THE ECONOMIC COST OF INSTRUCTIONAL COACHING

BY

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Abstract: *School-based instructional coaching is one of the fastest growing approaches to professional development today; however, little is known about the impact on student achievement or about the cost (Darling-Hammond et al., 2009). This study reports the economic cost of instructional coaching (Knight, 2007), a model of professional development currently used to support in-service learning for teachers. First, the study describes a useable framework for measuring the cost of a coaching program; next, this cost framework is applied to three schools with instructional coaching programs during the 2009-10 school year. The average cost per teacher was found to range from approximately $3,260 to $5,220, while model developers suggest a cost of $2,298 per teacher. Consistent with the literature (Miles, et al., 2003) many costs were hidden from school-leaders and district budgets, in particular, teacher salaried work time. Cost adjustments were made for geographical region, inflation, coach attrition, annualization and fringe benefits of compensation. Strategies to lower the costs of coaching programs are also discussed. Because schools are making large investments in coaching programs, educational professionals need to know whether instructional coaching is cost-effective. By presenting a framework for measuring costs and reporting costs of a specific program, this study lays the groundwork for cost-effectiveness studies.*

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Chapter 1: Introduction and Overview of the Study

This study reports the economic cost of instructional coaching (Knight, 2007), an approach to professional development currently used to support in-service learning for teachers. As a relatively new approach to professional development, little is known about its impact on student achievement (Darling-Hammond et al., 2009) or about the cost (Borman & Feger, 2006; Neufeld & Roper, 2003). By providing a cost framework for coaching, this study seeks to establish a standard method of measuring the cost of coaching programs. Educational leaders make more informed decisions when they take into account both the effectiveness *and* the cost of new reforms (Levin & McEwan, 2001). Since the No Child Left Behind Act of 2001, the focus on teacher quality has led school districts to make large investments in professional development for teachers, yet districts are often not well informed of the multitude of alternatives available to them, and their respective costs (Darling-Hammond, et al., 2009).

As evaluations of coaching models are beginning to surface in the education literature (Biancarosa, et al., 2008; Edwards, 2008) school leaders will want to know the cost-effectiveness of coaching; this study lays the groundwork for such research. Also, reporting an exhaustive list of costs for any school initiative or program informs school leaders of the necessary resources required for implementation. In order for school improvement strategies to be implemented with fidelity, school staff must have a full understanding of all resources required for proper implementation (Levin, Catlin & Elson, 2010). Notable experts in education finance have underestimated the cost of an instructional coaching program (Odden & Archibald, 2009). Knowing the true costs associated with reallocating resources and the incremental costs a district

must incur to implement instructional coaching will assist school districts with the implementation process.

Professional Development and the Instructional Coaching Model

A school-based coach is an individual who is an expert teacher and works with other teachers in one-on-one and small group settings to help teachers implement scientifically proven effective teaching strategies. School-based coaching is a progressive approach to teacher in-service learning that requires a large financial investment and a high level of commitment from the district (Neufeld & Roper, 2003). Instructional coaching is one model of coaching; however, some of the research on coaching generalizes to all coaching models, while other studies refer to a specific coaching model (Cornett, 2009). Therefore, while the terms coaching and school-based coaching are used interchangeably, instructional coaching refers to a specific model of school-based coaching.

Professional development for teachers has traditionally taken on a specific structure referred to in this paper (and others) as the "traditional model" for professional development (Darling-Hammond, et al., 2009; