and calculate the cost-effectiveness

ratio using that measure to provide an easily interpretable metric of the cost of Talent Search to produce an additional postsecondary enrollee. Similarly to high school completion, I also provide the results as the number of additional enrollees per \$100,000. In addition to site-level analyses, I also provide a pooled estimate for my sample.

### **Weight 3: Additional years of schooling**

One useful way of presenting the two outcomes of high school completion and postsecondary enrollment is to calculate the cost-effectiveness of the additional years of schooling obtained as a result of the program. I estimate the number of students who dropout, only complete high school, and enroll in college at each of the 9 sites in my sample using the high school completion and postsecondary enrollment results from the impact evaluation (1,2,3). I assumed that all students who enroll in postsecondary institutions graduated from high school or obtained a GED. I transform all rates into additional numbers of students by subtracting the comparison group's rate from the treatment group's rate and multiplying by the number of students served at each site in 2010.

The next step is to weight the different outcomes according the additional years of education received by each group of student. I weight dropouts as zero, high school graduates or completers as +1, and postsecondary enrollees as +2. Then, I add the total additional years of schooling obtained at each site (4). This is likely a low estimate because some students continue in school to complete an Associate's, Bachelor's, Professional, or Graduate degree. I unfortunately do not have those outcome data.

I utilize the same cost estimates based on site-level ingredients to compute the cost-effectiveness of Talent Search to produce an additional year of schooling. I also provide the number of additional years produced for \$100,000. As I stated previously, this is not to be

interpreted to mean that \$200,000 will provide two times the number of additional years. It is simply another metric for reviewing and understanding the cost-effectiveness results. In addition to site level results, I also provide the pooled estimate for my sample, which is weighted for site size to account for the differences in number of students served.

#### **Weight 4: US 2010 Dollar value of the two outcomes**

High school graduation and postsecondary enrollment both have monetary benefits in the labor market. This approach to combining the two outcomes more closely approximates a benefit-cost analysis rather than a cost-effectiveness analysis. However, it seems to be the most logical way to weight the two outcomes based on a value society has given them through the labor market. I estimate the net present value and the benefit-cost ratio for each site and for my sample overall in a pooled estimate. As I describe below, this analysis only utilizes earnings and does not include a full estimate of other benefits of Talent Search such as reduced crime, health benefits, and participation in civic duties. Therefore, the results will be a conservative lower bound estimate of the benefits of the program.

Similar to Weight 3, I use the high school completion and postsecondary enrollment results to estimate the number of students who dropped out, obtained a high school degree or equivalent only, and those who went on to enroll in a postsecondary institution. I subtracted the postsecondary enrollees from the high school graduates to obtain the number of students who only completed high school. This assumes that all students who enroll in postsecondary institutions graduated from high school or obtained a GED. I estimate the number of dropouts by taking the difference between the high school completion rate and 100%. I transform all rates in to additional numbers of students by multiplying by the number of students served at each site in

2010. The pooled estimate for this weighting scheme is weighted for site size to account for the differences in number of students served.

Next, I utilize U.S. Census data to obtain the mean earnings of adults for each type of outcome: less than high school completion, high school graduate or equivalent, and some college (please see Appendix D: Analysis Plan Equations, Question 2 for data). I use the mean earnings for people of all races and both genders aged 18 to 65. Because these earnings will occur in the future, I use a rate of 3% to discount the earnings back to age 18, the age of the present value costs of providing Talent Search. To remain consistent with my cost analyses, I adjusted the monetary values of the outcomes to 2010 U.S. Dollars using an average of the CPI-U, CPI-W, Teacher Wage Index, HEPI, and HECA indices (please see Appendix C: Cost Value Source List, Adjustment for Inflation for more information on the indices used).

I compute the additional earnings for each site by first multiplying the difference between the treatment and comparison groups in dropouts, high school graduates, and postsecondary enrollees with the discounted total estimated lifetime earnings for each level of education (6,7,8). Then I add the additional earnings for each level of education together to estimate the additional earnings produced at each site (9). I also provide a pooled estimate for my sample that is weighted by the number of students served at each site in 2010.

I utilize two benefit-cost estimation strategies to compare the additional earnings to the costs of Talent Search. First, I provide the Net Present Value, or the additional lifetime earnings due to Talent Search minus the costs of each site (10). Another term for Net Present Value is the Net Benefits (Levin & McEwan, 2001, p. 178). The result provides a single present value dollar value for the program. The second estimate is the Benefit-Cost Ratio, where the additional lifetime earnings are divided by the total site costs (11). The resulting ratio is the return on

investment, or the amount of money that benefits society per dollar of investment. Both strategies only utilize lifetime income values as the estimated benefit. Thus, these are not complete benefit-cost analysis results and would likely be higher if other measures of benefits were included. However, the results will provide useful information about the program's two outcomes.

Chapter 4 Tables

Table 4.1. *Impacts of Talent Search on High School Completion and Postsecondary Enrollment*

	HSC	PSE
Texas	9	18
Florida	14	15
Most Effective Site	27.3	35
Least Effective Site	-9.2	-2.2

*Note: Constantine et al., 2006, p. 32, 36, 82, & 85. Impacts are expressed in percentage point differences.*

*HSC = High School Completion*

*PSE = Postsecondary Enrollment*

Table 4.2. *Average Impact of Talent Search on High School Completion*

	Texas	Florida	Total
Percentage Point Difference	9	14	
Additional High School Completers	362	126	488
Sample Size	4027	900	4927

*Average Impact on High School Completion* 10

*Note: Average percentage point difference weighted for state-level treatment group sample size. Percentage point differences reported in Constantine et al., 2006, p. 32 & 82.*

## **Chapter 5. Estimating the Cost-Effectiveness of Talent Search**

This dissertation was designed to provide an example of an application of the ingredients method through a cost-effectiveness analysis of Talent Search, a nation-wide federally-funded program that targets *low-income first generation* (hereinafter LIFG) students in grades 6 to 12 to increase the rates of high school graduation and postsecondary enrollment. Because Talent Search is a multi-site program, the analyses focused on an exploration of three complexities in conducting cost-effectiveness analyses: site-level variation within a program, relating resource allocation to outcomes, and combining multiple outcomes to evaluate a program's efficiency. The goal of this work is two-fold. First, these results are intended to inform policymakers about the cost-effectiveness of Talent Search and the ways in which cost-effectiveness varies across sites. Second, through demonstrating the ingredients method and some of the complexities of conducting cost-effectiveness analysis, this work is intended to contribute to future applications of and the continued development of the methodology.

I utilize effectiveness data from a previously published impact evaluation of Talent Search by Constantine, Seftor, Martin, Silva, and Myers (2006). This evaluation found that while Talent Search positively impacted high school completion and postsecondary enrollment on average, the impact at each of the Talent Search sites varied considerably (Constantine et al., 2006; the results are provided in Tables 5.9 and 5.11). This dissertation builds upon the findings of the impact evaluation to add a cost-effectiveness analysis of the program following the ingredients method (Levin & McEwan, 2001). My methods are described in detail in Chapter 4. I collected the ingredients data by interviewing 11 Talent Search sites, 9 of which were included in the Constantine et al. (2006) evaluation. In order to determine the cost of the intervention, I

matched each ingredient at a site with a national price to provide a comparable price criterion among sites. My analyses were then split into two research questions:

1. What is the cost of Talent Search? What is the cost-effectiveness of Talent Search? How do these estimates vary by site? How does the variability in site-level costs relate to the variability in effects?
2. When a program impacts more than one outcome of interest, how can multiple weighting schemes be used to provide policy-relevant results within a cost-effectiveness framework?

For Question 1, I calculated the average cost among sites and the average cost-effectiveness for high school completion for Talent Search. The analyses establish an overall cost-effectiveness estimate followed by state- and site-level analyses to demonstrate the variability in the program's cost-effectiveness. I then examined the alignment between the costs and effects of the program on the premise that variability in costs across sites will be related to differences in effectiveness and cost-effectiveness. For Question 2, I utilized four weighting schemes to estimate the cost-effectiveness and the cost-benefit ratios of Talent Search when taking account of two outcomes, high school completion and postsecondary enrollment.

My findings show that on the basis of its benefits and costs, Talent Search is a good investment for society. However, as I present below, the variability I find across sites illustrates that more investigation and development is needed to improve the productivity of the program and to reduce disparities in resource yields across sites. More broadly, my findings point to the importance of including site-level analyses, when possible, within cost-effectiveness analyses. In what follows, I provide the results for each of the three research questions included in this dissertation. The final chapter of this dissertation, Chapter 6, provides a discussion of these results.

## The Cost-Effectiveness of Talent Search for High School Completion

Program evaluations typically provide an average treatment effect of a program on a particular outcome of interest, resulting in yields on a particular metric such as an effect size or (gain in z-score or standard deviation unit). Cost-effectiveness analyses typically pair this average treatment effect with an average cost to determine the cost per additional unit of effectiveness produced. While the estimation of average treatment effects has received much attention methodologically, the average estimation of costs has not been studied as closely. When estimating the overall cost of a program and that program's cost per student, the implied assumption is that the program is implemented in precisely the same way at every site so that one cost estimate is representative for all sites. But, costs can differ depending upon resource or ingredients use and different prices of ingredients from site-to-site. Here I use a national set of prices to provide uniformity on this dimension, but costs can still vary among sites according to how resources are used to implement the intervention.

Research question 1 computes overall estimates of the costs and cost-effectiveness of Talent Search. This estimate is followed by state-level and site-level estimates to show the wide range of costs, effects, and cost-effectiveness estimates that can be produced from one set of data on the same program. As the analyses are disaggregated by state and site, the precision of the findings is increased as the results are more representative of the implementation(s) of the program. More specifically, my findings illustrate how the cost-effectiveness estimate changes depending on the level of aggregation used and demonstrate the necessity of site-level data when possible.

## **Overall Cost-Effectiveness Estimate**

**Clarifying costs versus funding.** In 2010, Talent Search served 359,740 students at 463 program sites across the United States (Talent Search, 2011). The program received \$141.6 million in federal funding for site-level program implementation (Talent Search, 2011). While this number shows that the federal funding per student per year was about \$400, it does not capture the program's total costs. Talent Search relies on outside resources from targeted middle and high schools, the community, and the host university or organization to operate. All ingredients that contributed to the operation of the program have a value or opportunity cost and, thus, are included in my analyses.

The sites included in my analyses were hosted at 2 year or 4 year postsecondary institutions. These colleges provided a range of resources that are not captured in the program's budget such as facilities and support from the academic advisement and admissions offices. The host colleges may also provide special funding or classes for Talent Search students who chose to attend that school after graduation.

All sites relied on ingredients that were contributed from the middle or high schools being served by the program. Some schools provided a varying amount of space for the program counselors (or "advisors") to meet with students. Schools also provided assistance with recruitment, support during school site visits, opportunities for collaboration with the school, referral of students for other services, and assistance with program field trips. At most sites, community members gave a few hours of their time to share their work with the students or to speak about a topic that was relevant to the transition into high school or the transition into college.

All of these ingredients were utilized in my analyses, irrespective of if they were financed by Talent Search since all were required to produce the outcomes of the program. Following the ingredients method, I account for all of the ingredients that were used to implement the program when calculating the total cost.

**Methods review.** I provide a brief review of the methods for these analyses below. A more detailed description of the methods is provided in Chapter 4. This first section of research question 1 is intended to estimate the overall cost and cost-effectiveness of Talent Search. Thus, the analyses utilized all of the ingredients that were identified to obtain an aggregate cost estimate for the program. The ingredients data used for the overall cost-effectiveness estimates were drawn from 10 of the 11 sites interviewed. One of the interviews did not identify adequate data to undertake the analyses, so that site was dropped from these analyses. The site that was dropped was not a site that was included in the impact evaluation.

I used national prices in 2010 so that the cost of each ingredient was treated uniformly for purposes of comparison rather than relying on local prices. A list of all of the prices used is available in Appendix C. The majority of Talent Search student participants were active in the program for multiple years. From the interviews, I obtained information on the average years of student participation in the program at each site. Reported participation ranged from 3 to 7 years with an overall average of 5 years. To adjust for the time value of investment over the years of participation, I utilized a discount rate of 3% to calculate the present value of the cost per student at age 18 (Levin & McEwan, 2001, Ch. 5, p. 90-94). To estimate the total cost of the program, I multiplied the present value cost per student based on 10 sites by the total number of students served by the program nationally in 2010.

The analyses distinguish between the total cost of the intervention and the portion of the total cost borne by the Talent Search program to present how the cost burden was financed. The total cost of the intervention includes the costs borne by the Talent Search program as well as the value of ingredients that were contributed by other agencies such as schools, community members, and the host college. The total cost to Talent Search is the portion of the total costs that were borne by the program directly such as program staff, computers, and instructional materials.

**Total cost of Talent Search.** As shown in Table 5.1, the estimated total cost to provide Talent Search for a cohort of students (assuming multiyear participation) is approximately \$1.2 billion. The total cost includes both the multiple years that students participate in the program and the additional costs that are provided at local sites. The portion of the total cost borne by the Talent Search program directly is about 81% of the total cost or \$966 million. On average, in 2010 U.S. dollars, when all costs are taken into account (from Talent Search, the host organization, the targeted schools, community members, etc.), it takes about \$33,500 to produce an additional high school graduate (or completer). Constantine et al. (2006) estimated that Talent Search participants completed high school at higher rates in Texas and Florida than the comparison group by 9 percentage points and 14 percentage points, respectively. To estimate this overall cost-effectiveness estimate for the program, I utilized a weighted average (10%) of those two estimates based on the treatment sample sizes in each state from the impact evaluation (please see Tables 4.1 and 4.2 in Chapter 4).

The average cost of Talent Search masks substantial site-level variability in total costs and in costs for categories of ingredients. Table 5.2 illustrates the total costs of Talent Search by site, by ingredient category, and as distributed according to the financing of the program from Talent Search directly. The table demonstrates substantial variability, which indicates that the

data require further exploration to better understand the variability and the implications for the findings.

The total costs of Talent Search ranged from \$1.6 million to \$4.6 million per site with an average total site cost of \$2,651,350. The site-level costs also varied by ingredient category. The category of Personnel was more tightly distributed than the others with a range of \$264,200 to \$399,210 and an average of \$352,970. The categories of Facilities and Equipment/Materials had ranges of \$36,350 to \$97,400 and \$5,280 to \$20,670, respectively. The sites utilized drastically different quantities of other inputs, such as transportation and food for field trips and college tours, ACT/SAT test waivers, college application fee waivers, and college scholarships or tuition waivers. Site One had the lowest cost of these other inputs at \$19,680, while the total for other inputs at Site Four was \$209,460.

These data illustrate that sites are utilizing differing levels of resources across ingredient categories. This indicates that an overall estimate of the average cost-effectiveness of Talent Search may not reflect variations in how the program is implemented and operated at the local level. My next analyses explore this variation further.

### **State-Level Estimates**

**Methods review.** To estimate the state-level cost-effectiveness, I utilized site-level data from the nine sites for which I obtained detailed data and that contributed to the impact estimate reported in Constantine et al. (2010). The effectiveness estimate used in this analysis was a weighted average based on the site-level results reported in Constantine et al. (2006) and weighted for reported site size in 2010. The cost data were also weighted averages based on reported site size of the nine evaluated sites in my sample. The data used for the state-level analysis more closely approximates the costs of the program as it was evaluated because the

costs are more closely aligned to the effects. The results are based on the sample of sites that were included in both the overall evaluation and this dissertation rather than being based on the total number of students served in each state by Talent Search in 2010. Thus, the results for this analysis are not calculated to be representative of the program overall. While this estimate is more precise than the overall estimate, the results are still aggregated and may mask considerable variability at the site-level.

The per student costs used in this analysis were present values at age 18 discounted at a 3% interest rate. The state-level present value cost per student was weighted for reported site size in 2010. The total state-level cost was calculated by multiplying the present value cost per student by the total number of students served in my sample within each state in 2010. The state-level effects were an average of the site-level differences in percentage points weighted by site size in 2010. This weighted average percentage point difference was multiplied by the number of students served in the state in my sample to calculate the additional number of high school completers produced by Talent Search. Bear in mind that the costs must be invested in all students in a Talent Search intervention, but the cost per unit of effectiveness is the cost per additional completer which is considerably greater than the cost per participating student. Please refer to Chapter 4 for more details on the analyses.

**Cost-effectiveness at the state level.** The costs, effects, and cost-effectiveness varied between Texas and Florida, the two states included in Constantine et al. (2006). Table 5.3 shows the average present value cost per student, total cost, additional number of high school graduates or completers, and cost per additional graduate by state. The cost per student is cheaper in Florida than in Texas and Florida produced more graduates than Texas.

The cost in Texas per additional graduate through the Talent Search program is \$81,420. The cost-effectiveness ratio for Texas is substantially higher than the overall program's cost-effectiveness estimate reported above (\$33,500).

One reason for such a marked difference in cost-effectiveness between the overall estimate and the Texas estimate is the smaller yield of additional graduates in Texas from Talent Search sites, including one site that had a negative impact on high school completion. The state-level average effect of the program in Texas as reported by Constantine et al. (2006) was a 9 percentage point increase in high school completion. When I include only the effects from the sites in my sample and I include weights for site size in 2010, the estimated impact in Texas is reduced to a 4 percentage point increase. The impact report included four sites in Texas that were not included in my analyses.

In Florida, the cost per additional graduate is \$17,980. The estimate for Florida is lower than the overall cost-effectiveness estimate reported above (\$33,500). The cost-effectiveness estimate for Florida is markedly less than the state-level cost-effectiveness estimate from Texas (\$81,420).

Similar to Texas, the effect of Talent Search based on my sample and weighted by site size in 2010 was different from the percentage point difference reported by Constantine et al. (2006). The impact in Florida among sites in my sample was a 17 percentage point increase whereas the impact report showed a 14 percentage point increase for the state. The impact report included two sites in Florida that were not included in my analyses.

I reran the state-level analyses with the state-level impact estimates from Constantine et al. (2006) and found less variability. With these data, the cost per additional graduate in Texas is \$38,400 and \$21,370 in Florida. While the relative magnitudes did not change, the distance from

the program's overall cost-effectiveness estimate was reduced. This estimate is less precise than the state-level results I present above because the costs are from a smaller sample of sites than the effects.

These results imply that the variability in the cost-effectiveness of Talent Search has the potential to be quite high depending on the sample or sites included. Further exploration into the site-level costs and effects is necessary in order to draw conclusions about the cost-effectiveness of Talent Search or what is causing the variability between the estimates from Texas and Florida. Therefore, the next section moves on to site-level estimates.

### **Site-Level Estimates**

In their impact evaluation, Constantine et al. (2006) reported that the effects of Talent Search varied substantially across the 15 sites studied. It is not clear if the evaluation was designed to examine such variation, but it appears that the authors felt it was necessary to report it. My results have also shown that considerable variability exists in costs across sites. This variability in costs and effects seem to follow from the breadth in the overall design of Talent Search which was corroborated by the implementation report conducted by Mathematica prior to conducting the impact evaluation (Cahalan, Silva, Humphrey, Thomas, & Cunningham, 2004).

This section reviews the variation in costs, effects, and cost-effectiveness for each of the 9 sites in my sample to more fully explore the program's variability across sites.

**Site-level costs.** Table 5.4 shows the ingredients for the categories of personnel, facilities, materials/equipment, and other inputs used to implement Talent Search at each site for one year in 2010 national prices. The site-level costs varied across all categories of ingredients.

*Personnel.* All sites employed a director and program counselors. One site employed two counselors, four sites employed three counselors, and four sites employed four counselors. The

student to counselor ratio for seven sites fell between 200-275 with the lowest site being 150 and the highest site being 375.

There were two types of program counselors or advisors that required different prices. The first, Level A, indicates that the Talent Search counselor has a master's degree. The second, Level B, indicates that the Talent Search counselor had a bachelor's degree. The prices for both levels of counselors were adjusted for experience as needed based on the interview data. Sites tended to utilize differing combinations of the two levels of Talent Search counselors. Two sites had only Level A counselors and two sites had only Level B counselors. Five sites had a mix of both. Site Two in Texas employed only two Level A counselors. As a result, the site had the lowest cost for counselors among the sites, \$108,850. The site with the highest total cost for Talent Search counselors was Site Four in Texas, \$241,880. That site employed a mix of both Level A and Level B counselors.

Sites employed different numbers or types of other personnel: support staff ranged from \$18,560 to \$107,540 and Federal Work Study student positions ranged from non-utilization to \$11,240. Professional development activities, such as attending regional conferences and other TRIO conferences, also varied across sites ranging from \$430 to \$4,310.

Depending on the site, school staff at the targeted middle and high schools who are not paid from Talent Search funding may be involved in the day-to-day operations of Talent Search. Some teachers invite Talent Search into their classrooms, offer free tutoring to Talent Search students, and aid in program recruitment. The involvement of school principals in the program's operation may vary from cursory relations to meetings. Some sites were able to readily access student data, such as attendance and grades, while other sites required the assistance of office staff to obtain regular reports on student's progress in school. From the interviews, it was

apparent that all sites found the schools' guidance counselors to be an integral part of the program's success. The guidance counselors often serve as a liaison with the school as well as assisting Talent Search counselors in recruitment, pulling out students, obtaining assistance for students, obtaining data on students, and attending a field trip or a program event. The number of guidance counselors per school varied across sites. Many had one guidance counselor per school, but there were exceptions. One Talent Search program site reported that targeted schools had one guidance counselor per grade. Yet, another site reported that a targeted school had three guidance counselors. The time guidance counselors devoted to the program varied substantially, ranging from 18 – 600 hours per year. I am unable to report the student-to-guidance counselor ratio at targeted schools for each Talent Search site.

Some sites utilized community leaders or college educated people as volunteer speakers at special events for students. Site Four in Texas and Site One in Florida allocated the highest costs for the In-Kind Personnel ingredient. Site Four in Texas provided an event each summer where local community leaders came to talk to the students about college, careers, and life after high school and Site One in Florida had bankers come in throughout the year to assist in teaching their financial literacy curriculum.

*Facilities.* Facilities costs also varied across sites. Program sites utilized two types of facilities: office space at the host college and space for implementation at the targeted schools. Site Four in Texas had the highest facilities utilization costs totaling \$64,580. The site was able to secure dedicated space such as a classroom or an office at the targeted high schools for the program to operate. Site One in Florida had the lowest facilities utilization costs totaling \$14,320. The site was not able to secure space at the targeted school for implementation. However, the site was provided with storage space at the targeted high schools.

Across all of the sites, the space provided by the targeted schools for implementation varied. Some targeted schools designated space and time for the program to serve students, such as an empty classroom during an elective. Other targeted schools were not able to designate space or time for the program. In those schools, the program site would serve students in a corner of the lunchroom, a corner of the library, or use the auditorium. At the sites that were not provided with space or time to see students, the program site may provide lunch to create an incentive for students to come to the program meeting and miss lunch. Many of the directors reported that a key element to operating the program successfully was flexibility. On any given day, a Talent Search counselor would not know if the schools would have space for her/him to meet with students and where or how large that space would be and how long they would be able to utilize the space. One director spoke of obtaining better space in the schools as a big goal for the future.

*Materials and equipment.* Materials and equipment varied quite substantially across sites. The two sites with the highest direct costs in this category had high quantities of ingredients such as school supplies for students, technology/computing equipment, printed materials, and postage. Almost all sites used some kind of student data management software to keep track of students as they progress through the program.

*Other inputs.* All sites provided some transportation for students. Mostly, transportation was provided to students for a day trip or a longer overnight stay to visit colleges. Some sites provided transportation to program events. One site provided transportation for students to take the college entrance exams. Transportation was a difficult ingredient to price because some sites used school buses or the host college's buses for a fee, while one site leased vans. Because of this, all costs of transportation were assigned as direct costs to the Talent Search program. If

some costs of transportation were in fact completely contributed by the school system or the host college, the distribution of costs to Talent Search may be overestimated. However, the costs are real costs to the program and were most likely born by the program itself rather than being contributed in-kind. The costs of other directly born inputs were largely driven by food for students during trips, meetings, and other events.

Some programs were able to secure in-kind contributions from the college hosting the program or other organizations for admissions fee waivers, college scholarships, or college housing waivers. Site Four in Texas was the most prominent example of this with a cost subsidy of almost \$190,000. The cost was largely driven by scholarships provided by the host college to low-income, Talent Search students to cover tuition and fees. The site reported that this was a huge benefit for the students who received the awards.

*Comparing sites.* Site-level ingredients data, as shown in Table 5.4, provide a useful look into how the Talent Search program sites operate. However, these data are descriptive rather than comparative as the amounts and quantities of some categories of ingredients may be related to the scale, or number of students served at each site. Because there is no set level of staff per student or number of events or meetings per student, the allocation of these resources are program decisions and may be based on the scale of the site, staff preference, or some mix of both.

One metric that aids in comparing sites is the per student cost for one year of service or the unit cost. Site Three in Texas serves the highest number of students and shows the lowest unit cost or annual cost per student. The low annual cost per student seems to be due to the large number of students (1,100) rather than to ingredients use as the site did not have particularly low costs for any ingredient. Site Four in Texas looks particularly expensive per student, largely due

to the extra costs of contributed ingredients. Site Six in Texas is similar in the annual cost per student to Site Four in Texas, but the cost is high due to a lower number of students rather than a particular ingredient.

*Costs to the Talent Search program.* Table 5.5 illustrates the percentage of the total costs for each site that were contributed to the program by an outside source, such as the targeted schools, local volunteers, or the host college. Site Four in Texas has the largest percentage (41%) of total costs provided by an outside agency. The ingredients usage at Site Six in Texas was in about average for all of the ingredients. However, the direct costs born by the program at this site were the largest across all sites (93%). It seems that different sites were using differing bundles of ingredients and sites were able to obtain differing levels of contributed resources based on the local resources available. The next step is to pair the costs with the effects to determine how the variability in costs translates into variability in cost-effectiveness.

**Site-level effects.** As noted by Constantine et al. (2006), the sites varied substantially in the number of students who completed high school after participating in the program. Illustrated in Table 5.6, the variability in graduation rates is large. One site had an overall negative impact on completion rates while another had a 27.3 percentage point increase. Two sites had low impacts of 2 to 3 percentage point increases. The three sites with the largest impacts were located in the same state, Florida. In the next section, I combine these data with the costs data discussed above to examine cost-effectiveness across sites.

**Site-level cost-effectiveness.** Table 5.7 illustrates the cost per additional graduate or high school completer across the 9 sites in my sample. Because students often attend the program for several years, the cost per student is a present value at age 18 using a 3% discount rate that takes account of the number of years of participation at each site (Levin & McEwan, 2001, p. 91-94).

The present value cost per student is multiplied by the number of students served in 2010 to calculate the total cost for each site. Constantine et al. (2006) provided the effectiveness estimates as a percentage point difference in high school completion between the treatment group and the comparison group at each site. To make the results easier to interpret, I multiplied the percentage point change in high school completers by the number of students served in 2010 to obtain the number of additional high school completers produced at each site. The cost-effectiveness ratio is then the cost per additional high school completer (rather than the cost per additional percentage point increase in high school graduation/completion rates). In addition to the traditional cost-effectiveness ratio, I also present its inverse, the number of additional graduates per \$100k.

Similarly to the effectiveness data, the three sites with the lowest cost per additional graduate or the most graduates per \$100k are in Florida. I note also that the results for the two states are not overlapping: even the least efficient Florida site is more cost-effective than the most efficient site in Texas. Also, the sites with the lowest rates of effectiveness were the most inefficient. Overall, the range in cost-effectiveness is substantial from over \$140,000 per additional graduate down to \$10,000.

The table also includes the pooled estimate of the program's cost-effectiveness based on my sample, weighted for reported site size in 2010. The pooled cost per extra completer is about \$41,000 and the pooled number of additional completers per \$100,000 is over 2. This estimate is about \$5,000 more than the program's overall cost-effectiveness estimate of \$33,500. As the prior results have signaled, the costs and cost-effectiveness estimate varies based on the level of analysis and the particular pool of sites included. In the next section, I explore sensitivity analyses that provide more insight into the bounds of this variability.

## **Comparing Cost-Effectiveness Estimates from All Analyses: Testing the Sensitivity of the Overall Estimate**

Variation exists in the costs, effects, and cost-effectiveness of Talent Search. These next analyses try to capture the range of the variability in the cost-effectiveness estimate. The results are presented in Table 5.8. The baseline estimate is the overall cost-effectiveness estimate of the cost to produce an additional graduate due to Talent Search, which is \$33,500. The state-level estimates vary based on the sample used. In the sample of sites for which I have specific data, the ratio is \$81,420 per additional graduate in Texas and \$17,980 per additional graduate in Florida. As comparison, if the state-level effects are used that include sites I do not have costs data for, the cost-effectiveness estimates are \$38,400 for Texas and \$21,370 for Florida.

The site-level results are listed next. The pooled cost-effectiveness ratio based on the data from my sample was \$40,960. The most and least cost-effective sites from my site-level analyses are listed to illustrate the range of the cost per additional completer within my sample of sites. The most cost-effective site produced additional high school completers for approximately \$10,330, while the least cost-effective site has negative impact results, so no cost per additional graduate can be calculated. Because these two sites may be particularly efficient or inefficient due to local conditions, program characteristics, or measurement error, I calculated a pooled ratio without these sites, which was \$46,410 for an additional completer.

Policymakers may be most interested in pooled results from sites that had a positive and statistically significant impact on high school completion. I estimated the pooled cost-effectiveness ratio for only those sites with statistically significant positive impacts. First, I include all costs because resources were allocated to all sites, including those sites that did not have positive significant results. This estimate is \$49,370 per additional graduate. I also estimate

the optimistic scenario where only the costs and effects are included from the sites that had a statistically significant positive impact. While it is not possible to know *a priori* if sites will be effective, it is possible that all sites could be improved to this productivity level. In this instance, the cost per additional graduate is about \$24,260.

**Monte Carlo simulation.** In an attempt to better estimate the interval of costs and effects, and the resulting cost-effectiveness ratios, I ran a 3,000 trial Monte Carlo simulation. This simulation was not interpretable because the simulation produced negative or zero costs, which is not possible. The second issue that arose with this simulation is that negative effects make it very difficult to interpret the cost-effectiveness ratio. The simulation produced these negative results because there is not an option to generate random numbers within a (reasonably expected) range.

As the costs and effects of a program may be related and both are likely to be affected by scale, I re-estimated the Monte Carlo simulation utilizing a joint distribution with the assistance with CBCSE staff member, Yilin Pan. We estimated 3 simulations with 30,000 trials of 500 observations. First, we used a two variable model with the present value of cost per student and the percentage point difference in high school completion rates. The average cost-effectiveness ratios were very consistent and quite similar to the overall cost-effectiveness estimate: 1)  $M = \$40,010$ ,  $SD = \$1,890$ ; 2)  $M = \$40,070$ ,  $SD = \$1,890$ ; 3)  $M = \$40,020$ ;  $SD = \$1,880$ . The three variable model incorporated scale by including the reported site size in 2010. Similarly, the results of these three simulations were consistent and close to the overall cost-effectiveness estimate: 1)  $M = \$41,850$ ,  $SD = \$2,120$ ; 2)  $M = \$41,840$ ,  $SD = \$2,120$ ; 3)  $M = \$41,900$ ,  $SD = \$2,130$ . The large standard deviations may be a result of my small sample size.

In sum, these results demonstrate the importance of considering site-level data on costs, especially when the program is large and is designed to vary based on the location implementing the program. The potential range in the cost per additional graduate is quite wide from about \$10,000 to \$140,000 (excluding the site with a negative impact). The number of additional graduates per \$100K also has a wide range (0 to +14). However, 10 out of 18 of the sensitivity tests shown in Table 5.8 have similar estimates that fall between 2 and 3 additional graduates per \$100k.

Next, the results from research question 2 are presented. Chapter 6 provides a discussion of the results, recommendations for future study, and conclusions based on the findings presented here.

### **Examining Site-level Variability in Resource Use**

This focused on examining the context of the variability found in estimating the cost-effectiveness of Talent Search. This response is also intended to promote future studies that have more statistical power to investigate the role of ingredients use in predicting site-level performance. My sample of 9 sites is too small to utilize sophisticated modeling and statistical techniques. Therefore, I examine data trends qualitatively and provide two case studies of the most and least efficient sites. These results are intended to start a discussion about what researchers can do to collect and analyze this kind of information in future studies.

It was difficult to identify any clear trends in the data that may be indicative of a relationship warranting further investigation. The three sites with the lowest cost per additional high school completer were located in Florida. When postsecondary enrollment is analyzed, there is no longer a distinction between states. Another example is the reported average number of years of participation. The top four efficient sites at producing additional high school

completers served 400 - 500 students, but so do the two least efficient sites. It seems that the portion of ingredients that are contributed to the site by the targeted schools, the host college, or local community members may play an important role, as well as the education level of Talent Search counselors and whether or not the site targeted students seeking a GED. With a larger sample, I would be able to say with more certainty what ingredients may be important in efficiency. My results present two broad hypotheses: 1) resources and where they come from are important, 2) aspects of implementation, such as quality of personnel, site leadership, the materials used, and the collaboration between sites and schools, make a difference. I am not able to test either hypothesis with my limited data.

In Appendix E: Case Studies, I provide more detailed information in the form of case studies about the most cost-effective site and the least cost-effective site. I review the characteristics of the targeted areas and the students served by the program sites. I provide information about the services provided and relationships the sites have with the targeted schools. I also discuss the use of volunteers and field trips. I am not able to report what the schools provide for students at either site. It would be interesting to be able to examine the baseline services and quality of schooling provided to see if Talent Search performs differently based on the resource level of the targeted schools.

#### Options to Evaluate the Production of High School Completers and Postsecondary Enrollees

Talent Search was created under the Higher Education Act of 1968 with the intention of increasing the college going rates of *low-income first-generation* students (TRIO, 2012). The program's impacts on high school graduation are necessary but not sufficient to achieve the goal of the program. To target postsecondary enrollment, Talent Search sites teach students about financial literacy topics and career options. The sites often take students to visit college

campuses and provide other enriching experiences and discussions. At all sites in my sample, the program assisted students in applying to colleges and in applying for financial aid to attend college.

A critical component of a cost-effectiveness analysis is to appropriately construct comparisons (Levin, 1975). In the case of Talent Search, this dissertation would fall short of a true cost-effectiveness evaluation if postsecondary enrollment were not incorporated as an outcome. Without including those impacts, the results based solely on high school completion give the false impression that all other outputs of the program, including enrolling in college, are valued at zero by the policy community (or that the program's impact on postsecondary enrollment is so highly related to the rate of high school completion that one outcome represents both).

But, the multiple output situation creates a dilemma for measuring a fuller range of outcomes. Somehow the two different outputs must be weighted by their relative importance or values to provide an overall measure of effectiveness. When they can be converted into market outcomes, this is the logical strategy, enabling a benefit-cost comparison. But, when market value is not feasible as an outcome measure, other approaches to weighting the multiple outcomes by value must be employed.

This research employs four options for weighting the two main outcomes of Talent Search: high school completion and postsecondary enrollment. The first weighting option recaps the results from Question 1 in a scheme that weights high school completion as being valued at 1 and postsecondary enrollment as being valued at 0 (giving all of the value to completion). The second weighting scheme option is just the opposite - postsecondary enrollment is valued at 1 and assumes all the costs while high school completion is valued at 0. The third and fourth

schemes provide two different approaches to combining the two outcomes to provide one metric for comparison purposes.

**Weight 1: High school completion = 1, Postsecondary enrollment = 0**

The first weighting scheme I applied to my data was weighting high school completion as 1 and postsecondary enrollment as 0. This analysis assumes that the only outcome of interest is high school completion. These results replicate the findings from research question 1.

As reported by Constantine et al. (2006), the effect of Talent Search on high school completion rates ranged from a high increase of 27 percentage points to a loss of graduates (Table 5.9). As I mentioned above in the case study findings from research question 2, I am not completely confident in the negative impact estimated at Site Five in Texas because the data provided by the Department of Education's Talent Search office show higher completion rates for Talent Search participants over time than Constantine et al. (2006) reported for the treatment group at this site.

Table 5.10 illustrates the cost-effectiveness results for high school completion. Ignoring the site with negative impacts, the range of the cost of Talent Search to produce an additional high school completer (graduates + GED completer) is from \$10,000 to \$142,000. The pooled estimate from my sample is about \$41,000 per additional completer.

**Weight 2: Postsecondary enrollment = 1, High school completion = 0**

Just as high school graduation may be the only outcome considered, postsecondary enrollment could be considered as the only outcome of interest. Constantine et al. (2006) estimated this outcome in a similar way to high school completion. The effectiveness results for each site in my sample are provided in Table 5.11. While the site-level postsecondary enrollment

rates are lower than the high school completion rates, the difference between the treatment and comparison groups still varies substantially across sites. The most effective site had an increase of 35 percentage points, while the least effective site increased enrollment rates by 3.1 percentage points. Unlike high school completion, no sites were found to have a negative impact. The most effective site is the same site for both outcomes, and the least effective site is not the same across both outcomes. The pooled impact estimate across sites weighted for the number of students served in 2010 is about 11%.

The cost-effectiveness of Talent Search on the production of additional postsecondary enrollees is detailed in Table 5.12. The table provides the present value of cost per student, the number of students served in 2010, the total cost in 2010, the additional postsecondary enrollees generated by each site, and cost-effectiveness ratios for each site in my sample. The cost data and site size are the same estimates that are used throughout this dissertation. I estimated the additional postsecondary enrollees by multiplying the difference in enrollment rates between the treatment and comparison groups by the site size in 2010. This yield ranges from 29 to 247 additional postsecondary enrollees, with a total of 767 additional enrollees from these 9 sites.

The cost per extra postsecondary enrollee ranges from \$8,000 to \$158,000. Most of the site-level estimates are lower (or more efficient) than the cost-effectiveness ratios for high school completion. There are four estimates that are markedly different across the two outcomes. Sites Three, Four, Five, and Six in Texas are almost \$100,000 different across the two outcomes. Site Two in Florida is almost \$30,000 different. These findings strongly point to the need to consider both outcomes when evaluating the costs and cost-effectiveness of Talent Search. Site One in Florida, for example, is highly effective and cost-effective across both outcomes. Site Five in

Texas had negative impacts on high school completion but positive impacts on postsecondary enrollment rates. Thus, the cost-effectiveness estimates are quite different.

The pooled estimate for postsecondary enrollment for my sample shows that the cost to produce an additional college enrollee is about \$31,000. The additional number of postsecondary enrollees per \$100,000 investment is about three. This estimate is consistent with the direction of the site-level findings for high school completion. Because these two outcomes are inseparable, meaning that you cannot attend college without completing high school, it seems most beneficial to consider weighting schemes that incorporate both outcomes together.

### **Weight 3: Additional years of schooling**

An effective program that targets high school graduation and matriculation results in more education for participating students. Each additional year of education is valuable and provides a simple metric for which to calculate a program's cost-effectiveness on both outcomes: high school completion and postsecondary enrollment. This third weighting scheme utilizes a base of zero for students who dropout. Because of data limitations, the additional years assumed in this analysis for each additional level of schooling completed is conservative. I assume that high school completion is equal to 1 additional year of schooling. Unfortunately, I do not have data from Talent Search sites regarding the time at which students drop out and am thus limited in my ability to accurately estimate the additional number of years gained by the treatment group for completing high school. For students that go on to college, I assume that college enrollment is equal to 1 additional year of schooling. Because I also do not have data on how many students graduated from college, I am not able to estimate any additional years obtained by Talent Search participants beyond initial enrollment.

The number of dropouts, high school completers, and postsecondary enrollees are weighted by 0, 1, or 2 for the additional years of school obtained by the students in each group. Table 5.13 illustrates the cost-effectiveness results for each site and a pooled estimate for my sample. From weights one and two above, we know that Site One in Florida was the most effective and the most cost-effective site in both high school completion and postsecondary enrollment. As the table shows, this site was also the most cost-effective site under this weighting scheme. Based on the site size in 2010, Site One in Florida produced over 400 additional years of education for the participating students. The cost of Talent Search to produce an additional year of education at this site is about \$4,500.

The site-level cost-effectiveness ratios range up to \$198,720 per additional year of education at Site Five in Texas. While the site-level postsecondary enrollment results at this site were more positive than the high school completion results, the estimated increase in high school dropouts due to the program at this site was so inefficient that coupling the outcomes together made little improvement in the cost-effectiveness ranking of this site. Most of the sites have ratios between \$12,000 and \$40,000. The pooled estimate is \$17,800 for an additional year of schooling.

These results provide one option for weighting the two outcomes of high school completion and postsecondary enrollment. It is important to try another weighting scheme because these cost-effectiveness estimates are conservative and may not be robust to another weighting scheme. Thus, the next weighting scheme utilizes labor market values of each outcome.

#### **Weight 4: Labor Market Outcomes from Talent Search**

Both high school graduation and attending college have monetary values in the labor market. These values provide objective weights for the two outcomes based on how the labor market responds to the different skills or signals produced by the two different outcomes. In this analysis, I also include students who did not complete high school, as those students also have labor market outcomes, albeit lower than the more socially desirable outcomes of graduation or college enrollment.

The numbers of dropouts, the number of students who only completed high school, and the number of students who enrolled in college vary across sites, as shown in Table 5.14. All sites besides Site Five in Texas produced fewer dropouts than the comparison group. Only three sites produced more students who only complete high school and who do not obtain any additional education. All sites produce more postsecondary enrollees than the comparison group. The variation in total additional earnings produced by these students at each site is notable, similar to the variation reported elsewhere in this dissertation.

Using U.S. Census data discounted to age 18 using a rate of 3% and adjusted to 2010, the estimated mean lifetime earnings of a dropout is \$510,213, a high school graduate or completer is \$739,295, and a person with some college is \$809,214. As expected, individuals with more education tend to earn more in the workforce.

As shown in Table 5.15, the site rankings of the additional earnings produced are similar to other results presented here. Site Five in Texas fared the worst, likely due to the higher dropout rate among treatment group students in contrast to site's the comparison group. Site One in Florida produced an additional \$61 million dollars in earnings when compared to the comparison group. The pooled estimate shows that the sites in my sample generated an

additional \$188 million dollars in earnings, based on the total number of students served at these nine sites in 2010.

The additional earnings produced by postsecondary enrollees must be adjusted for the cost of attending college. I obtained the average cost of college attendance from the National Center for Education Statistics at the Institute for Education Sciences of the U.S. Department of Education (NCES, 2013). In 2010 dollars, the cost for tuition, fees, books, and supplies was \$3,627 at a 2-year institute and \$7,544 at a 4-year college. I applied the cost of college to the number of additional enrollees at 2-year and 4-year colleges as reported by site by Constantine et al. (2006) and transformed into number of enrollees by multiplying the percentage point difference in enrollees by the number of students served in 2010 (see tables III.9, III.10, V.9, V.10). I subtracted the cost of college from the estimated additional earnings of postsecondary enrollees described above.

Table 5.16 provides the net present value (benefits - costs) and the benefit-cost ratio (benefit/cost) for each site in my sample. These results are likely a lower bound estimate of the additional income generated by Talent Search and are conservative for a few reasons. First, the estimates are capped at “some college”, which in the census data is defined as some college but no degree, and do not include those students who go on to graduate with an associate’s or bachelor’s degree or go on to obtain professional or graduate degrees (U.S. Census Bureau, 2012). Second, the estimate is based solely on earnings and does not include the benefits to student’s health, life happiness, and civic participation or the benefits to society through higher tax revenue and lower spending on welfare, crime, and healthcare. Third, earnings do not equal income, which includes money earned from investments. This distinction between earnings and income may not matter for high school dropouts because they do not have the capability to

invest; however, this distinction could be substantial for college graduates or individuals with professional degrees.

The positive net present values range from over \$3.5 million to over \$58 million. The pooled net present value estimate for my sample is approximately \$160 million. The positive benefit-cost ratios translate into a return on investment that ranges from 2.59 to 30.33. The pooled estimate suggests a return of about \$8 for each dollar invested. Regardless of the wide variation, Talent Search is clearly a sound investment in 8 of the 9 sites in my sample.

The next and final chapter of this dissertation focuses on interpreting these results. The chapter discusses the results presented here and provides suggestions for the Talent Search program and for researchers who are interested in conducting cost-effectiveness analyses and program evaluation.

## Chapter 5 Tables

Table 5.1. Total costs of Talent Search (TS).

	Average PV Per Student	Students Served	Total Cost	% Additional HS Completers	Number of Additional Graduates	Cost Per Additional Graduate
Total Costs	\$3,320	359,740	\$1,194,508,760	10%	35,662	\$33,500
Costs to TS	\$2,690	359,740	\$965,910,650	10%	35,974	\$26,850

Note: Average Present Value per Student was calculated with all 10 interviewed sites, weighted by site size in 2010. Number of students served was the total number of students reported in the 2010 budget data (TRIO, 2011). Average percentage points of additional high school completers calculated from state-level estimates in Constantine et al (2006) and weighted for state-level treatment group sample size. All estimates in 2010 US dollars and rounded to the nearest ten.

Table 5.2. Total costs of Talent Search by site and ingredient category.

Site	Ingredients Categories				Total Cost by Source	
	Personnel	Facilities	Equipment and Materials	Other Inputs	Total Cost	Cost To Talent Search
One	\$297,390	\$43,990	\$12,240	\$19,680	\$2,951,500	\$2,627,390
Two	\$264,200	\$41,910	\$5,280	\$81,970	\$2,153,940	\$1,584,270
Three	\$369,620	\$36,350	\$12,620	\$38,120	\$3,047,590	\$2,700,730
Four	\$368,460	\$97,400	\$13,660	\$209,460	\$4,597,550	\$2,710,620
Five	\$399,210	\$54,850	\$20,670	\$64,830	\$2,325,880	\$2,100,030
Six	\$313,720	\$44,170	\$8,720	\$55,260	\$2,310,060	\$2,153,260
Seven	\$356,290	\$67,270	\$14,270	\$61,560	\$1,591,260	\$1,170,910
Eight	\$362,020	\$38,830	\$17,200	\$42,770	\$1,987,960	\$1,745,550
Nine	\$399,040	\$50,850	\$15,890	\$40,280	\$2,771,100	\$2,412,130
Ten	\$362,950	\$59,800	\$20,650	\$21,020	\$2,003,500	\$1,663,030
<b>Site Average</b>	<b>\$352,970</b>	<b>\$54,140</b>	<b>\$14,300</b>	<b>\$66,970</b>	<b>\$2,661,350</b>	<b>\$2,152,030</b>

Note: Total costs are present values at age 18, calculated using the reported length of treatment and a 3% discount rate. Averages weighted by reported 2010 site size. All estimates in 2010 US dollars and rounded to the nearest ten.

Table 5.3. *Cost-effectiveness of Talent Search in Texas and Florida.*

State	Present Value Cost per Student	Total Cost	Additional Number of Graduates	Cost Per Additional Graduate
Texas	\$3,560	\$17,386,520	214	\$81,420
Florida	\$2,990	\$6,762,560	376	\$17,980

*Note: Calculated from 9 interviewed sites with effectiveness data. Present value cost per student per state and additional number of graduates per state were weighted by reported site size in 2010. Present value at age 18 estimated using a 3% discount rate and the reported average length of treatment. All prices in 2010 US dollars rounded to the nearest ten.*

Table 5.4. *Ingredients by site.*

Ingredients List	Texas						Florida		
	Site One	Site Two	Site Three	Site Four	Site Five	Site Six	Site One	Site Two	Site Three
<b>Personnel:</b>									
TS Staff: Directors	\$73,890	\$79,520	\$79,520	\$79,520	\$79,520	\$79,520	\$79,520	\$79,520	\$79,520
TS Staff: Counselors (Level A)	\$183,600	\$108,850	\$0	\$134,650	\$128,620	\$0	\$74,700	\$126,330	\$144,910
TS Staff: Counselors (Level B)	\$0	\$0	\$195,210	\$107,220	\$100,000	\$176,640	\$132,770	\$66,380	\$53,610
TS Staff: Other	\$25,970	\$46,000	\$70,610	\$18,560	\$83,820	\$49,340	\$45,860	\$107,540	\$45,860
TS Work Study	\$0	\$5,220	\$6,960	\$11,240	\$0	\$0	\$3,480	\$7,540	\$4,640
TS Staff: Professional Development	\$430	\$3,220	\$2,370	\$1,290	\$1,520	\$1,580	\$3,970	\$4,310	\$2,580
School Staff: Principals/Teachers	\$1,730	\$3,400	\$7,230	\$400	\$2,060	\$540	\$770	\$5,370	\$8,020
School Staff: Guidance Counselors	\$8,360	\$9,430	\$4,560	\$3,990	\$3,540	\$3,460	\$12,780	\$680	\$22,810
School Staff: Other	\$3,180	\$8,180	\$1,930	\$6,230	\$150	\$2,590	\$3,340	\$740	\$770
In-kind Personnel	\$230	\$390	\$1,230	\$5,360	\$0	\$60	\$4,840	\$630	\$230
<b>Facilities</b>									
Host College	\$20,100	\$17,360	\$9,850	\$30,530	\$25,770	\$15,200	\$12,340	\$16,080	\$26,870
School Sites	\$510	\$10	\$6,790	\$34,050	\$690	\$5,630	\$1,980	\$9,290	\$7,270
Overhead charged to TS	\$23,380	\$24,540	\$19,710	\$32,830	\$28,380	\$23,350	\$24,510	\$25,490	\$25,670
<b>Materials/Equipment</b>									
TS Site	\$8,800	\$2,180	\$11,890	\$11,140	\$20,480	\$8,280	\$14,900	\$12,380	\$18,920
Contributed	\$3,440	\$3,090	\$740	\$2,520	\$190	\$440	\$2,300	\$3,520	\$1,730
<b>Other Inputs</b>									
Transportation	\$14,960	\$18,720	\$18,280	\$12,800	\$23,430	\$16,080	\$23,150	\$14,960	\$7,780
Other TS Inputs	\$1,270	\$1,080	\$7,140	\$8,200	\$21,650	\$38,450	\$5,250	\$3,610	\$6,660
Other In-kind Inputs	\$3,450	\$62,180	\$12,700	\$188,460	\$19,750	\$730	\$14,370	\$21,710	\$6,580
<b>Total Annual Cost</b>	<b>\$373,290</b>	<b>\$393,360</b>	<b>\$456,700</b>	<b>\$688,980</b>	<b>\$539,150</b>	<b>\$421,870</b>	<b>\$460,820</b>	<b>\$506,060</b>	<b>\$464,420</b>
<b>Students Served</b>	<b>615</b>	<b>751</b>	<b>1100</b>	<b>952</b>	<b>867</b>	<b>601</b>	<b>705</b>	<b>759</b>	<b>796</b>
<b>Unit Cost</b>	<b>\$610</b>	<b>\$520</b>	<b>\$420</b>	<b>\$720</b>	<b>\$620</b>	<b>\$700</b>	<b>\$650</b>	<b>\$670</b>	<b>\$580</b>

Note: 2010 US dollars rounded to the nearest ten.

Table 5.5. *Site costs by source.*

Source	Texas						Florida		
	Site One	Site Two	Site Three	Site Four	Site Five	Site Six	Site One	Site Two	Site Three
% Total Cost to Talent Search	89%	74%	89%	59%	90%	93%	88%	87%	83%
% Total Costs to Other Sources	11%	26%	11%	41%	10%	7%	12%	13%	17%
Unit Cost to Talent Search	\$540	\$390	\$370	\$430	\$560	\$650	\$570	\$630	\$510

*Note: 2010 dollars rounded to the nearest ten. Other sources include public middle and high schools that were targeted by Talent Search sites, local volunteer speakers, the hosting institution of the program, and colleges visited by the program.*

Table 5.6. Site-level effectiveness results from Constantine et al (2006).

Site	Treatment Group	Comparison Group	Percentage Point Difference
<i>Texas</i>			
Site One	90.4%	81.4%	9.1
Site Two	88.3%	80.6%	7.7
Site Three	63.4%	61.3%	2.1
Site Four	77.6%	68.0%	9.6
Site Five	77.3%	80.8%	-3.5
Site Six	68.0%	65.3%	2.7
<i>Florida</i>			
Site One	96.7%	69.4%	27.3
Site Two	85.0%	72.7%	12.4
Site Three	71.1%	59.8%	11.2

Note: Constantine et al. (2006) Table 111.6 and Table V.6. An average is listed where multiple rates were reported.

Table 5.7. Site-level cost-effectiveness.

Site	Cost per Student	Number of Students	Total Cost (\$ millions)	Additional HS Completers <sup>a</sup>	Cost per Additional HS Completer	Additional HS Completers per \$100,000
<i>Texas</i>						
Site One	\$4,800	615	\$2.952	56	\$52,740	2
Site Two	\$2,870	751	\$2.154	58	\$37,250	3
Site Three	\$2,770	1100	\$3.048	23	\$131,930	1
Site Four	\$4,830	952	\$4.598	91	\$50,310	2
Site Five	\$2,680	867	\$2.326	-30	-	0
Site Six	\$3,840	601	\$2.310	16	\$142,360	1
<i>Florida</i>						
Site One	\$2,820	705	\$1.988	192	\$10,330	10
Site Two	\$3,650	759	\$2.771	94	\$29,560	3
Site Three	\$2,520	796	\$2.004	89	\$21,830	5
Pooled Estimate	\$3,380	7146	\$24.149	590	\$40,960	2

*Note: Cost per student is a present value at age 18 calculated with a discount rate of 3% and the reported average number of years of participation at each site. Pooled estimate weighted for number of students per site. 2010 US dollars rounded to the nearest ten.*

*a) HS = High School*

Table 5.8. *Comparing Cost-Effectiveness Estimates from All Analyses: Testing the Sensitivity of the Overall Estimate.*

	Cost per Extra HS Completer	Extra HS Completers per \$100K
<b>Overall Cost-Effectiveness Estimate</b>	<b>\$33,500</b>	<b>3</b>
<i>States</i>		
Estimated from sample in Texas	\$81,420	1
Estimated from evaluation in Texas	\$38,400	3
Estimated from sample in Florida	\$17,980	6
Estimated from evaluation in Florida	\$21,370	5
<i>Site-Level Estimates</i>		
Pooled sample estimate	\$40,960	2
Most cost-effective site	\$10,330	10
Next to Least cost-effective site	\$142,360	1
Pooled estimate without most and least cost-effective sites	\$46,410	2
Pooled estimate without most and least costly sites	\$42,910	2
Pooled estimate without most and least effective sites	\$46,410	2
Pooled estimate with only sites with statistically significant positive effectiveness; all costs	\$49,370	2
Pooled estimate with only sites with only positive statistically significant effectiveness; associated costs	\$24,260	4
Pooled estimate with only sites with average positive impact; all costs	\$38,960	3
Pooled estimate with only sites with average positive impact; associated costs	\$35,210	3
Pooled estimate with without Talent Search site facilities costs	\$39,310	3

*Note: Statistical significance reported in Constantine et al (2006). 2010 US dollars rounded to the nearest ten.*

Table 5.9. Site-level high school completion results. (Reproduction of Table 5.6)

Site	Treatment Group	Comparison Group	Percentage Point Difference
<i>Texas</i>			
Site One	90.4%	81.4%	9.1
Site Two	88.3%	80.6%	7.7
Site Three	63.4%	61.3%	2.1
Site Four	77.6%	68.0%	9.6
Site Five	77.3%	80.8%	-3.5
Site Six	68.0%	65.3%	2.7
<i>Florida</i>			
Site One	96.70%	69.40%	27.3
Site Two	85.0%	72.7%	12.4
Site Three	71.1%	59.8%	11.2

Source: Constantine et al. (2006) Table 111.6 and Table V.6. An average is listed where multiple rates were reported.

Table 5.10. Site-level cost-effectiveness. (Reproduction of Table 5.7)

Site	Cost per Student	Number of Students	Total Cost (\$ millions)	Additional HS Completers <sup>a</sup>	Cost per Additional HS Completer	Additional HS Completers per \$100,000
<i>Texas</i>						
Site One	\$4,800	615	\$2.952	56	\$52,740	2
Site Two	\$2,870	751	\$2.154	58	\$37,250	3
Site Three	\$2,770	1100	\$3.048	23	\$131,930	1
Site Four	\$4,830	952	\$4.598	91	\$50,310	2
Site Five	\$2,680	867	\$2.326	-30	-	0
Site Six	\$3,840	601	\$2.310	16	\$142,360	1
<i>Florida</i>						
Site One	\$2,820	705	\$1.988	192	\$10,330	10
Site Two	\$3,650	759	\$2.771	94	\$29,560	3
Site Three	\$2,520	796	\$2.004	89	\$21,830	5
Pooled Estimate	\$3,380	7146	\$24.149	590	\$40,960	2

Note: Cost per student is a present value at age 18 calculated with a discount rate of 3% and the reported average number of years of participation at each site. Pooled estimate weighted for number of students per site. 2010 US dollars rounded to the nearest ten.

a) HS = High School

Table 5.11. *Site-level postsecondary enrollment results.*

Site	Treatment Group	Comparison Group	Percentage Point Difference
<i>Texas<sup>a</sup></i>			
Site One	49.3%	42.1%	7.2%
Site Two	57.5%	41.4%	16.2%
Site Three	41.9%	34.6%	7.2%
Site Four	46.8%	43.8%	3.1%
Site Five	56.7%	51.8%	4.9%
Site Six	50.9%	43.9%	7.0%
<i>Florida<sup>b</sup></i>			
Site One	64.2%	29.2%	35.0%
Site Two	44.6%	38.1%	6.5%
Site Three	42.2%	28.0%	14.2%

Source: Constantine et al. (2006) Table 111.8 and Table V.8. An average is listed where multiple rates were reported.

<sup>a</sup> Texas postsecondary enrollment measured in 1999, 2000, 2001

<sup>b</sup> Florida postsecondary enrollment measured in 1999, 2000

Table 5.12. *Site-level cost-effectiveness of postsecondary enrollment.*

Site	Cost per Student	Number of Students	Total Cost (\$ millions)	Extra PS Enrollees <sup>a</sup>	Cost per Extra PS Enrollee	Extra PS Enrollees per \$100,000
<i>Texas</i>						
Site One	\$4,800	615	\$2.952	44	\$66,660	2
Site Two	\$2,870	751	\$2.154	121	\$17,740	6
Site Three	\$2,770	1100	\$3.048	79	\$38,480	3
Site Four	\$4,830	952	\$4.598	29	\$158,340	1
Site Five	\$2,680	867	\$2.326	42	\$54,750	2
Site Six	\$3,840	601	\$2.310	42	\$54,910	2
<i>Florida</i>						
Site One	\$2,820	705	\$1.988	247	\$8,060	12
Site Two	\$3,650	759	\$2.771	49	\$56,600	2
Site Three	\$2,520	796	\$2.004	113	\$17,230	6
Pooled Estimate	\$3,380	7146	\$24.149	767	\$31,480	3

Note: Cost per student is a present value at age 18 calculated with a discount rate of 3% and the reported average number of years of participation at each site. Pooled estimate weighted for number of students per site. 2010 US dollars rounded to the nearest ten.

a) PS = Postsecondary

Table 5.13. *Site-level cost-effectiveness of additional years of schooling.*

<b>Site</b>	<b>Cost per Student</b>	<b>Number of Students</b>	<b>Total Cost (\$ millions)</b>	<b>Number of Additional Years of Schooling<sup>a</sup></b>	<b>Cost per Additional Year of School</b>	<b>Additional Years of School per \$100,000</b>
<i>Texas</i>						
Site One	\$4,800	615	\$2.952	100	\$29,630	3.38
Site Two	\$2,870	751	\$2.154	179	\$12,030	8.31
Site Three	\$2,770	1100	\$3.048	103	\$29,630	3.37
Site Four	\$4,830	952	\$4.598	120	\$38,330	2.61
Site Five	\$2,680	867	\$2.326	12	\$198,720	0.50
Site Six	\$3,840	601	\$2.310	58	\$39,630	2.52
<i>Florida</i>						
Site One	\$2,820	705	\$1.988	439	\$4,530	22.09
Site Two	\$3,650	759	\$2.771	142	\$19,470	5.14
Site Three	\$2,520	796	\$2.004	203	\$9,870	10.13
Pooled Estimate	\$3,380	7146	\$24.149	1356	\$17,810	5.61

*Note: Cost per student is a present value at age 18 calculated with a discount rate of 3% and the reported average number of years of participation at each site. Pooled estimate weighted for number of students per site. 2010 US dollars rounded to the nearest ten.*

<sup>a</sup>*Student outcomes weighted according to number of additional years obtained for each outcome and summed for each site. Weights: dropout = 0, high school completion = 1, postsecondary enrollment = 2.*

Table 5.14. Educational outcomes across sites.

Site	Site Size	Treatment Group Dropouts	Comparison Group Dropouts	Dropout Impact	Treatment HS Only Completion	Comparison HS Only Completion	HS Only Completion Impact	Treatment PS Enrollment	Comparison PS Enrollment	PS Enrollment Impact
<i>Texas</i>										
Site One	615	59	114	-55	253	242	11	303	259	44
Site Two	751	88	146	-58	231	294	-63	432	311	121
Site Three	1100	403	426	-23	237	294	-57	460	381	80
Site Four	952	213	305	-92	293	230	63	446	417	29
Site Five	867	197	166	31	179	251	-72	491	449	42
Site Six	601	192	209	-17	103	129	-26	306	264	42
<i>Florida</i>										
Site One	705	23	216	-193	229	283	-54	453	206	247
Site Two	759	114	207	-93	307	263	44	338	289	49
Site Three	796	230	320	-90	230	253	-23	336	223	113

Notes: Outcomes estimated from impacts reported in Constantine et al. (2006). Site size was reported during interviews and from 2010.

Table 5.15. Calculating the additional income produced at each Talent Search Site.

<b>Sites</b>	<b>Dropouts</b>	<b>Dropout Income</b>	<b>HS Completers</b>	<b>High School Completion Income</b>	<b>PS Enrollees</b>	<b>Some Postsecondary Income</b>	<b>Total Additional Income Produced</b>
<i>Texas</i>							
Site One	-55	\$510,213	11	\$739,295	44	\$809,214	\$15,974,693
Site Two	-58	\$510,213	-63	\$739,295	121	\$809,214	\$21,562,503
Site Three	-23	\$510,213	-57	\$739,295	80	\$809,214	\$10,714,787
Site Four	-92	\$510,213	63	\$739,295	29	\$809,214	\$22,749,475
Site Five	31	\$510,213	-72	\$739,295	42	\$809,214	-\$3,774,685
Site Six	-17	\$510,213	-26	\$739,295	42	\$809,214	\$6,427,688
<i>Florida</i>							
Site One	-193	\$510,213	-54	\$739,295	247	\$809,214	\$61,205,070
Site Two	-93	\$510,213	44	\$739,295	49	\$809,214	\$24,914,949
Site Three	-90	\$510,213	-23	\$739,295	113	\$809,214	\$28,504,492

Notes: U.S. Census data discounted to age 18 using a rate of 3% in 2010 US Dollars.

Table 5.16. Site-level cost-benefit based on additional earnings.

Site	Cost per Student	Number of Students	Total Cost (\$ millions)	Additional Earnings (\$ millions) <sup>a</sup>	Net Present Value (\$ millions)	Benefit-Cost Ratio
<i>Texas</i>						
Site One	\$4,799	615	\$2.952	\$15.758	\$12.807	5.34
Site Two	\$2,868	751	\$2.154	\$20.798	\$18.644	9.66
Site Three	\$2,771	1100	\$3.048	\$9.962	\$6.914	3.27
Site Four	\$4,829	952	\$4.598	\$22.727	\$18.129	4.94
Site Five	\$2,683	867	\$2.326	-\$4.067	-\$6.393	-1.75
Site Six	\$3,844	601	\$2.310	\$5.985	\$3.675	2.59
<i>Florida</i>						
Site One	\$2,820	705	\$1.988	\$60.296	\$58.308	30.33
Site Two	\$3,651	759	\$2.771	\$24.698	\$21.927	8.91
Site Three	\$2,517	796	\$2.003	\$27.861	\$25.858	13.91
Pooled Estimate	\$3,379	7146	\$24.149	\$184.018	\$159.869	7.62

Note: Cost per student is a present value at age 18 calculated with a discount rate of 3% and the reported average number of years of participation at each site. Pooled estimate weighted for number of students per site. 2010 US dollars rounded to the nearest ten.

<sup>a</sup> Additional earnings is a present value based on U.S. Census lifetime earnings data by age and education level discounted to age 18 using a rate of 3%: dropout = \$527,126, high school graduate = \$763,802, some college = \$836,039. The earnings for postsecondary enrollees was adjusted for the cost of attending a 2-year or 4-year college based on the results reported by Constantine et al., 2006 in Tables III.9, III.10, V.9, and V.10. The cost of college attendance was adjusted to 2010\$ and based on NCES estimates of tuition, fees, books, and supplies and adjusted available at: [http://nces.ed.gov/programs/digest/d13/tables/dt13\\_330.40.asp](http://nces.ed.gov/programs/digest/d13/tables/dt13_330.40.asp)

## **Chapter 6. Implications for Cost-Effectiveness Analysis and Talent Search**

This dissertation demonstrates the ingredients method through a cost-effectiveness analysis of Talent Search, a nationally provided and federally funded program intended to increase postsecondary enrollment among low-income, first-generation college going students. The analyses conducted provide examples of challenges in conducting cost-effectiveness analysis such as site-level variation within a program, relating resource allocation to outcomes, and combining multiple outcomes to evaluate a program's efficiency. The third and final aim of this work is to contribute a rigorous cost analysis of Talent Search to the education community. Therefore, this dissertation has three target audiences: cost-effectiveness researchers, evaluation researchers, and policymakers.

In what follows, I review my findings for the two research questions included in this dissertation. I then discuss the implications of this work for policymakers interested in the Talent Search program and researchers conducting program evaluations and cost analyses. Finally, I conclude with a brief summary of the contributions of this research and suggestions for future research.

### Findings

#### **The Cost-Effectiveness of Talent Search on High School Completion**

**Costs.** The total cost to provide Talent Search to one cohort of students is estimated to be \$1.2 billion. The federal government supplies funding to finance about 81% of the program's costs. The rest of the costs are contributed by middle and high schools targeted by the program, the host colleges, and community members in the program's targeted areas.

It is difficult to disentangle the relationship between contributed ingredients (such as space provided to implement the program at the targeted schools, a scholarship for students to attend the host college, or time volunteered by community leaders) and the effect produced. My analyses include all ingredients utilized to replicate the effect. Therefore, I include all of the contributed costs in my analyses. It is important to note that most of the ingredient prices used here for in-kind contributions do not reflect particular variations in the qualities of the contributed ingredients. By this, I mean that the price for a school's guidance counselor's time was the same across sites and did not reflect differences in quality. For most of the sites in my sample, I did not have the data to apply such specific prices to the contributed ingredients. Another example is the community volunteers. The same hourly wage was applied to all community speakers who contributed a few hours to the program per year, regardless of the different professions of the volunteers. It was too burdensome to collect many details about such minor aspects of the program.

However, it is plausible that in another circumstance where specific data on contributed ingredients were available and the contributed ingredients were a large portion of the program's costs, prices might be assigned based on those site specific qualities. With the availability of more detail, it would be important to explore this issue further. If the policy question were asking what ingredients were necessary to implement the program rather than what ingredients were needed to replicate a particular site's productivity, the cost results may be different. I plan to explore this further in future work where such specificity is available in the data.

**Cost-Effectiveness.** My analyses were designed to illustrate how the cost-effectiveness estimate changes as the data for the costs and effects are more closely aligned to the same sample of participants. The cost-effectiveness estimate for the program overall was about \$33,500 to

produce an additional high school completer. The effectiveness report, as well as the WWC Intervention Report albeit to a lesser extent, focuses on the state-level impacts rather than the program's overall impact (Constantine et al., 2006; US Department of Education, 2006). To maintain consistency with the impact report, I provided state-level cost-effectiveness estimates next. These estimates were not very different from the overall estimate. However, if I used the costs and effects for only the sites in my sample, the estimates changed drastically (about \$81,000 in Texas and \$18,000 in Florida). This suggested that the site-level analyses would be important to better understand why the cost-effectiveness estimate may differ based on what sample was used.

The site-level analyses followed the ingredients approach with the intention of comparing the cost-effectiveness ratios across sites. The estimates ranged from about \$10,000 per additional completer to over \$143,000 per additional completer. Of the nine sites I examined at the site-level, one site had a negative impact on high school completion, rendering the upper bound of the program's cost per additional high school completer difficult to determine. An interesting finding was that the site-level rankings for effects, costs, and cost-effectiveness of high school completion looked similar. Table 6.1 ranks sites by effects, costs, and cost-effectiveness.

Site One in Florida had the highest impact in the percentage point difference between the high school completion rates among Talent Search participants and the comparison group. When those percentages are transformed into the additional number of graduates due to the program, Site One in Florida remains in the first position. The unit cost is the cost per student for one year of the program. For this variable, the ranks go from lowest to highest. Site One in Florida was ranked sixth. When the length of participation is included as a present value cost per student, Site One in Florida ranks fourth. When that present value cost per student is paired with the site's

high impacts, the program was ranked first for cost-effectiveness, meaning that the site had the lowest cost per additional high school completer in my sample. For this site, it appears that the impacts were so large that the site was the top ranked in cost-effectiveness as well. Another site, Site Five in Texas, also seems to have had the cost-effectiveness estimate driven by the magnitude of the impact estimate. Site Five in Texas ranked last in the percentage point difference in high school completion because the site lost graduates compared to the comparison group. While the site ranked 5<sup>th</sup> in unit cost and 2<sup>nd</sup> in the present value cost per student, the negative impact resulted in the site being ranked last in cost-effectiveness as well.

The cost-effectiveness ranking for other sites seems more related to the site's costs. Site Four in Texas had the fourth ranked effect and the third ranked number of additional completers, yet the site was ranked 5<sup>th</sup> in cost-effectiveness. The site's costs, both the unit cost and the present value cost per student, were the highest amongst the sites and thus was ranked ninth. This site was the site with the large contributed costs due to space provided for implementation at the targeted schools and scholarships provided by the site's host university. However, the site also had the highest cost for Talent Search counselors and for facilities at the host college. The site did serve the second highest number of students so the differences in personnel and facilities at the host college could be attributed to scale.

I conducted three sensitivity tests of the site-level cost-effectiveness ranks. First, I removed each site's facilities costs at the host college. This was an important test because my analyses also include the overhead cost charged to each project site. While the overhead finances to many services from the college, it could be considered to cover the cost of the space provided to the program. After removing the facilities costs and re-estimating each site's cost-effectiveness ratio, the ranking results did not change for any of the sites. The last two sensitivity

checks involved the present value calculation. I varied the number of years of treatment and the discount rate. The ranks from both tests were very similar to my main analyses, with a Spearman's rho correlation of 0.95 with the main findings.

The next step was to put all of the cost-effectiveness estimates together to determine the sensitivity of and to establish the range of the overall program estimate. Of the 16 comparable estimates produced through sensitivity analyses, 10 resulted in a cost of between \$30,000 and \$50,000 per additional graduate and between two and three additional completers per \$100,000. Three Monte Carlo simulations provided further confirmation of the bounds of the cost-effectiveness of Talent Search. The simulations results showed a range of approximately \$40,000-\$42,000 per additional graduate. The overall cost-effectiveness estimate of \$33,500 per additional graduate is at the lower end of the bounds estimated. When the analyses are restricted to nine sites that had site specific costs and effectiveness data, the pooled estimate is almost \$41,000 per additional high school completer.

The wide range of variability across sites in effectiveness, costs, and cost-effectiveness does raise some concern about the generalizability of an overall cost-effectiveness estimate and the applicability of such results to policymakers. While variation across sites is expected, how much variation is too much? Raudenbush and Liu argued for designing evaluations to have the power to examine site-by-treatment effects to determine whether the variability in impacts is small or large (2000). This dissertation points to a similar need in cost analysis. Site-level analyses, when possible, provide the opportunity to examine the bounds and variability of the costs and cost-effectiveness of a program. By documenting the existing variation, policymakers are better able to evaluate the program's success or the program's fit for a new location.

This dissertation's findings may be limited by small sample size. A sample of nine sites may not fully represent the variability present across the 463 Talent Search sites nationally. However, the cost-effectiveness ratios calculated from the varying levels of aggregation (overall, state-level, and site-level) and the sensitivity analyses do provide a wide range in the cost per additional graduate. This range may adequately approximate the true range of the program's cost-effectiveness for policy purposes.

As described in Chapter 3, Talent Search is a grant program that is intended to allow each site to adapt the program to the needs of the targeted population. Thus, variability is expected in each site's selection and use of ingredients, as well as organizational structure and relationships with the schools and community. Implementation research points to such adaptability as a strong indicator of a program's success (Durlak & DuPre, 2008; Levin, 1971; McLaughlin, 2005). However, such a vast range in effectiveness and cost-effectiveness may not be considered successful from a policy perspective. I discuss implications of these findings for the Talent Search program below and suggest ways for policymakers to reduce disparities in cost-effectiveness across sites.

### **Evaluating the Cost-Effectiveness of Producing High School Completers and Postsecondary Enrollees**

On average, Talent Search positively impacts high school completion and postsecondary enrollment. The cost-effectiveness of Talent Search at producing these two outcomes can be compared separately or jointly, depending on how the outcomes are valued. Table 6.2 illustrates the results from four different weighting schemes utilized in this dissertation. The cost per additional high school completer is about \$41,000 (range of \$10,000-\$142,000). The cost per additional postsecondary enrollee is about \$32,000 (range of \$8,000-\$158,000).

On average, Talent Search is more efficient at producing postsecondary enrollees than high school completers. This could be because all of the effectiveness estimates for the postsecondary outcome were positive, whereas one site's high school completion outcome was negative. The magnitude of the impacts of Talent Search on postsecondary enrollment was also larger than high school completion for 6 of the 9 sites in this sample. However, the range of the cost per additional postsecondary enrollee is larger than the range of the cost per additional high school completer suggesting even greater inequities in productivity across sites. Unfortunately, I do not have any information about the sites' relative prioritization of high school graduation versus college enrollment. Some directors did reference that it seemed unfair that the program sites were evaluated for their performance in postsecondary enrollment (or more recently the potential for postsecondary completion) because they do not maintain contact with students once they transition into college.

The site rankings in cost-effectiveness were not stable for all sites across the two outcomes. Site One in Florida, Site Three in Florida, and Site Two in Texas have similar relative rankings across both outcomes. However, the other six sites showed different rankings for each outcome, suggesting the possibility that site level differences in services or resource allocation could contribute to differential impacts across the two outcomes. Some differences are stark. Site Four in Texas, for example, produced an additional high school completer for \$50,000 (ranked 5<sup>th</sup>) but the cost to produce an additional post-secondary enrollee was \$158,000 (ranked 9<sup>th</sup>, with the 8<sup>th</sup> ranked site's result falling much lower at \$66,660 per additional enrollee).

While it is possible that policymakers may be interested in each outcome separately, it is more likely that policymakers are interested in learning about the efficiency of the program based on both high school graduation and postsecondary enrollment. One way to combine the

two outcomes is to weight high school completion and postsecondary enrollment by the additional years of education obtained. The results from this analysis show that the cost per additional year of education is about \$18,000 (range of \$4,530–\$199,000).

A second combination option to combine the two outcomes in one analysis is to calculate a benefit-cost ratio using the additional income generated by Talent Search. The results, based on the additional income generated by the program minus the additional costs for college, suggest that the program returns about \$8 for every dollar invested. Based on these findings, the program overall is a good investment.

While the program is successful overall, it is important that every site be as productive and as influential as possible. The site-level benefit-cost ratios ranged from a loss of \$1.75 to a return of about \$30, depending on the site. Disregarding inequitable outcomes, it is at a minimum necessary to ensure that all sites have a positive impact on the outcomes of interest in order to generate the economic benefit necessary to justify the expense of the program. As discussed in Chapter 5, the variability across program sites in cost-effectiveness is substantial however and must be addressed when discussing these findings. To be transparent about the variability, I include the range of each estimate. In summary, the variability of these results have implications for not only how we as researchers present them, but also for the future success of the Talent Search program.

### Implications for Talent Search

Talent Search is one of the original TRIO programs. The TRIO programs were created in the 1960s to target the cycle of poverty and to increase the educational attainment of children from homes that qualify as low-income and homes where the children would be the first-generation to attend college. The students served tend to be average performers with interest in

attending college. When compared with the other alternative dropout prevention programs listed by the What Works Clearinghouse, the population served by Talent Search stands out because the participants are students who are in school with aspirations of attending college rather than being dropouts seeking a GED. While Talent Search participants are not likely the students with the highest risk of dropping out of school, the interview data showed that these students are not on a comfortable path to college by any means. These are children who are living in tents because their family is homeless, children who are not able to eat regularly because they cannot afford food, children living in foster care, children who have non-English speaking families, and children who cannot afford school supplies. Yet, these children are striving to overcome the odds predicted by their backgrounds to achieve the “American Dream” by attending college. Their motivation to succeed makes them a particularly interesting population to target for public investment. These children are in need of support and guidance and this research shows that Talent Search is an excellent program to help them with the transition into college.

The adaptability of Talent Search to fit the needs of the local population targeted by each site may be the key to the program’s success. The program is a grant-based program that allows each site to select their population based on the needs of the area. The program site designs the curriculum, structures its own administration, and organizes activities based on the children’s needs and the resources available in the area. This flexibility allows staff to buy into the program and to redesign the program for the needs of their population when it is not working well or when the needs of the population change. Based on my findings, however, it does appear that the program could use a few improvements to ensure that all sites are serving their children well and achieving the best results possible. I list some suggestions below for consideration by the Talent Search office at the U.S. Department of Education. While my recommendations are based on my

research and perceptions, I strongly encourage policymakers to work with the program sites to determine the best approach to program reform.

**Share best practices.** My first recommendation is to create a way for Talent Search sites to share best practices and to reach out when they need assistance or information. This could be facilitated by the main Talent Search office in the U.S. Department of Education or it could be offered through the Council for Opportunity in Education (COE). During the interviews, it did not appear that the sites currently have a means to problem solve or to learn best practices from one another. The relationship between the sites and the federal office was largely described as one of administrative oversight for funding accountability.

I attended the annual national COE conference to learn more about how personnel from different sites across all of the TRIO programs come together. During the interviews, I learned that the COE conference is regularly attended by many Talent Search directors and counselors. I was able to attend the session by the Department of Education's Talent Search office. The session reviewed new requirements for the annual progress reports submitted by the sites. There were many questions about required paperwork, reporting data, and criteria for performance review. From the conference program, it did not appear that there were any sessions for the Talent Search sites to share ideas and to talk with the federal office about improving the services provided. The conference seemed to be heavily influenced by developers marketing materials and curricula.

The sites could not only benefit from communicating with one another about successful practices, they could also use a reliable source of information from the research community. The sites should be provided with up-to-date research and resources about meeting the needs of middle and high school students and new perspectives on the high school-to-college pipeline.

This could be accomplished through a partnership with the Regional Educational Laboratories or through another one of the U.S. Department of Education's national assistance centers.

**Improve data collection.** My second recommendation is to revise the data collection system to allow sites to better identify when they need assistance to improve a particular area or to identify what they are excelling at. The results of this dissertation show that some sites are very effective and cost-effective at producing additional high school graduates and additional postsecondary enrollees. However, there are other sites that may be good at producing one outcome but struggling to produce another.

With the current data requirements set out by the federal office, sites may not have the capacity to identify their own strengths and weaknesses—nor the incentive to do so for fear that they could lose funding. Sites are required to keep annual data on the number of students served, demographics (such as eligibility, age, race, gender, grade level), the schools served, and student outcomes (promoted to the next grade, received high school diploma, received GED, financial aid applications, postsecondary applications, postsecondary enrollment, and postsecondary placement). There are a few areas where site data collection could be improved.

First, the data currently collected and reported are annual and cross-section rather than longitudinally relating to a cohort of students. Thus, it is not easy to determine what assistance is needed. It is also difficult to learn more about the dosage of the program that works best without cohort specific outcomes. The data that the programs are required to collect and report could be revised so that they are also useful to the sites themselves in helping them to diagnose problems early and to seek assistance.

It was shared in the interviews that the outcomes measured by the program and reported in the annual performance report were at times unfair. The program serves students through high

school and currently reports graduation rates and GED obtainment. Providing these two outcomes separately is a practice that should be kept. As discussed in Chapter 3, the two outcomes are different from one another and have different implications in the labor market and should not be combined. It is difficult though for sites to be held accountable for outcomes beyond high school graduation. After the students graduate, the sites are no longer serving the students and are not in regular contact with them to obtain information about their progress or to influence their behavior. The sites could benefit from a better approach to data collection on these other important outcomes, such as postsecondary enrollment. Some sites mentioned that they were going to be required to start reporting postsecondary completion and felt that it was unfair to be judged on an outcome that they cannot target directly or reliably measure. Thus, it would be beneficial for the federal office to differentiate between outcomes that the sites will be expected to achieve and those that are being collected to learn more about how the program is impacting students' lives. It would also be helpful to the sites to have better systems of obtaining data after students have left high school.

In addition to longitudinal reporting and improved outcome measurement, sites could benefit from a shared system of data storage and management. Currently, each site operates independently. Most sites purchased a type of software (that was marketed at the COE conference) and spent scarce time learning the software and updating the software. If the federal office could provide the management system, these resources could be reallocated to more productive uses that would directly serve students. Not only would the department likely get a better price than each individual site, but the department would then have access to site-level data without all of the paperwork that seems to dominate current communication outlets and time of both site and main office employees.

**Investigate what works.** From my analyses, it seems that some ingredients may be more influential than others in leading to a site's success. The program could benefit from more rigorous research about what works within the program. Some questions that could be beneficial are: Is it best to have counselors with master's degrees, or can the counselors be a mix of both master's and bachelor's degree holders to reduce the financial burden of personnel? How can sites benefit from strong relationships with the schools they target? Is productivity improved when program sites are allocated space at the schools they serve? Should the Talent Search program only focus on students who are in school and seeking a diploma and refer GED students to a different program? Should sites restrict participation to a particular number of students or schools or would the program operate better with a recommended student-to-counselor or school-to-counselor ratio? Does the program become less effective if it only serves high school students? Is there an optimal length of treatment for the program overall or does this vary across the country? Should all program sites provide tutoring or SAT prep? If more of these questions could be answered, the program could target reforms at the areas that are known to produce results more effectively and efficiently.

**Evidence-based policy reform.** Ron Haskins and Cecilia E. Rouse recently recommended that the federal government shut down all TRIO programs and utilize the funding instead as grants for evidence-based programs. In their review of the Upward Bound, Upward Bound Math and Science, Talent Search, and Gear Up programs, Haskins and Rouse relied on What Works Clearinghouse ratings of effectiveness and determined that none of the TRIO programs show effects worthy of maintaining them. While I agree that reform must be evidence based and that evaluations should be as rigorous as possible, I think this approach would be akin to "throwing out the baby with the bath water." They reference the Obama administration's

approach to reforming Head Start as an approach for reforming TRIO. Head Start grantees are now required to meet certain performance criteria in order to continue to receive funding. The oversight of Talent Search and procedure for awarding funding is not that different from this approach. Sites are frequently judged on their performance and seem to expend a lot of energy on meeting the paperwork and data requirements to remain in good standing. The main issue I see is that the data being collected are not as informative as needed and the sites could benefit from more assistance based on proven reform strategies to reduce the wide variability in performance across sites.

As recommended above, better communication, improved data requirements, and additional research could assist the program in reaching its full potential. Based on the sample I examined of nine sites and 7,146 students, the benefits of the program on average from increasing high school graduates and increasing postsecondary enrollees outweigh the costs. However, the program does need to examine ways in which the wide variability across sites can be reduced. Certainly, if a site is not meeting an acceptable level of output, the site should no longer receive funding. In the case of Talent Search, it appears that such failure may be the exception rather than the norm. Thus, it would be a more beneficial approach to reform the program as it exists rather than to close the program altogether.

To revisit my introductory advisory comment above, if the program sites feel that the Talent Search program is so overwrought with inefficiency that their site would be better off on its own without a unifying program, than that option should certainly be considered. However, from my analyses and perspective, it does appear that the Talent Search program is serving a needy population with potential for high returns and should continue to operate as a federal program.

## Implications for Cost-Effectiveness Analysis

This dissertation provides a thorough application and discussion of the ingredients method. In addition to demonstrating the method, this work focused on several complexities that were encountered in conducting a cost-effectiveness analysis of a national program that accommodates local differences through site specific design and service delivery. The results provide a few key points for future cost analyses and further investigation.

**Site-level analyses.** My results demonstrate that a program may be more efficient in one setting than in another and that ingredients and costs may differ by site as well. While this is not a new finding, this dissertation provides an example of why it is important to study the variation of cost-effectiveness and to include a range of the costs and cost-effectiveness ratios in the results. Without this information, considerable variation could be masked, which could inhibit successful replication of the program or refinement of the program being studied. Additionally, as my results show, the validity of the cost-effectiveness estimate is directly related to the measurement of costs and effects from the same implementation. This match between the costs and effects is also important to understand the variability that exists.

**Examine relationships.** My results regarding the relationships between the ingredients used to implement Talent Search and the outcomes of the program sites are not as strong as I would have preferred. This is an area that future research could build upon. By collecting site-level data, especially if a study is designed to estimate effects at the site level, researchers could begin to estimate what predicts success within a program to build a better performing program in the future.

**Monte Carlo simulation as a sensitivity test.** Another way to estimate the range of costs within a program is to utilize site-level data in a Monte Carlo simulation. The simulation results

were in line with my site-level results and indicate that this could be a beneficial tool for cost-effectiveness analyses in the future. However, my utilization of this method was limited. Additional research of Monte Carlo simulation as a sensitivity test in cost-effectiveness analyses of educational programs is needed to establish the appropriate use of the method and the usefulness of the results.

**Multiple outcomes.** My results show that a program's cost-effectiveness ratio changes if other outcomes are examined and incorporated into the analysis. While some policymakers may only be interested in one outcome, it is useful to provide more comprehensive results by including all policy relevant outcomes in the analysis.

My results suggest that the type of weighting strategy used to compile multiple outcomes into one effectiveness estimate for a cost-effectiveness ratio is related to the domain of the outcomes and to unit of measurement used for the effectiveness estimate. In this dissertation, the two outcomes had a clear temporal order (high school graduation before postsecondary enrollment), the outcomes were related (one must complete high school prior to entering college), and they were related to labor market outcomes. Other programs that impact multiple outcomes may not be as easy to combine into one effect because the outcomes may not have a transparent order or rank to them. Further research is needed to better understand how utility theory and weighting schemes can be used when multiple outcomes are present.

### Implications for Future Program Evaluations

Evaluations of educational policies and programs are driven by two goals: (1) to establish the impact of a program on an outcome among a target population compared to what would have occurred had the program not existed, (2) estimating the likelihood that a program would have a given impact in a new setting (Heckman, 2001). Often, these goals are blended or combined,

which may complicate the interpretation of the results. If a program has a positive impact in one location, can we assume it will work similarly in another? The answer to this question seems to be “it depends.” This dissertation shows that one of the aspects upon which the results are likely to depend is resource use. The ingredients method allows for a rigorous investigation of the resources required to implement a program in a particular implementation. The results can be valuable to both the current program as well as to other new locations considering adopting the reform. Additionally, the results provide a level of specification of the ingredients required to replicate a program, which is exactly the type of information needed to consider adopting a program in a new context and planning for implementation (Levin, Catlin, & Elson, 2007). Therefore, the results of the ingredients method of estimating a program’s costs are useful for all evaluations of programs and policies in education. I provide two sets of recommendations below for the inclusion of the ingredients method in future program evaluations.

**Importance of capturing variations in context and ingredients.** The impact estimate from an evaluation can be influenced by specific characteristics of the program, the method of outcome measurement, or demographics of the sample (Hill, Bloom, Black, & Lipsey, 2007). This information is important for the implications of this dissertation in three ways. First, it indicates that it is important to include a study of variation and context within a program evaluation (Lipsey et al., 2012). More specifically, a study should document the way the effects of a program vary depending on the type of program selected, the location of implementation, the groups of participating students, and the context of the implementation (Weiss, Bloom, & Brock, 2013). My results indicate that it is also necessary to include a study of a program’s ingredients and costs to document an important source of variability that is related to the efficiency of the program.

Second, if the effect of a program depends on the circumstances of the evaluation, those circumstances must be included when selecting programs for comparison in cost-effectiveness analysis. When conducting a cost-effectiveness analysis the first principle is to ensure that the programs being compared are in fact legitimate alternatives for one another. If programs target different students or if the outcomes are measured differently, it is not helpful within a policy context to compare the efficiency of those programs.

The third implication for my findings is the time at which we conduct cost-effectiveness analyses. It is possible and sometimes important to conduct retrospective cost-effectiveness analyses. Retrospective cost-analyses can be useful when a program has been established for a long period of time so that short-term and long-term costs can be identified (Levin, 2001). It is also very useful to conduct cost-effectiveness analyses of programs or evaluations that are considered to be exemplary or paramount in the field (Ross, Barkaoui, & Scott, 2007). As this dissertation shows, it is useful to estimate the costs of a program retrospectively, especially when that program has been provided for over 40 years and has come up as a source of debate recently in discussions of the program's worth to society. However, this dissertation also points to the difficulty in conducting cost-effectiveness analyses retrospectively due to data limitations. Because an evaluator conducting an impact evaluation of a specific implementation has intimate knowledge of the program, the implementation, and the impact evaluation, it is clear that the best approach to estimating the cost of a program is to conduct an evaluation of impacts and costs simultaneously (Levin, 2013).

If future impact studies included both aspects (impacts and costs) of program evaluation, the limitation of relying on the memories of those who implemented the program when it was evaluated would be mitigated and the estimate of effectiveness and the estimate of costs would

indeed reflect the same implementation of a program (Levin, 2013). This would ensure the validity of the cost-effectiveness ratio for the program's output and make it easier to compare program alternatives with confidence.

**Including costs in program evaluation.** Identifying the causal impact of a program or policy on an outcome of interest is no simple task. Impact evaluations are expensive and laborious. And often, even the most rigorous, well-designed studies are not free of limitations. Given how difficult it can be to determine effectiveness, it may seem unrealistic to begin to expand expectations placed on evaluators to now also include the costs and to study variability. However, as research has shown, policymakers need studies to be useful, related to extant problems, and to benefit the decision-making process (Levin, 1978). By incorporating the ingredients method, evaluations can provide more comprehensive information by combining both aspects of program evaluation, impacts and costs. I expect that the additional work (and funding) needed to conduct more comprehensive evaluations that include impacts and costs is not likely large relative to the current costs of impact evaluations. The benefits of producing more comprehensive results would probably outweigh the costs. However, I am only able to hypothesize about the impacts of including both costs and effects in an evaluation as there are not enough examples of this practice to study. Therefore, it seems that the next step is to begin to include costs within program evaluations so that we can learn from examples and continue to refine our methods and presentation of results.

There are two approaches an evaluator could take to including the ingredients method into a program evaluation. One is to include the method from start to finish and to estimate the cost-effectiveness ratio of the program or policy being evaluated. By providing the cost-effectiveness ratio, policymakers and researchers could collaborate to review findings reported

from evaluations of alternatives and determine which program alternative is most suitable. The more researchers that utilize the ingredients as a common framework for conducting cost-effectiveness analysis, the easier it will be to compare findings across studies.

The second option is to include the collection of ingredients data during the impact evaluation, but conducting the cost-effectiveness analysis in the future. While this second “lite” option is not as helpful to policymakers as a complete cost-effectiveness analysis, collecting and providing detailed information about the ingredients needed to implement the program would allow other researchers the opportunity to cost the program at a later date. This recommendation is shared in recent guidance for conducting cost-effectiveness analysis from the Poverty Action Lab at Massachusetts Institute of Technology (Dhaliwal, Duflo, Glennerster, & Tulloch, 2011). Taking into account that most impact evaluations also include an implementation fidelity study, the additional data needed to list ingredients are likely few. Establishing a list of ingredients without including the method within the impact evaluation requires intensive interviews, site visits if possible, acquisition of records, and many hours of researcher time. In addition to those additional costs, the data collected retrospectively are not as precise because the data rely on people’s memories of what occurred in the past.

Through this dissertation and demonstration, I feel that the effort required to collect ingredients data retrospectively was time well spent. Yet, it is clear that it would be much more efficient and precise to collect the data at the time of the impact evaluation. In my future work, I plan to be a pioneer in this effort to combine two methods of program evaluation with the goal of providing policymakers with better information about what works and how much it costs to achieve that outcome. The next step is to begin to outline specific steps to include the ingredients method (either the full or lite approach mentioned above) in impact evaluations and to provide

guidance on how to design a study to include site-level estimates of costs and effects. To aid this work, I would like to investigate how many sites are needed to provide useful results and to examine the difference in funding required to conduct retrospective versus concurrent cost studies. It would be interesting to randomly assign studies to various sampling conditions (such as all sites, site selection based on implementation fidelity, random site selection, purposeful site selection based on characteristics or local context, etc.) to determine the most useful and precise approach to conducting site-level cost analyses in conjunction with impact evaluations.

### Conclusion

There are three contributions of this work that are important to our field. First, the dissertation demonstrates ingredients method as a rigorous approach to estimating a program's costs and cost-effectiveness, which should be applied more frequently in education evaluations. Second, it is important to examine variability in estimating a program's costs and cost-effectiveness. And lastly, Talent Search is good social investment, one that could potentially benefit even more students through a few programmatic improvements.

This dissertation provides a rigorous cost-effectiveness analysis of Talent Search. As discussed in Chapter 2, McEwan (2002) lists seven criteria for high-quality cost-effectiveness analyses. This research meets 5 of the 7 criteria, or all of the criteria related to estimating the cost-effectiveness of one program (rather than a comparative cost-effectiveness analysis). The analyses utilize various levels of outcomes data (overall, state-level, and site-level) across two policy relevant outcomes (high school graduation and postsecondary enrollment). The ingredients method was used to estimate the costs and cost-effectiveness of the program. I discounted the costs for time and provide several sensitivity analyses. In addition, I provide site-level analyses, include detailed ingredients information, and estimate the bounds or ranges of the

costs and cost-effectiveness ratios reported. I must note though that my results are limited by the rigor of the effectiveness estimate and collecting ingredients data retrospectively.

From this work, I plan to dedicate my career to the unification of two evaluation strategies— estimating a program’s impacts and costs—through the application of rigorous methods. While it seems bold to attempt to follow in the footsteps of great economists of education who have devoted their careers to similar goals of uniting two literatures or factions, such as Heckman’s efforts to produce a common framework for econometric modeling or Levin’s work in the same area as my own, I firmly believe that this is the best approach to evaluating programs and policies. I hope that this dissertation persuades more researchers to share my vision and to begin to utilize the ingredients method regularly.

## Chapter 6 Tables

Table 6.1. *Site ranking of effectiveness, costs, and cost-effectiveness of high school completion.*

Rank	Effects (HSC)	Number of Additional Completers	Unit Cost	PV Cost Per Student	Cost Per Additional Completer
1	FL 1	FL 1	TX 3	FL 3	FL 1
2	FL 2	FL 2	TX 2	TX 5	FL 3
3	FL 3	TX 4	FL 3	TX 3	FL 2
4	TX 4	FL 3	TX 1	FL 1	TX 2
5	TX 1	TX 2	TX 5	TX 2	TX 4
6	TX 2	TX 1	FL 1	FL 2	TX 1
7	TX 6	TX 3	FL 2	TX 6	TX 3
8	TX 3	TX 6	TX 6	TX 1	TX 6
9	TX 5	TX 5	TX 4	TX 4	TX 5

Note: HSC = High School Completion.

Table 6.2. *Four weighting schemes to evaluate the cost-effectiveness of Talent Search.*

Site	HSG = 1, PSE = 0 CER	HSG = 0, PSE = 1 CER	Additional Years CER	Additional Income BCR
<i>Texas</i>				
Site One	\$52,740	\$66,660	\$29,630	5.41
Site Two	\$37,250	\$17,740	\$12,030	10.01
Site Three	\$131,930	\$38,480	\$29,630	3.52
Site Four	\$50,310	\$158,340	\$38,330	4.95
Site Five	-\$76,650	\$54,750	\$198,720	-1.62
Site Six	\$142,360	\$54,910	\$39,630	2.78
<i>Florida</i>				
Site One	\$10,330	\$8,060	\$4,530	30.79
Site Two	\$29,560	\$56,600	\$19,470	8.99
Site Three	\$22,470	\$17,730	\$9,870	14.23
Pooled Estimate	\$40,960	\$31,480	\$17,810	7.80

Note: 2010 U.S. Dollars rounded to the nearest ten. Pooled estimate weighted for site size in 2010.

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## Appendix A: Interview Protocol

### Introduction for the interviewee:

- The federal government's What Works Clearinghouse has identified Talent Search as an effective program in increasing high school graduation rates.
- We are interested in what resources are used for implementing Talent Search at your site. So, our questions will help us understand *how you make Talent Search work*.
- Our research is under a federal grant from the Institute for Educational Sciences at the U.S. Department of Education.
- All responses will be anonymous and confidential as per IRB protocol #12-270.
- We would like to know about all the resources for Talent Search, including those not covered in budgets or paid for directly.
- We know that Talent Search is one of the federal TRIO programs, and may work together with other TRIO programs or outreach programs at your center. As best we can, we would like to focus only on the Talent Search activities, even if it means saying something odd like approximately 20% of a person's time is devoted to Talent Search.
- From our research, we have learned that nationally Talent Search can provide a range of support services for children between grades 6 through 12, who are at risk but who have high academic potential.
- Such services might include tutoring, career services, testing and test prep, counseling, mentoring, FAFSA/financial aid assistance, academic advising, alternative education services or assistance with GED or re-entry into high school, assistance for English Language Learners, college campus visits, college application and college admission test assistance, family counseling.
- Our questions are intended to learn which of these services are provided at your site and the resources required to provide them.

### A. TS at your site – Students and Schools:

A1. How many schools do you serve?

A2. How many students did you serve in the 2010 – 2011 school year? Was this a typical year for the program?

A3. What grades/ages are they?

A4. Do you provide services for children based on their specific age or grade?

MS:

HS:

A5. Do students remain in the program once they join or do students go in and out regularly? On average, how long to students participate?

A6. How many times do the counselors go out to the schools? Could you tell me a little bit about their meetings with students? (pullout, in a classroom, one-on-one, 45 minutes, etc.)

A7. Could you list the services or workshops you provide in addition to school visits?

**B. College Tours & Field Trips**

**B1. College Tours**

- Number per year:
- Number of students per trip:
- Transportation:
- Non-staff chaperones:
- Lodging:
- Food:
- Other:

**B2. Cultural or Educational Field Trips**

- Number per year:
- Number of students per trip:
- Transportation:
- Non-staff chaperones:
- Lodging:
- Food:
- Other

**C. Personnel**

**C1. TS Staff:**

For each type of personnel ask:

- Percent time devoted to TS or amount of time within period [2010-11]
- Academic year or Calendar Year?
- Benefits?
- Qualifications
- Experience - prior and on the job? Or specific prior training needed before employment?
- Length on the job
- Roles and responsibilities?

Program Director?

TS Counselors?

Administrative assistant/receptionist:

Data entry or database specialist?

Webpage support?

Work-study students? AY or CY?

Tutors? AY or CY?

Other college student hires, advisors, interns? AY or CY?

Support from other college administrative or facilities staff? (HR, legal, IT, etc.)

Do Talent Search students receive any other services from the host college that they would not have access to otherwise? (health care, psychological counseling, dental care, etc.)

**C2. Professional Development:**

Do any of your staff attend regional or state conferences or meetings? The annual Council for Opportunity in Education conference? Trainings or meetings provided by the Department of Education?

**C3. Collaborative staff at school site:**

- Number of hours devoted to TS within the AY or CY?
- Roles and responsibilities?
- Notable qualifications?

Principals?

Teachers?

Guidance Counselors?

Tutors?

Administrative Assistant?

Data clerk?

Other school staff?

**C4. Volunteers for Talent Search Events and Workshops:**

- Hours per AY or CY?
- Qualifications?
- Position description?

**D. Facilities:**

**D1. On Site:**

Please describe your office space. Try to estimate the square footage if possible.

Are any of these spaces shared with other programs? What percentage is used by Talent Search?

**D2. At the Host College or Center:**

Do you use any other on site space to provide services? Could you tell me the approximate size and describe the space? How often do you use it? Is it shared with other programs or offices?

**D3. Other off-site locations:**

What about off-site locations, like other colleges or community centers?

**D4. At the schools:**

What space is used at the schools? About how large it is? How often? For how many students?

- Student meetings?
- Other workshops?
- Class presentations?
- Office space? Library?

***E. Equipment and Materials***

E.1 Does the site use the following?

E.2 Do persons off-site use the following for TS services?

Talent Search Office	At the Schools (Or other sites – label if other)
Computers for TS Staff	
Computers for TS Students	
Telephones	
Printers	
Internet services	
Video recorders	
Headphones	
Information materials (e.g. pamphlets)	
Materials for advertising, recruitment, or incentives?	
Materials for summer programs	
Materials for Test Prep	
Materials/curriculum for tutoring?	
Materials for parent workshops? Or parent counseling?	
Materials for career assessment?	

***F. Other Inputs***

**F1. Transportation:**

Do you provide mileage or time reimbursement for staff to travel to the schools?

Do you provide any other transportation for students than what was discussed above?

**F2. Other**

Does Talent Search provide waivers for the ACT/SAT? Are these donated to the program or purchased?

Do to students receive any goods from the host college?

Do the students receive any other goods or vouchers? Were they donated to the program?

Do the students receive college admissions fee waivers? Tuition waivers or scholarships? Housing waivers? Are these donated from the college?

***G. Changes in program implementation over time:***

G1. Has the program changed in scale since the 1990s? Has the number students or schools served changed over time?

G2. Has the staff mix changed? If so, give details of new positions added/augmented.

G3. Are there any other ways the program has changed since the 1990s?

G4. Do you do things differently from other Talent Search offices? How so?

G5. Are there any other services, volunteered or donated time or materials, or other aspects of the program we haven't already covered?

**For pre-study (PILOT) sites:**

General:

Evolution of TS program over time?

How similar or different is this site to other TS sites?

Participants:

Is there variation in services across grades or ages of students?

Is it accurate that most students enter the program in 11th grade and continue on until high school graduation?

Do students generally continue to participate once they enter the program or do they come and go as they need assistance?

Would you say that a student's time commitment differs by grade level or age?

Do you have a summer program? Is it for students of all ages or is it specifically for one age group or grade level?

Is the level of service provided consistent throughout the calendar year? Or do you have to hire additional staff to "ramp up" over the summer or in the fall?

Training:

Could you tell us about the training that the site has received? Start-up? Occurring on a regular interval? Do you have to apply to receive training from the Department of Ed? Where does the training take place? Are there training sessions on site for staff or new hires?

Does the Council for Opportunity in Education provide training or services? Do you pay for these or are they “voluntary”?

Materials:

Do all TS sites use a standardized curriculum for test prep, tutoring, or parent workshops?

Do all TS sites use the same career assessment tool?

Do you have to purchase computers often? Does the DOE provide any additional funding for this?

Facilities:

How much of the services are provided here? Or are most services provided at the student’s schools? (follow-up if necessary based on response with questions about space provided from the school)

Other:

Your Talent Search program is housed within the Double Discovery Center. Are services blended across the programs you provide here or is specifically Talent Search earmarked?

Board of directors or internal evaluation?

Is there anything else that we have missed?

## **Appendix B: Ingredients List**

### **Personnel**

#### TS Staff

Program Director

Assistant Director

TS Counselors (Midlevel or Entry Level)

Administrative assistant/receptionist

Data entry or database specialist

Webpage support

Work study

Tutors

Other college student hires

Other support from site college

#### Staff at School Sites

Principals

Teachers

Guidance Counselors

Tutors

Administrative assistant

Data clerk

Other school staff (e.g. computer support technician)

#### Volunteers

College student support services

College financial aid staff

College faculty

Local banks

Health educators

Former TS participants and other college students

Parents

TS Board

#### Professional Development

National COE Conference

Local/Regional/State/Other Conferences

### **Facilities**

#### TS Site

Site offices

Field Offices at other colleges or centers

Other facilities at the host college or center

Other off-site locations (colleges, community centers, etc.)

#### School Site

Office space at the school

Computer labs

Classrooms

Auditorium  
Cafeteria  
Library or other meeting space  
Storage Space  
Overnight  
Overnight lodging for students

**Materials and Equipment**

TS Expense  
Computers  
Student Database Service  
Telephones  
Telephone service  
Printers  
Internet access  
Video recorders  
Headphones  
School Supplies  
Newsletters and other printed material  
Postage  
Materials for school visits & workshops (purchased or donated, not printed)

Contributed  
Computers  
Telephones  
Telephone Service  
Internet access  
Printers  
Postage  
Printed materials

**Other Inputs**

Transportation  
Mileage reimbursed for staff  
Field Trips  
College Visits  
Other student transportation  
Other TS Inputs  
Tickets/Admission fees  
Food and snacks  
Standardized test waivers (ACT/SAT)  
Other small goods  
Any other goods or vouchers  
College application fee waivers  
College tuition waivers and scholarships  
College housing waivers  
Other In Kind Inputs

Tickets/Admission fees  
Food and snacks  
Standardized test waivers (ACT/SAT)  
Any goods from the host college  
College application fee waivers  
College tuition waivers and scholarships  
College housing waivers

## **Appendix C: Cost Value Source List**

Costs of ingredients were collected from databases, documents, and websites across a range of sources. The following sections outline the sources of data for the categories of Personnel, Facilities, and Materials and Equipment. These data were collected and used by the Center for Benefit-Cost Studies of Education for the larger project, Cost-Effectiveness of Educational Alternatives, of which this dissertation contributes. The project was funded by the U.S. Department of Education, Institute of Education Sciences Award Number R305U120001.

## Value of Ingredients

The Table below provides all of the values, data sources, and adjustments used to cost the ingredients of Talent Search. Some ingredients include a general description. Largely, this column was used for notes from the site interviews. The price per unit is listed along with a column for the assumptions and sources for that price.

<b>Ingredients</b>	<b>Description (for prices and notes)</b>	<b>Price/unit</b>	<b>Assumptions/Sources/specifications</b>
Program Director	The data appear to be similar enough to use the average salary for this ingredient. The data used to create this average captures a variety of experience and duties that likely captures the variance in the site directors.	\$79,518.26	CUPA-HR "Administrative Compensation Survey 2010-2011"- Director, Student Activities (\$55,608) [7026]; Director, Student Academic Counseling (\$64,601)[7052]; (average of the two positions)=\$60,104.5 + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010)=\$79,518.26
Assistant Director	May be part time or full time - serves below the director and supervises or coordinates counselors	\$68,268.78	Assistant Director of student activities is: \$41,844; Associate Director of student counseling is: \$61,359 - average of the two = \$51,601.50 + 32.3% of benefits = \$68,268.78
TS Counselors	More similar to academic advisors or student support services than a psychological counselor. Education varies from BA to MA. Needs adjustment for years of experience and management/leadership duties.		For adjustment: BLS: 3.1% for experience/additional duties For master's - add years over 5 up to 10 years total (5 additional years of experience) For bachelor's - add years over 3 up to 10 years total (7 additional years of experience) EXAMPLE: Master's with 10 years experience will get an increase of $1.031^5$ . This will base each year's increase off the prior year's income.
- Midlevel	Master's Degree in counseling or related with 4 - 5 years experience	\$62,198.20	CUPA-HR "Mid-level Administrative and Professional Survey for 2010-2011 Academic Year" - Student Affairs Counselor [7602] - median for all institutions. =\$47,013.00 + 32.3% of

			benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) =\$62,198.2
- Entry Level	Bachelor's Degree in counseling or related with 2 - 3 years experience	\$53,610.61	CUPA-HR "Mid-level Administrative and Professional Survey for 2010-2011 Academic Year" - Academic Advisor/Counselor (\$40,522) [7550] + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) =\$53,610.60
Administrative assistant/receptionist	High school diploma or equivalent	\$45,855.18	Department of Labor Bureau of Labor Statistics "Occupational Outlook Handbook"- Administrative assistant =\$34,660.00 + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) =\$45,855.18
Data entry or database specialist		\$42.08 ----- \$31.81/hr	CUPA-HR "Mid-level Administrative and Professional Survey for 2010-2011 Academic Year"- Database administrator =\$66,155.00 + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) =\$87,523.07; divided 52 weeks a year, and 40 hrs of work per week = \$42.08 per hour For part-time staff without benefits, the hourly rate should be: \$66,155.00 divided by 52 weeks/year, then by 40 hrs/week = \$31.81 per hour
Webpage support		\$30.90 ----- \$23.35/hr	CUPA-HR "Mid-level Administrative and Professional Survey for 2010-2011 Academic Year" - Web/content developer =\$48,578.00 + 32.3% of benefits for state and local government employees in the

			education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) = \$64,268.7; divided 52 weeks a year, and 40 hrs of work per week = \$30.9 per hour For part-time staff without benefits, the hourly rate should be: \$48,578.00 divided by 52 weeks/year, then by 40 hrs/week = \$23.35 per hour
Work study		\$7.25/hr	Federal minimum wage 2010 - <a href="http://www.dol.gov/whd/state/stateMinWageHis.htm">http://www.dol.gov/whd/state/stateMinWageHis.htm</a> (Alternatively would be taken based on some public institutions)
Tutors	See tutors below under School Staff for more details	\$7.25/hr	Federal minimum wage - <a href="http://www.dol.gov/whd/state/stateMinWageHis.htm">http://www.dol.gov/whd/state/stateMinWageHis.htm</a>
Other college student hires		\$7.25/hr	Federal minimum wage - <a href="http://www.dol.gov/whd/state/stateMinWageHis.htm">http://www.dol.gov/whd/state/stateMinWageHis.htm</a>
Other support from site college (overhead)	Using overhead percentage to estimate. Note: facilities, phone and internet service, college give away items, college courses, college scholarships, application waivers, housing waivers, and any other materials (computers, printing, buses) that the college provides are already listed.	8% of total annual funding	All sites in sample use 7.4%. Statute says 8% or less for Educational Training Programs based on the application, site-specific circumstances, and the agreement with the DOE. Using this as the national average.
Staff at School Sites			
Principals		\$54.98	US Department of Labor, Bureau of Labor Statistics: Occupational outlook handbook <a href="http://www.bls.gov/ooh/management/elementary-middle-and-high-school-principals.htm">http://www.bls.gov/ooh/management/elementary-middle-and-high-school-principals.htm</a> = \$86,970 + 31.5% of benefits for state and local government employees in the education industry in

			elementary and secondary schools (BLS, National Compensation Survey, 2010) = \$114,365.55; divided 52 weeks a year, and 40 hrs of work per week = \$54.98/hr
Teachers		\$34.61	National Education Association (NEA) 2010 average secondary school teacher salary=\$55,595+ 29.5% of benefits for state and local government teachers in elementary and secondary schools (BLS, National Compensation Survey, 2010) = \$71,995.53; divided 52 weeks a year, and 40 hrs of work per week = \$34.61/hr
Guidance Counselors		\$38.02	Educational Research Services "National Survey of Salaries and Wages in Public Schools" - counselors (cited by U.S. Census Bureau, Statistical Abstract of the United States: 2012) = \$60,142 + 31.5% of benefits for state and local government employees in the education industry in elementary and secondary schools (BLS, National Compensation Survey, 2010) = \$79,086.73; divided 52 weeks a year, and 40 hrs of work per week = \$38.02/hr
Tutors	Tutors can be other high school students, college students, teaching aids, teachers, or an online service.  Important to note if time is donated or paid for by TS	In School: \$13.48/hour  Online: \$40/hour \$72/year/student  If teacher - use teacher hourly rate: \$38.02	Educational Research Services "National Survey of Salaries and Wages in Public Schools" - Teacher aides, instructional (cited by U.S. Census Bureau, Statistical Abstract of the United States: 2012) \$13.48/hour  Online tutoring is \$15 - \$40 per hour <a href="http://www.growingstars.com/online-tutoring-subjects/">http://www.growingstars.com/online-tutoring-subjects/</a> <a href="http://www.tutor.com/pricing/">http://www.tutor.com/pricing/</a> (\$40/hr) <a href="http://www.comfit.com/intro/default.asp?SID=935">http://www.comfit.com/intro/default.asp?SID=935</a> (\$72/yr)
Administrative assistant		\$19.27	Educational Research Services "National Survey of Salaries and Wages in Public Schools" - Secretaries (cited by U.S. Census Bureau, Statistical Abstract of the United States: 2012) [OR US Department of labor - Current Population Survey - Education administrator \$1202/w] = \$30,474 + 31.5% of benefits for state and local government employees in the education industry in primary and

			secondary schools (BLS, National Compensation Survey, 2010)=\$40,073.31; divided 52 weeks a year, and 40 hrs of work per week = \$19.27 per hour
Data clerk		\$20.58	Educational Research Services "National Survey of Salaries and Wages in Public Schools" - Typists/data entry clerks (cited by U.S. Census Bureau, Statistical Abstract of the United States: 2012)=\$32,555 +31.5% of benefits for state and local government employees in the education industry in primary and secondary schools (BLS, National Compensation Survey, 2010) = \$42,809.83 ; divided 52 weeks a year, and 40 hrs of work per week = \$20.58/hr
Other school staff (e.g. computer support technician)		\$22.24/hr	Department of Labor Bureau of Labor Statistics "Occupational Outlook Handbook"- Computer support specialist <a href="http://www.bls.gov/ooh/computer-and-information-technology/computer-support-specialists.htm">http://www.bls.gov/ooh/computer-and-information-technology/computer-support-specialists.htm</a>
Volunteers	IF FLEXIBLE, USE THIS HOURLY RATE. IF NOT, USE PRICES BELOW.	28.60	Median weekly earning for bachelor's degree and higher (25 years and older) (BLS, 2010: <a href="http://www.bls.gov/cps/cpswom2010.pdf">http://www.bls.gov/cps/cpswom2010.pdf</a> )=\$1,144 ; divided by 40 hours a week= \$28.6
College student support services		\$53610.61 ----- \$19.48/hr (without benefits)	CUPA-HR"Midlevel Administrative and Professional Salary Survey for 2010-11" - Academic Advisor/Counselor [7550]=\$40,522 +32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010)=\$53,610.61
College financial aid staff		\$49674.68 ----- - \$18.05/hr (without benefits)	CUPA-HR"Midlevel Administrative and Professional Salary Survey for 2010-11" - Financial-aid counselor =\$37,547 + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National

			Compensation survey, 2010)=\$49,674.68
College faculty	Average salary for full-time average faculty on 9/10-month contracts in public institution	\$93420 ----- \$34.70/hr (without benefits)	Average faculty salary in 9/10 month contract in public institutions (NEA, IPED, 2010)=\$72,186 + \$21,234 of average benefit on full time faculty in 9-month contracts (NCES, 2010)=\$93,420
Local banks		\$84498.75 ----- \$31.13/hr (without benefits)	Department of Labor Bureau of Labor Statistics "Occupational Outlook Handbook"-Personal financial advisor <a href="http://www.bls.gov/ooh/Business-and-Financial/Personal-financial-advisors.htm">http://www.bls.gov/ooh/Business-and-Financial/Personal-financial-advisors.htm</a> = \$64,750 + 30.5% of benefits for civilian workers ("civilian workers" consider state or local government employees and private industry employees) (BLS, National Compensation Survey, 2010)=\$84,498.75
Health educators	e.g. Planned Parenthood staff	\$59808.15 ----- - \$22.03/hr (without benefits)	Department of Labor Bureau of Labor Statistics "Occupational Outlook Handbook"- Health Educator <a href="http://www.bls.gov/ooh/Community-and-Social-Service/Health-educators.htm">http://www.bls.gov/ooh/Community-and-Social-Service/Health-educators.htm</a> = \$45,830+ 30.5% of benefits for civilian workers ("civilian workers" consider state or local government employees and private industry employees) (BLS, National Compensation Survey, 2010)=\$59,808.15
Other college students	Possibly former TS participants	\$7.25/hr	Federal minimum wage - <a href="http://www.dol.gov/whd/state/stateMinWageHis.htm">http://www.dol.gov/whd/state/stateMinWageHis.htm</a>
Parents	Median annual earnings for high school diploma or equivalent	\$39019.50 ----- \$14.38/hr (without benefits)	IES National Center for Education Statistics "The Condition of Education" Table A-49-1 <a href="http://nces.ed.gov/programs/coe/tables/table-er2-1.asp">http://nces.ed.gov/programs/coe/tables/table-er2-1.asp</a> = \$29,900 + 30.5% of benefits for civilian workers ("civilian workers" consider state or local government employees and private industry employees) (BLS, National Compensation Survey, 2010)=\$39,019.5
TS Board		Vice Provost:	CUPA-HR Administrative compensation survey 2010-2011 Academic year (2011).

		<p>\$197,908.9 / Assistant Provost: \$127,688</p> <p>-----</p> <p>--</p> <p>Vice Provost: \$71.92/hr (without benefits); Assistant Provost: \$46.40/hr (without benefits)</p>	<p>Vice Provost [2001]=\$149,591 + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) = \$197,908.9</p> <p>Assistant Provost [2003]=\$96,514 + 32.3% of benefits for state and local government employees in the education industry in junior college, colleges and universities (BLS, National Compensation Survey, 2010) = \$127,688</p>
<b>Professional Development</b>			
National COE Conference		\$1729.68 /person	<p>COE: \$540 for early registration (2012). Per diem: \$67.25*4=\$269 (average of Federal per diem rates for 4 metro areas of most recent conferences: NYC, New Orleans, Las Vegas, Atlanta) <a href="http://www.gsa.gov/portal/category/21287">http://www.gsa.gov/portal/category/21287</a></p> <p>Annual U.S Domestic Average Itinerary Fare: \$336 (2010) <a href="http://www.bts.gov/programs/economics_and_finance/air_travel_price_index/html/annual.html">http://www.bts.gov/programs/economics_and_finance/air_travel_price_index/html/annual.html</a></p> <p>Hotel: \$146.17*4=\$584.68 based on average hotel rate for most expensive US cities</p>
Local/Regional /State/Other Conferences	Price is for 1 night in a low cost hotel and 1/2 air fare because some of these conferences or trainings do not have a registration cost, some include most meals, and some provide funding for hotels. Also, because these conferences may be closer to the sites, this average air fare may	\$212.43 /person	<p>Registration: TRIO has 5 priority trainings by various organizations at various locations across the country. \$395, <a href="http://center.saeoppevents.org/course-feedback/tseocstaffnolaiscalling">http://center.saeoppevents.org/course-feedback/tseocstaffnolaiscalling</a> \$0 (plus \$100 for travel and a 5% airfare discount), <a href="http://www.renaissance-ed.net/triotraining.htm#">http://www.renaissance-ed.net/triotraining.htm#</a> (confirmed by phone) \$0 (no hotel and most meals included)</p>

	be high enough to capture some of the other costs that are not included.		<a href="http://caeo.unlv.edu/training.html">http://caeo.unlv.edu/training.html</a> Avg. Flight Cost: \$336 (see above) Avg. Hotel Cost - Most expensive cities: \$146.17 Least expensive cities: \$44.43 from the Hotel Price Index Regional and State Orgs also provide training or conferences. Regional, so should be cheaper. All others are less costly because they are in state or locally provided.
<b>Facilities</b>			
<b>TS Site</b>			
Site offices		\$13.40	Median cost per SQ. FT. in 2011 USD for construction cost only (College Planning and Management magazine, 2012) = \$212.67; Adjusted for 2010 Dollars = \$ 205.85 per SQ FT; Amortized per 30 years of construction (aprox) with an interest rate of 5% (Levin and McEwan, 2001)= \$13.4 per SQ FT. This is the price of the construction cost of an office building sq ft in a college per year.
Field Offices at other colleges or centers	\$13.40		Median cost per SQ. FT. in 2011 USD for construction cost only (College Planning and Management magazine, 2012) = \$212.67; Adjusted for 2010 Dollars = \$ 205.85 per SQ FT; Amortized per 30 years of construction (aprox) with an interest rate of 5% (Levin and McEwan, 2001) = \$13.4 per SQ FT. This is the price of the construction cost of an office building sq ft in a college per year.
Other facilities at the host college or center	Student Activities Center	\$19.53 \$0.05/day	Median cost per SQ. FT. in 2010 USD for construction cost only (College Planning and Management magazine, 2011) = \$300; Amortized per 30 years of construction (aprox) with an interest rate of 5% (Levin and McEwan, 2001)= \$19.53 per SQ FT. This is the price of the construction cost of a student activities center sq ft in a college per year.
School Site	This is often flexible and based on availability		***We don't have school space prices differentiated by their purpose, just for level (elementary, middle and high school).

Office space at the school	Permanent TS space that has a cost	MS: \$20.9/yr HS: \$18.33/yr	Median cost per SQ. FT. in 2010 USD for construction cost only (School Planning and Management magazine, 2011) = (MS: \$215.14 ; HS: \$188.68); if we assume that construction costs corresponds to 67% of the total costs of the building (according to National Clearinghouse of Educational Facilities, 2012), then we must add the additional 33% for the site, site development, and furnishing and equipment. Thus, the total cost (100%) of the facility adds up to= (MS: \$321.1 ; HS: \$281.61); Amortized per 30 years of construction (aprox) with an interest rate of 5% (Levin and McEwan, 2001)= (MS: \$20.9 ; HS: \$ 18.33) per SQ FT. These are the prices of the sq ft of middle school (MS) and high school (HS) per year.
Computer labs	flexible or for after hours workshops - priced per hour based on the annual cost above	MS: \$0.015/hr HS: \$0.013/hr	For flexible use of space we estimate an hourly rate from the price estimated for permanent TS space [(price per sq ft per year) / (180 school days * 8 hrs per day)]= (MS:\$0.015 ; HS:\$0.013)
Classrooms	flexible	MS: \$0.015/hr HS: \$0.013/hr	If classroom needed or sqft provided, use that number. If flexible space is used, the square footage required per student is: 20 qrft MS: 149 sqft/student HS: 156.3 sqft/student Multiply the sqft by the number of students and then multiply by the \$/sqft times the number of hours used.
Auditorium	flexible or for after hours workshops	MS: \$0.015/hr HS: \$0.013/hr	(idem)
Cafeteria	flexible or for after hours workshops	MS: \$0.015/hr HS: \$0.013/hr	(idem)
Library or other meeting space	flexible	MS: \$0.015/hr HS: \$0.013/hr	(idem)

Storage Space	Permanent TS Space that has a cost	MS: \$20.9/yr HS: \$18.33/yr	(idem)
Overnight lodging for students	Hotel or dormitory at host college - going to confirm with more sites. It sounds like the colleges provide overnight lodging in the dorms for free, as a service to any visiting student (not just Talent Search).	Dorm: \$20.55/night [\$19.56 in 2010 dollars]  Hotel: \$34.11/night	Dormitory cost (see below) \$2,302, divided by number of weeks in a semester (16), divided by days of the week (7), to total \$20.55 per night - 2012 \$19.56 in 2010 dollars Cheapest hotel cost in 2010 was \$34.11 per night
<b>Materials and Equipment</b>			
<b>TS Expense</b>			
Computers	Dell Vostro 260s Slim Tower Desktop	Desktop: \$163.32/yr \$0.11/hr ----- Laptop: \$167.17/yr ----- Projector: \$137.35/yr	Core i3 cpu, 4GB memory, 250GB HD, 19 Inch LCD (www.dell.com, 2012) = \$532 ; with 5 year depreciation of computers and peripheral equipment (according to IRS, 2012: <a href="http://www.irs.gov/pub/irs-pdf/p946.pdf">http://www.irs.gov/pub/irs-pdf/p946.pdf</a> , pg. 41) with 5% rate of interest (Levin and McEwan, 2001, p. 68 Table 4.1)= \$120.81 per year (\$532*0.231). 2010 computer price adjusted by PPI is: \$707, with 5 years depreciation and 5% interest rate, the annual cost of computer is: \$707*0.231=\$163.32 Hourly rate for schools: 163.32/(180*8) = \$0.11/hr Laptops (www.dell.com, 2012)= \$550 ; 2010 computer price adjusted by PPI is: 2010 price = \$550 / [(1-13.6%) *(1-12.6%)]= \$723.68 , with 5 years depreciation and 5% interest rate, the annual cost of computer is: \$723.68*0.231=\$167.17 ; which in an hourly rate for schools is: \$167.17/(180*8)=\$0.12/hr. portable projectors \$449.00 <a href="http://accessories.us.dell.com/sna/product_detail.aspx?c=us&amp;l=en&amp;s=soho&amp;cs=ussoho1&amp;sku=225-1466">http://accessories.us.dell.com/sna/product_detail.aspx?c=us&amp;l=en&amp;s=soho&amp;cs=ussoho1&amp;sku=225-1466</a>

			adjust to 2010 by assuming same rate as the laptop - $\$449 / [(1-13.6\%) * (1-12.6\%)] = \$594.59$ , with 5 years depreciation at a rate of 5%, the annual cost is: $\$594.59 * 0.231 = \$137.35$
Student Database Service	Blumen	\$1,563.13	Blumen packet from COE conference shows \$595 for script and full packages starting from \$1590 up to \$4995 plus 24.95 S+H. Using base package price \$1614.95. Seems like it is per year, but not clear. In 2010 \$ = 1563.13
Telephones	AT&T CL2909 Corded Telephone	\$6.70	AT&T CL2909 Corded Telephone (AT&T, 2012, <a href="http://www.staples.com/ATT-CL2909-Corded-Telephone-with-Caller-ID/product_779551">http://www.staples.com/ATT-CL2909-Corded-Telephone-with-Caller-ID/product_779551</a> ) = \$29 ; with 5 year depreciation of computers and peripheral equipment (according to IRS, 2012: <a href="http://www.irs.gov/pub/irs-pdf/p946.pdf">http://www.irs.gov/pub/irs-pdf/p946.pdf</a> , pg. 41) with 5% rate of interest (Levin and McEwan, 2001)= \$6.7 per year.
Telephone service		\$44.95/month for first line, \$24.95/month for each additional line	<a href="http://business.comcast.com/smb/services/phone/plans">http://business.comcast.com/smb/services/phone/plans</a>
Printers	Lexmark™ E260 Laser Printer Series	\$46.20	Prices for laser printers ranges from \$119 to over \$2,000. The price of this model is the second lowest found on Staples website. ( <a href="http://www.staples.com/Lexmark-E260-Laser-Printer-Series/product_SS1043274">http://www.staples.com/Lexmark-E260-Laser-Printer-Series/product_SS1043274</a> , 2012)=\$199.99 ; with 5 year depreciation of computers and peripheral equipment (according to IRS, 2012: <a href="http://www.irs.gov/pub/irs-pdf/p946.pdf">http://www.irs.gov/pub/irs-pdf/p946.pdf</a> , pg. 41) with 5% rate of interest (Levin and McEwan, 2001)= \$46.2/yr.
Internet access	AT&T DSL Pro	\$19/month	<a href="http://www.att.com">www.att.com</a>
Video recorders	Vivitar - DVR 518 Digital Camcorder - 2" LCD - CMOS - SD	\$10.39	Vivitar - DVR 518 Digital Camcorder - 2" LCD - CMOS - SD ( <a href="http://www.bestbuy.com/site/Vivitar+-+DVR+518+Digital+Camcorder+-+2%22+LCD+-+CMOS+-">http://www.bestbuy.com/site/Vivitar+-+DVR+518+Digital+Camcorder+-+2%22+LCD+-+CMOS+-</a>

			+SD/6258315.p?id=1218721446352&skuId=6258315 , 2012) =\$44.99 ; and with 5 year depreciation of computers and peripheral equipment (according to IRS, 2012: <a href="http://www.irs.gov/pub/irs-pdf/p946.pdf">http://www.irs.gov/pub/irs-pdf/p946.pdf</a> , pg. 41) with 5% rate of interest (Levin and McEwan, 2001)= \$10.39/yr.
Headphones	Koss ED1TC Education Headphones	\$2.31	Koss ED1TC Education Headphones ( <a href="http://www.staples.com/Koss-ED1TC-Education-Headphones/product_799664">http://www.staples.com/Koss-ED1TC-Education-Headphones/product_799664</a> , 2012)= \$9.99; 5 year depreciation of computers and peripheral equipment (according to IRS, 2012: <a href="http://www.irs.gov/pub/irs-pdf/p946.pdf">http://www.irs.gov/pub/irs-pdf/p946.pdf</a> , pg. 41) with 5% rate of interest (Levin and McEwan, 2001)= \$2.31/yr.
School Supplies			- post-it notes: \$3.94 (Post-it Notes Cube, 1 7/8 in x 1 7/8 in, Neon Collection, One Cube of 400 Sheets) <a href="http://www.amazon.com/Post--Notes-Cube-Collection-Sheets/dp/B000V7RCIK/ref=sr_1_11?ie=UTF8&amp;qid=1346337651&amp;sr=8-11&amp;keywords=post-it+notes">http://www.amazon.com/Post--Notes-Cube-Collection-Sheets/dp/B000V7RCIK/ref=sr_1_11?ie=UTF8&amp;qid=1346337651&amp;sr=8-11&amp;keywords=post-it+notes</a> - spiral-bound notebooks: \$1.29 (Staples® 1 Subject Notebook, 8" x 10-1/2") <a href="http://www.staples.com/Staples-1-Subject-Notebook-8-inch-x-10-1-2-inch/product_321463">http://www.staples.com/Staples-1-Subject-Notebook-8-inch-x-10-1-2-inch/product_321463</a> ) - highlighters: \$2.64 (BIC Brite Liner, Assorted Colors (5-Pack)) <a href="http://www.amazon.com/BIC-Brite-Assorted-Colors-5-Pack/dp/B000Q5ZGIA/ref=sr_1_1?s=office-products&amp;ie=UTF8&amp;qid=1346337783&amp;sr=1-1&amp;keywords=highlighters">http://www.amazon.com/BIC-Brite-Assorted-Colors-5-Pack/dp/B000Q5ZGIA/ref=sr_1_1?s=office-products&amp;ie=UTF8&amp;qid=1346337783&amp;sr=1-1&amp;keywords=highlighters</a> - 1" notebooks: \$4.95 <a href="http://www.staples.com/office/supplies/StaplesCategoryDisplay?catalogId=10051&amp;interceptedCatEntryId=19289&amp;identifier=BI270700&amp;langId=-1&amp;storeId=10001">http://www.staples.com/office/supplies/StaplesCategoryDisplay?catalogId=10051&amp;interceptedCatEntryId=19289&amp;identifier=BI270700&amp;langId=-1&amp;storeId=10001</a>

			<p>- folders: \$2.79  <a href="http://www.staples.com/Wilson-Jones-Snapper-Twin-Pocket-Poly-Folder-3-Hole-Punched-Assorted-Colors/product_507414">http://www.staples.com/Wilson-Jones-Snapper-Twin-Pocket-Poly-Folder-3-Hole-Punched-Assorted-Colors/product_507414</a>  - program file/expanding folder 3.5": \$37.99/10  <a href="http://www.staples.com/Staples-Heavy-Duty-Expanding-Pockets-Letter-3-1-2-inch-Expansion-10/product_704358">http://www.staples.com/Staples-Heavy-Duty-Expanding-Pockets-Letter-3-1-2-inch-Expansion-10/product_704358</a>  - bar Charts (laminated study guides - about 8 per student): \$5.95  <a href="http://www.amazon.com/s/ref=nb_sb_noss_1?url=search-alias%3Daps&amp;field-keywords=barcharts">http://www.amazon.com/s/ref=nb_sb_noss_1?url=search-alias%3Daps&amp;field-keywords=barcharts</a>  - middle school bundle of supplies: \$24.15  (with logical options selected, like the pack of mechanical pencils and larger spiral bound notebook)  <a href="http://www.walmart.com/ip/21152599">http://www.walmart.com/ip/21152599</a></p>
Newsletters and other printed material		<p>In house B/W: \$0.04  Prof Color: \$0.49</p>	<p>In house black and white: \$0.04 per page (toner + paper)  Hi-yield toner: \$0.025 per page  <a href="http://www.quill.com/content/iw/adv/special/inksavings/highyield.aspx?cm_sp=W11_12_128_ITHYZ7_-_Na_-_Na">http://www.quill.com/content/iw/adv/special/inksavings/highyield.aspx?cm_sp=W11_12_128_ITHYZ7_-_Na_-_Na</a>  Paper: \$0.014 per page  <a href="http://www.quill.com/georgia-pacific-copy-print-paper/cbs/026267.html">http://www.quill.com/georgia-pacific-copy-print-paper/cbs/026267.html</a>  Professionally printed color: \$0.49 per page  Office Max at 5 locations confirmed</p>
Postage	2010 First-Class mail postage	\$0.44	
Materials for school visits & workshops (purchased or donated, not printed)	Kaplan ACT/SAT test prep; career game booklets; portable projectors; other materials	<p>ACT book: \$30.45  SAT book: \$44.58  Career game: \$4.00  ACT prep online:</p>	<p>\$31.99 (Kaplan ACT 2012 Premier) [\$30.45 in 2010 dollars]  \$46.84 (Kaplan SAT 2012 Premier with CD-ROM) [\$44.58 in 2010 dollars]  \$4.00 (Careers booklets  <a href="http://www.amazon.com/Careers-booklet-SDS-career-explorer/dp/B0006QZO54/ref=sr_1_1?s=books&amp;ie=UTF8&amp;qid=1345651385&amp;sr=1-1&amp;keywords=career+game+booklets">http://www.amazon.com/Careers-booklet-SDS-career-explorer/dp/B0006QZO54/ref=sr_1_1?s=books&amp;ie=UTF8&amp;qid=1345651385&amp;sr=1-1&amp;keywords=career+game+booklets</a>)</p>

		<p>\$1,064.71/yr  ACT prep tests:  \$33.88/25 tests  ACT Workshop:  \$45/child</p> <p>Career assessment online:  \$595/yr</p>	<p>[\$3.81 in 2010 dollars]  ACT online prep flat license for 1 year: \$1,100  In 2010 \$ = 1,100 * 126.7/130.9 = \$1,064.71  09/13/12 phone communication with ACT  ACT retired tests are packets of 25 tests for \$35. Two available at a time. New test comes out every four years or so.  In 2010 \$ = 35 * 126.7/130.9 = \$33.88  09/13/12 phone communication with ACT  careercruising.com: \$595/yr (2010\$)  <a href="http://www.libraryjournal.com/lj/ljinprint/currentissue/885917-403/ereviews_career_cruising_from_ananca.html.csp">http://www.libraryjournal.com/lj/ljinprint/currentissue/885917-403/ereviews_career_cruising_from_ananca.html.csp</a></p>
<b>Contributed</b>			
Computers	hourly use	\$163.32/yr \$0.11/hr	
Telephones	if permanent	\$6.70	
Telephone Service	College sites only - not enough use at high schools to count	\$44.95/month for first line, \$24.95/month for each additional line	
Internet access	College sites only - not enough use at high schools to count	\$19/month	
Printers	if permanent	\$46.20	
Postage		\$0.44	
Printed materials		Prof Color: \$0.49	
<b>Other Inputs</b>			
<b>Transportation</b>			
Mileage reimbursed for staff	Varies by location	\$0.50 per mile	2010 Standard Mileage Reimbursement Rates, Internal Revenue Service, <a href="http://www.irs.gov/newsroom/article/0,,id=216048,00.html">http://www.irs.gov/newsroom/article/0,,id=216048,00.html</a>
Field Trips	Cultural trips taken per year - usually for	see below	

	middle school students		
College Visits	Can be overnight or day long. No indication that there is any admissions fee or other charges affiliated with this other than for travel and food. (See overnight stay under facilities above)	School bus: \$594.86/day  Charter bus: \$832.21/day	Used lowest cost for a full day (12 hours) in 2012 prices: School Bus: \$625 [\$594.86 in 2010 dollars] <a href="http://www.busbank.com/Charter+Bus+Options/School+Bus+Content">http://www.busbank.com/Charter+Bus+Options/School+Bus+Content</a> Deluxe motor coach: \$875 [\$832.81 in 2010 dollars] <a href="http://www.busbank.com/Services/Charter+Bus+Options?result=Deluxe+Motor+Coach">http://www.busbank.com/Services/Charter+Bus+Options?result=Deluxe+Motor+Coach</a>
Other student transportation	see above		
Other TS Inputs	From TS		
Tickets/Admission fees		\$6.36 for museum admission \$7.89 for movie tickets	American Association of Museums, <a href="http://aam-us.org/pressreleases.cfm?mode=list&amp;id=116">http://aam-us.org/pressreleases.cfm?mode=list&amp;id=116</a> , adjusted from 2006 to 2010 dollars; National Association of Theatre Owners 2010 median ticket price, <a href="http://www.natoonline.org/statisticstickets.htm">http://www.natoonline.org/statisticstickets.htm</a>
Food and snacks		0.74 per snack 1.74 per breakfast 5.82 per lunch 8.73 per dinner	Breakfast and snack from maximum reimbursable rates for USDA school lunch program, 2009-2010. Lunch from Khan, Powell & Wada 2011, Fast Food Consumption and Food Prices. Adjusted 1982-1984 estimate of fast food meal cost (2.66), based on ACCRA food price estimates, from 1983 to 2010 dollars using BLS CPI. Dinner is assumed to be 1.5x lunch price.
Other small goods		\$1.76 per novelty item	Average of personalized foam footballs, stress globes, and personalized koozies, from <a href="http://www.absorbentprinting.com/toys-and-novelties/balls/foam-sport-balls/7-budget-foam-footballs">http://www.absorbentprinting.com/toys-and-novelties/balls/foam-sport-balls/7-budget-foam-footballs</a> , <a href="http://www.absorbentprinting.com/toys-and-novelties/stress-balls/assorted-stress-balls/globe-stress-ball">http://www.absorbentprinting.com/toys-and-novelties/stress-balls/assorted-stress-balls/globe-stress-ball</a> , <a href="http://www.customink.com/lab?PK=127914#shared">http://www.customink.com/lab?PK=127914#shared</a> , converted from 2011 to 2010 dollars

Other In Kind Inputs			
Tickets/Admission fees		\$6.36 for museum admission \$7.89 for movie tickets	
Food and snacks		0.74 per snack 1.74 per breakfast 5.82 per lunch 8.73 per dinner	
Standardized test waivers (ACT/SAT)	Provided by the college board or other organizations.	\$47.00	SAT: \$47 2010 <a href="http://sat.collegeboard.org/register/us-services-fees">http://sat.collegeboard.org/register/us-services-fees</a> Confirmed 2010 price via phone call on 08/23/12 ACT: \$33, plus writing \$47 2010 <a href="http://www.actstudent.org/">http://www.actstudent.org/</a> Confirmed via phone call on 08/23/12 (plus writing may have been \$47.50, they were not sure)
Any goods from the host college		\$1.76 per novelty item	
College application fee waivers	National average reported by U.S. News	\$37.64	<a href="http://www.usnews.com/education/best-colleges/the-short-list-college/articles/2011/09/14/top-10-highest-college-application-fees">http://www.usnews.com/education/best-colleges/the-short-list-college/articles/2011/09/14/top-10-highest-college-application-fees</a>
College tuition waivers and scholarships	in-state public higher ed (assumptions)	4 year: \$585 per credit  2 year: \$212 per credit	\$7,020 (public 4-year in-state) \$2,544 (public 2 year) College Board "Trends in College Pricing 2009" <a href="http://trends.collegeboard.org/downloads/archives/CP_2009.pdf">http://trends.collegeboard.org/downloads/archives/CP_2009.pdf</a> Prices per AY Assumed 12 credits per year
College	in-state public higher	\$2190.99 in	\$2,302 average cost per semester

housing waivers	ed, for one semester (both assumptions)	2010 dollars	Cheapest option w/AC for these schools: \$2,250 per semester at Auburn \$2,255 per semester at Kentucky \$2,204 per semester at Florida \$2,545 per semester at Virginia \$2,256 per semester at Texas State
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## Personnel Costs

### **Personnel Costs Databases**

- CPS (Current Population Survey, US Department of Labor). Reports median gross wages per occupation reported by occupied households. Reported wage is on an annual basis for every occupation estimated from an hourly wage considering 2,080 hours a year, except for teachers. For teachers the wage reported is annual. Teachers are asked to report their annual wage regardless the amount of hours they work. Teacher wages for year 2010 are available (see Allegretto et al., 2004).  
[<http://www.bls.gov/bls/empsitquickguide.htm>]
- CPS-ORG (Current Population Survey - Outgoing Rotation Groups, US Department of Labor). Includes earnings data per occupation per educational level (see Mishel et al., 2008). [<http://www.nber.org/data/morg.html>]
- NCS (National Compensation Survey, US Department of Labor). Mean annual and weekly wages reported from survey of employers. NCS also reports employee benefits per hour worked for state/local government employees and civilian workers. Teacher wages and benefits for year 2010 are available but weekly wage estimates are sensitive to assumptions about weeks worked per year (see Allegretto et al., 2004).  
[<http://www.bls.gov/ncs/>]
- CES (Current Employment Statistics, US Department of Labor). Reports industry – but not occupational – data on employment, hours, and earnings of workers on non-farm payrolls. [<http://www.bls.gov/ces/home.htm>]
- NEA Education Worker Survey (National Education Association). Reports mean wages per occupation for teachers and educational paraprofessionals. Data are collected from state departments of education. [<http://www.nea.org/home/13566.htm>]
- SASS (Schools and Staffing Survey, US Department of Education, National Center for Education Statistics). The Public Teacher Questionnaire from SASS reports national data on teachers' wages by highest degree earned and years of experience. Data for primary and secondary school teachers is aggregated; results for some teacher qualifications and years of experience not reported due to low sample size. Data from Public and Private School Principal Questionnaire from SASS reports information on wages for K-12 principals by years of experience and institutional type. Data from 2007-2008.  
[[http://nces.ed.gov/programs/digest/d11/tables/dt11\\_079.asp](http://nces.ed.gov/programs/digest/d11/tables/dt11_079.asp)]
- IPEDS (Integrated Postsecondary Education Dataset, US Department of Education, National Center for Education Statistics). Reports salaries for faculty in public and private institutions for the academic year on 11/12-month and 9/10-month contracts. No data is reported for salaries and benefits of other staff. [<http://nces.ed.gov/ipeds/>].
- CUPA-HR (College and University Professional Association for Human Resources). Reports data from annual survey for high level and mid-level college administrators.  
[<http://www.cupahr.org/surveys>]
- OECD-INES Survey on Teachers and Curriculum (Education at a Glance 2011). Reports data on statutory teachers' salaries for 2008-2009. Statutory salary for a full-time teacher is the number of hours per year that a teacher is required to spend teaching. It does not

adjust salaries for the amount of time that teachers spend on other teaching-related activities. [<http://www.oecd-ilibrary.org/>]

- OES (Occupational Employment Statistics Survey, US Department of Labor). Reports mean annual wages reported by employers (but not disaggregated by educational levels or years of experience) and information on minimum levels of educational level required across occupations. Teacher wages for year 2010 are available. [<http://www.bls.gov/oes/home.htm>]

### Facilities Costs

- NCEF (National Clearinghouse for Educational Facilities). The NCEF recommends as sources of facility costs the Annual Construction Reports from the School Planning and Management and College and Planning and Management magazines. Their annual construction reports provide national and regional cost data on school and university construction. [<http://www.ncef.org/ds/index.cfm>]
  - School Planning and Management magazine reports total cost per construction reported. Construction costs are two-thirds of total costs per sqft. Other costs include: site purchase (2%), site development (9%), furnishing and equipment (14%), fees/others (8%). Also, square footage is not disaggregated by functionality. [<http://www.peterli.com/spm/pdfs/SchoolConstructionReport2011.pdf>]
  - College Planning and Management magazine reports construction costs and these are disaggregated in terms of functionality of the sqft. [<http://www.peterli.com/cpm/pdfs/CollegeConstructionReport2011.pdf>]
- Reed Construction Data provides detailed information on building costs based mainly in cost estimation of 2008. Costs are separated for universities and community colleges, as well as for schools by level (elementary, middle, and high) and by use (classrooms, auditoriums, laboratories). [<http://www.reedconstructiondata.com/building-types>]
- State statutes for California, New York, New Jersey, Washington, DC. State statutes include some information on the requirements for school facilities construction and/or instructional building aid.
- Educational institutions vary in the square footage requirements. Per student in a school building, these are: 125sqft for elementary school; 149sqft per middle school; and 156sqft per high school (School Planning and Management, 2010). Per student in a classroom, the occupancy load requires 20sqft (National Fire Protection Association, 1999).
- The costs of facilities need to be amortized over their operational life. This lifespan may vary but is at least 25 years. According to the National Center for Education Statistics, in 1998 the average public school building in the United States was 42 years old. [<http://nces.ed.gov/surveys/frss/publications/1999048/index.asp>]

## Materials and Equipment Costs

The prices for materials and equipment vary according to type. For most materials, e.g. printers and computers, market prices were collected from internet searches. We used retail prices net of transportation [<http://www.educationmarketplace.com>].

## Adjustment for Inflation

This adjustment was used by the Center for Benefit-Cost Studies of Education in their report on the Cost-Effectiveness of High School Completion (Levin et al, 2012). If a dollar value of an ingredient was not obtained from 2010, the value was transformed to 2010 using an average of the following price indices: CPI-U, CPI-W, Teacher Wage Index, HEPI, and HECA indices.

CPI-U – Consumer Price Index including expenditures in urban environments.  
<http://www.bls.gov/cpi/cpiovrw.htm#item1>

CPI-W – Consumer Price Index including expenditures from hourly wage earners or clerical workers.  
<http://www.bls.gov/cpi/cpiovrw.htm#item1>

Teacher Wage Index – Adjustment for teacher wage inflation

HEPI – Higher Education Price Index that tracks the inflation of costs in higher education.  
<https://www.commonfund.org/CommonfundInstitute/HEPI/Pages/default.aspx>

HECA – Higher Education Cost Adjustment including expenditures by colleges and universities.

## Appendix D: Analysis Plan Equations

This appendix provides all equations used in this dissertation to answer research question 1 and research question 2.

### Question 1

#### Overall Cost-Effectiveness Estimate

##### **Weighting by site size**

Calculation of the weight for each site based on the reported number of students served in 2010 at 10 interviewed sites

$$(1) \quad W_i = n_i/n$$

where  $W$  = weight,  $n$  = reported number of students served in 2010, and  $i$  = site.

##### **Weighted average cost per student**

Calculation of the average cost per student based on the 10 interviewed sites

$$(2) \quad AC = W_1 * PVS_1 + W_2 * PVS_2 + \dots + W_{10} * PVS_{10}$$

where  $AC$  = average cost per student weighted by site size in 2010,  $W$  = site-level weight, and  $PVS$  = site-level present value cost per student.

##### **Total cost of Talent Search**

Estimation of the total national cost of Talent Search in 2010

$$(3) \quad TC = AC * N$$

where  $TC$  = total cost of Talent Search in 2010,  $AC$  = average cost per student, and  $N$  = total number of students served nation wide by Talent Search in 2010.

##### **Direct costs to Talent Search at sites**

Calculation of the proportion of site-level costs born by the program in 2010

$$(4) \quad PTSC_i = dc_i/tc_i$$

where  $PTSC_i$  = percent of costs born by Talent Search at site  $i$ ,  $dc$  = direct costs,  $tc$  = total site-level costs,  $i$  = site.

##### **Distribution of cost per agency**

Weighted average of the proportion of costs directly born by Talent Search in 2010

$$(5) \quad APTSC = W_1 * PTSC_1 + W_2 * PTSC_2 + \dots + W_{10} * PTSC_{10}$$

where  $APTSC$  = weighted average proportion of cost born by the program,  $W$  = site-level weight,  $PTSC$  = site-level percentage of direct costs in 2010.

##### **Total cost of Talent Search by agency**

Estimation of the proportion of costs born by Talent Search directly in 2010

$$(6) \quad PTC = AC * APTSC$$

where  $PTC$  = percent of total cost born by Talent Search,  $AC$  = average cost per student,  $APTSC$  = weighted average proportion of cost born by Talent Search.

### Percentage of additional high school graduates or completers

Weighted average of the state-level percentage point gains in high school completion based on estimates from Constantine et al. (2006)

$$(7) \quad HSG = [(G_{Tx} - G_{C_{Tx}}) * (n_{Tx}/n)] + [(G_{Fl} - G_{C_{Fl}}) * (n_{Fl}/n)]$$

where HSG = average percentage point difference in high school graduates/completers, G = graduation/completion rate, n = treatment group sample size in impact evaluation, T = Treatment group, C = Comparison group, Tx = Texas, and Fl = Florida.

### Number of additional high school graduates or completers

Calculation of the additional number of graduates due to the intervention

$$(8) \quad E = HSG * N$$

where E = the additional number of graduates produced by Talent Search nation-wide in 2010, HSG = the average percentage point difference in high school graduates/completers, and N = the total number of students served nation-wide by Talent Search in 2010.

### Cost per additional graduate

Calculation of the cost per additional graduate (cost-effectiveness ratio) from Talent Search in 2010

$$(9) \quad CER = TC/E$$

where CER = cost per additional graduate/completer, TC = total cost of Talent Search in 2010, and E = the additional number of graduates produced by Talent Search in 2010.

### Cost per additional graduate to Talent Search

Calculation of the proportion of the cost per additional graduate that is born by Talent Search

$$(10) \quad CERTS = CER * APTSC$$

Where CERTS = cost per additional graduate to Talent Search, CER = cost per additional graduate, APTSC = weighted average percent of cost born by Talent Search.

### Total costs of Talent Search by site by category

Calculation of site costs per category in 2010

$$(11) \quad scc_{ij} = cc_{ija} + cc_{ijb} + \dots + cc_{ijz}$$

where scc = site-level category cost total, cc = category cost, i = site, j = category, a = specific ingredient, b = specific ingredient, z = specific ingredient.

### Weighted average site-level category costs

Weighted average of site-level category costs based on reported site size in 2010

$$(12) \quad ACC = W_1 * scc_1 + W_2 * scc_2 + \dots + W_{10} * scc_{10}$$

where ACC = weighted average category cost, W = site-level weight, scc = site-level category cost total in 2010.

### Weighted average of site costs

Weighted average of site-level costs in 2010 based on 10 interviewed sites

$$(13) \quad ASC = W_1 * tc_1 + W_2 * tc_2 + \dots + W_{10} * tc_{10}$$

Where ASC = weighted average site cost, W = site-level weight, tc = total site-level costs.

### Average cost to Talent Search

Weighted average of the site-level cost directly born by Talent Search in 2010 using 10 interviewed sites

$$(14) \quad ATSC = ASC * APTSC$$

where ATSC = weighted average cost to talent search, ASC = weighted average site cost, APTSC = weighted average proportion of costs to Talent Search.

#### State-Level Cost-Effectiveness Estimates

##### **Weighting by site size by state**

Calculation of the weight for each site based on the reported number of students served in 2010 at 9 interviewed sites with effectiveness data

$$(15) \quad W_{is} = n_i/n_s$$

where  $W_{is}$  = weight for site  $i$  in state  $s$ ,  $n$  = reported number of students served in 2010,  $i$  = site, and  $s$  = state.

##### **Weighted average cost per student by state**

Calculation of the average cost per student based on the 9 interviewed sites

$$(16) \quad AC_s = W_1 * PVS_1 + W_2 * PVS_2 + \dots + W_{is} * PVS_{is}$$

where  $AC_s$  = average cost per student weighted by site size in 2010 in state  $s$ ,  $s$  = state,  $W$  = site-level weight in state  $s$  (1),  $PVS$  = site-level present value cost per student,  $i$  = site.

##### **Total cost of Talent Search by state**

Estimation of the total cost of Talent Search in each state in 2010

$$(17) \quad C_s = AC_s * n_s$$

where  $C_s$  = cost of Talent Search in 2010 in state  $s$ ,  $s$  = state,  $AC$  = average cost per student, and  $n$  = reported number of students served in 2010.

##### **Percentage of additional high school graduates or completers by state**

Calculation of the average state-level program impact based on the 9 interviewed sites

$$(18) \quad HSG_s = W_1 * HSG_1 + W_2 * HSG_2 + \dots + W_{is} * HSG_{is}$$

where  $HSG_s$  = average percentage point difference in high school graduates/completers in state  $s$ ,  $s$  = state,  $W$  = site-level weight in state  $s$  (1), and  $i$  = site.

##### **Number of additional high school graduates or completers by state**

Calculation of the additional number of graduates due to the intervention

$$(19) \quad E_s = HSG_s * n_s$$

where  $E_s$  = the additional number of graduates produced by Talent Search in state  $s$ ,  $s$  = state,  $HSG$  = the average percentage point difference in high school graduates/completers, and  $n$  = reported number of students served in 2010.

##### **Cost per additional graduate by state**

Calculation of the cost per additional graduate (cost-effectiveness ratio) for each state in 2010 based on 9 interviewed Talent Search sites

$$(20) \quad CER_s = C_s/E_s$$

where  $CER_s$  = cost per additional graduate/completer in state  $s$ ,  $s$  = state,  $C$  = total cost of Talent Search in 2010, and  $E$  = the additional number of graduates produced by Talent Search in 2010.

### Site-Level Cost-Effectiveness Estimates

#### **Direct costs to Talent Search by site**

Calculation of the proportion of site-level costs born by the program in 2010

$$(21) \quad PTSC_i = dc_i/tc_i$$

where  $PTSC_i$  = percent of costs born by Talent Search at site  $i$ ,  $dc$  = direct costs,  $tc$  = total site-level costs,  $i$  = site.

#### **Total cost of Talent Search by site**

Estimation of the total site-level cost of Talent Search in 2010

$$(22) \quad C_i = PVS_i * n_i$$

where  $C$  = cost of Talent Search in 2010 at site  $i$ ,  $i$  = site,  $PVS$  = site-level present value cost per student, and  $n$  = reported number of students served by Talent Search in 2010.

#### **Number of additional high school graduates or completers by site**

Calculation of the additional number of graduates due to the intervention at each Talent Search site

$$(23) \quad E_i = HSG_i * n_i$$

where  $E_i$  = the additional number of graduates produced by Talent Search in site  $i$ ,  $i$  = site,  $HSG$  = the average percentage point difference in high school graduates/completers, and  $n$  = reported number of students served in 2010.

#### **Cost per additional graduate by site**

Calculation of the cost per additional graduate (cost-effectiveness ratio) for each site in 2010 based on 9 interviewed Talent Search sites

$$(24) \quad CER_i = C_i/E_i$$

where  $CER_i$  = cost per additional graduate/completer in site  $i$ ,  $i$  = site,  $C$  = site-level cost of Talent Search in 2010, and  $E$  = the additional number of graduates produced.

#### **Number of additional graduates per \$100,000 by site**

Calculation of the number of additional high school graduates/completers per \$100,000 by site

$$(25) \quad EC_i = \$100,000/CER_i$$

where  $EC_i$  = number of additional graduate/completers for \$100,000 in site  $i$ ,  $i$  = site, and  $CER_i$  = cost per additional graduate/completer in site  $i$ .

### Pooled Sample Estimate

#### **Weighting by site size for pooled estimate across sites**

Calculation of the weight for each site based on the reported number of students served in 2010 at 9 interviewed sites with effectiveness data

$$(26) \quad W_i = n_i/n$$

where  $W_i$  = weight for site  $i$ ,  $n$  = reported number of students served in 2010, and  $i$  = site.

#### **Weighted average cost per student for pooled estimate across sites**

Calculation of the average cost per student based on 9 interviewed sites with effectiveness data

$$(27) \quad AC = W_1 * PVS_1 + W_2 * PVS_2 + \dots + W_i * PVS_i$$

where  $AC$  = average cost per student weighted by site size in 2010,  $W$  = site-level weight,  $PVS$  = site-level present value cost per student,  $i$  = site.

**Total number of students served for pooled estimate across sites**

Calculation of the number of students served by 9 interviewed sites with effectiveness data in 2010

$$(28) \quad n = n_1 + n_2 + \dots + n_9$$

where n = number of students served in 2010.

**Total cost of Talent Search for pooled estimate across sites**

Calculation of the total cost of Talent Search from the 9 interviewed sites with effectiveness data in 2010

$$(29) \quad C = C_1 + C_2 + \dots + C_9$$

where C = cost of 9 interviewed Talent Search sites in 2010.

**Total additional number of high school graduates for pooled estimate across sites**

Calculation of the number of additional high school graduates/completers from the 9 interviewed sites with effectiveness data in 2010

$$(30) \quad E = E_1 + E_2 + \dots + E_9$$

where E = the additional number of graduates produced by Talent Search.

**Cost per additional graduate for pooled estimate across sites**

Calculation of the cost per additional graduate (cost-effectiveness ratio) across 9 interviewed Talent Search sites

$$(31) \quad CER = C/E$$

where CER = cost per additional graduate/completer, C = pooled cost of Talent Search in 2010, and E = the additional number of graduates produced.

**Number of additional graduates per \$100,000 for pooled estimate across sites**

Calculation of the number of additional high school graduates/completers per \$100,000 across 9 interviewed sites

$$(32) \quad EC = \$100,000/CER$$

where EC = number of additional graduate/completers per \$100,000 and CER = cost per additional graduate/completer.

**Question 2**Weight 3: Additional Years of Schooling**Assignment of additional years per outcome**

Dropouts = 0 additional years

High school graduates only = 1 additional year

Postsecondary enrollees = 2 additional years

**Determining the number of dropouts**

Calculation of the number of dropouts for the treatment and comparison groups at each site based on the reported number of students served in 2010 at the 9 interviewed sites with effectiveness data

$$(1) \quad DO_{ig} = (100 - PPSE_{ig} - PHSG_{ig}) * n_i$$

where DO = number of dropouts, i = site, g = treatment or comparison group, PPSE = percent postsecondary enrollment, PHSG = percent high school graduates/completers, and n = number of students served in 2010.

**Determining the number of high school graduates only**

Calculation of the number of high school graduates due to the intervention at each site who did not advance beyond high school, in the treatment and comparison groups at each site based on the reported number of students served in 2010 at the 9 interviewed sites with effectiveness data

$$(2) \quad HSGO_{ig} = (PHSG_{ig} - PPSE_{ig}) * n_i$$

where HSGO = the number of high school graduates only, i = site, g = treatment or comparison group, PHSG = percent high school graduates/completers, PPSE = percent postsecondary enrollment, and n = number of students served in 2010.

**Determining the number of postsecondary enrollees at each site**

Calculation of the additional number of postsecondary enrollees due to the intervention at each site based on the reported number of students served in 2010 at the 9 interviewed sites with effectiveness data

$$(3) \quad PSE_{ig} = PPSE_{ig} * n_i$$

where PSE = the number of postsecondary enrollees, i = site, g = treatment or comparison group, PPSE = percent postsecondary enrollment, and n = number of students served in 2010.

**Additional years of schooling per site**

Calculation of the additional number of years of schooling per site at the 9 interviewed sites with effectiveness data

$$(4) \quad AYS_i = (DO_{iT} - DO_{iC}) * 0 + (HSGO_{iT} - HSGO_{iC}) * 1 + (PSE_{iT} - PSE_{iC}) * 2$$

where AYS = additional years of schooling in 2010, i = site, DO = number of dropouts, T = treatment group, C = control group, HSGO = the number of high school graduates, and PSE = the number of postsecondary enrollees.

Weight 4: Labor Market Outcomes

**Estimating lifetime earnings**

2012 U.S. Census Data Mean Earnings by Age Range

Age Range	Dropout (“nongrad”)	High school only (includes GED)	Postsecondary (“some college”)
18-24	\$8,124	\$15,656	\$12,049
25-29	\$18,735	\$26,477	\$28,691
30-34	\$23,114	\$30,141	\$34,589
35-39	\$24,104	\$33,873	\$39,677
40-44	\$26,374	\$37,060	\$42,118
45-49	\$27,013	\$36,273	\$43,553
50-54	\$27,731	\$40,577	\$46,582
55-59	\$29,413	\$40,261	\$46,581
60-64	\$23,758	\$36,705	\$40,869

Calculation of total lifetime earnings from age 18 – 65 using a discount rate of 3%

$$(6) \quad DOE = DEARN_a / (1 + r)^{a-18}$$

where DOE = dropout lifetime earnings, DEARN = dropout average earnings, a = age, and r = discount rate.

$$(7) \quad HSGOE = GEARN_a / (1 + r)^{a-18}$$

where HSGOE = high school graduate only lifetime earnings, GEARN = high school graduate average earnings, a = age, and r = discount rate.

$$(8) \quad PSEE = PEARN_a / (1 + r)^{a-18}$$

where PSEE = postsecondary enrollee lifetime earnings, PEARN = postsecondary enrollee average earnings, a = age, and r = discount rate.

### **Additional lifetime earnings per site**

Calculation of the additional number of years of schooling per site at the 9 interviewed sites with effectiveness data

$$(9) \quad AEARN_i = (DO_{iT} - DO_{iC}) * DOE + (HSGO_{iT} - HSGO_{iC}) * HSGOE + (PSE_{iT} - PSE_{iC}) * PSEE$$

where AEARN = additional lifetime earnings, i = site, DO = number of dropouts, T = treatment group, C = control group, DOE = dropout lifetime earnings, HSGO = the number of high school graduates, HSGOE = high school graduate only lifetime earning, PSE = the number of postsecondary enrollees, and PSEE = postsecondary enrollee lifetime earnings.

### **Net Present Value per site**

Calculation of the net present value at each site

$$(10) \quad NPV_i = AEARN_i - C_i$$

where NPV = net present value, i = site, AEARN = additional lifetime earnings, and C = total cost of Talent Search.

### **Benefit-Cost Ratio per site**

Calculation of the benefit-cost ratio at each site

$$(11) \quad BC_i = AEARN_i / C_i$$

where BC = benefit-cost ratio, i = site, AEARN = additional lifetime earnings, and C = total cost of Talent Search.

## Appendix E: Case Studies

### Most Cost-Effective Site

The most cost-effective site is hosted at a community college in a city and serves almost 10 rural counties. In order to serve such a large geographic area, the main site location works with two other community colleges as a consortium. The consortium includes a board of directors for the program site and a small office at the location of one of the affiliates.

**Population demographics.** The majority of the population of the area served by the program site was educated at the high school level: 90% of the population does not have a bachelor's degree and almost 30% did not graduate from high school. In the site's service area, the percentage of families with school age children that are considered low-income ranges from 16% to almost 30%.

**Targeted Schools.** In 2010, the site served 12 high schools and 2 middle schools. These schools do not offer advanced placement or honors level coursework. In many of these schools, there may be more than 500 students to 1 guidance counselor. Most of the targeted schools have populations over 1,000 students and only a few of the smaller schools serve less than 500 students. Almost all of the students who attend the targeted schools are first-generation students - students who would be among the first generation in their families to attend college. Many of the students in these targeted schools are also low-income, ranging from 30% to over 60% of the study body. The graduation rate among low-income students in the targeted high schools is about 50%.

**Participants.** The site is funded to serve 700 students and tends to serve between 1 to 5 additional students per year. Around 70% of the students served fit the criteria for *low-income first-generation* (LIFG) status. The site director reported that there are often stories of children

living in cars and tents because 80% of their students are in poverty. About 50% of the students served are white and around 60% are female. The director reported that 90 – 95% of the students remain in the program once they join. The students who leave are usually moving out of the site’s service area. One of the target high schools is also served by Upward Bound, another TRIO program that focuses on graduation and postsecondary enrollment. The director reported that some students transfer to that program because it offers a stipend.

**Site organization.** This site has been open for around 20 years. The director has been with the program for almost half of that time. Their Talent Search counselors are better described as academic advisors than psychological counselors. They spend 80% or more of their time serving target schools. The site employs 3 counselors, one “level A”, who is a certified social worker, and 2 “level B” counselors with degrees in education. All three work full-time and have been with the program for more than 10 years. The director reported that the counselors tended to go beyond the standard requirements for the position, often attending events outside of regular work hours. Almost since the time the site opened, the site has employed the same administrator, who holds a bachelor’s degree. The site also employs a work study student during the academic year.

**Service description.** The site provides middle school and high school students with extensive program materials and workbooks that were developed in house. The director feels that these materials are excellent and are one of the site’s best qualities. Students in each grade are visited by Talent Search counselors 7 times per school year. About half of those visits will occur in the library and the other half in the computer lab, depending on available space. Some of the schools allow the program to store the Talent Search workbooks on site. Other than the small storage space at some schools, the program has no reliable space available to them in the schools

they serve. In fact, in one school the program has to provide lunch for students to incentivize attendance.

In addition to their extensive in-house developed program materials, the site provided students with school supplies, such as paper, pens, highlighters, and notebooks. Reportedly, the students really appreciated this assistance from the program.

**Collaboration with school staff.** The school staff members in the targeted schools were reportedly very welcoming to the program. The guidance counselors aided in the early weeks of the school year with recruitment and principals met with program staff once per year for planning. Beyond these initial activities, the program did not rely heavily on school staff to operate throughout the school year. However, while the continuous involvement of school staff involved in implementing the program was low, the total number of hours the guidance counselors spent assisting the program with recruitment efforts was higher than the total contributed hours from school guidance counselors at many other sites.

**Field trips.** In addition to serving students during school time, the program also takes students on day trips to colleges. When they visit a college, one of the site's former Talent Search students who attends the college they are visiting meets with the current students to answer questions and gives them a tour. The director stressed how important it seemed that the students were able to ask a former student real questions - questions that may not have been asked otherwise. In one instance, a student asked if students in college were supposed to raise their hands. This was reportedly not an easy question for the student to ask, and it was clear that the alumni's response was appreciated by the students. While the site originally provided overnight visits to colleges that were farther away, the site no longer provides overnight trips. The director reported that the budget just didn't allow for the extra expense.

**Volunteer time.** The site utilized volunteers from the community to give students the opportunity to talk with experts (and college educated individuals) in the area. Local bankers were invited to assist them with providing financial literacy training to the students. Financial literacy training is a major focus of the Talent Search program across all sites. The site also provided access to an admissions counselor to give the students the opportunity to ask questions about their goals or qualifications.

**Effectiveness.** This site was the most effective in both high school completion rates and in postsecondary enrollment rates. The impact report showed that the site had an increase of 27 percentage points in high school completion and an increase of 35 percentage points in postsecondary enrollment over the comparison group. For high school completion, the students who participated in the program had a completion rate of 97%.

Interestingly, the impact study's rate of completion for the treatment group seems to be consistent with the administrative records I obtained from the U.S. Department of Education's Talent Search Office. Based on the number of seniors served in each year, 100% graduated in 2008, 89% graduated in 2007, and 96% graduated in 2006. The comparison group for this site graduated at a rate of almost 70%. Both are well above the site's target school low-income student average graduation rate of 50%.

#### Least Cost-Effective Site

A 2-year college that focuses on serving disadvantaged students across a large rural geographic area hosts the least cost-effective site in my sample. The site serves students in eight counties, an area of almost 6,000 square miles. The site is affiliated with two sister 2-year colleges. One of the two affiliates provides a desk for the Talent Search program.

**Population demographics.** Almost 90% of the population does not have a bachelor's degree, more than one third of the population in the targeted area did not complete high school, and almost 20% did not complete 8<sup>th</sup> grade. The per capita income is almost half of the national average and is a third lower than the state average. Up to 30% of the families in the area with children below the age of 18 are low-income.

**Targeted Schools.** The site serves 27 high schools and 4 junior high schools. Almost half of the students in these schools qualify as low income. About 6,000 students in the targeted schools would likely qualify for Talent Search services as *low-income first-generation* (LIFG) students. For the schools that have the luxury of having a guidance counselor, the student to counselor ratios range from 42:1 up to 1,498:2 (the state recommends 200:1).

**Participants.** In 1990, the site was established to serve 800 students. The actual number of students served is often more than the minimum amount by 30 to 70 students. In 2010, the site reported serving 867 students. Between 65% to 80% of their students tend to qualify as LIFG. Over two-thirds of the students are white and about 65% are female.

Students who join the program in 7<sup>th</sup> or 8<sup>th</sup> grade tend to stay on through high school, unless they move out of the target area. However, because the site serves many more high schools than junior high schools, many of their students join in 9<sup>th</sup> grade or later rather than in middle school. The site does accept high school seniors. The director estimated that the average length of participation was 4 years.

In addition to serving students who are seeking a high school diploma, this site also accepts students who are interested in obtaining a GED. The director reported that this is a small number of students per year ranging from 5 – 10. The program provides some support and pays for the certification exam for these students.

**Site organization.** All of the site’s staff had worked for the program for 10 years or less. The director had been there for less than 5 years. The site has two “level A” counselors with master’s degrees. One has almost 10 years of experience and the other has less than 5. The site also employs 2 “level B” counselors with bachelor’s degrees with similar experience as the “level A” counselors. Three of the host college’s TRIO programs share an IT database specialist. The site also employs two part time tutors that mostly serve the junior high school students. The site leases vans with another TRIO program to provide transportation to tutoring, field trips, and college tours.

**Service description.** The counselors go out to schools and meet with participating students for 15 – 20 minutes once or twice per month. The program is not given any permanent space in the schools, instead they rely on flexible space available at each school. Thus, the size of the groups served tends to vary based on the space and time available. The Talent Search staff developed the curriculum the use and they update it each year. They provide students with a few program supplies and study materials.

**Field trips.** The program takes students on five field trips per year for educational outings. They also take five day trips to college campuses per year. The site used to offer students a career day event. However, due to budget limitations, they have not provided this event in several years. The program has been able to continue to provide ACT/SAT testing prep nights with pizza to give students the opportunity to practice with the testing software. The site also hosts three parent nights to review the material covered in the school sessions with the children’s families.

**Effectiveness.** The site was found to have the lowest effect on high school completion: in fact the site had a negative overall impact compared to the comparison group. Constantine et al.

(2006) estimated two impacts for this site because the sample was large enough to split the analyses into an earlier cohort and a later cohort. The earlier cohort had a small positive impact of 2 percentage points that was not statistically different from zero. The later cohort had a statistically significant loss of 9 percentage points. I use an average of the two cohorts, which is 77.3% for the treatment group and 80.8% for the comparison group (as shown in Table 5.6).

I examined the Annual Performance Reports to determine if the treatment group's rate of completion measured in the impact evaluation seemed consistent with the graduation rate of students served at that site over time. The administrative data provided different rates of graduation than the impact evaluation reported. In two later years, the site had completion rates (graduates + GED) of 92% and 100%. The high school graduation rate alone was 75% and 85%. While I do not have a comparison group to provide an estimate of the difference due to the program, this does perhaps suggest that the effectiveness result for this site may not be representative of other cohorts.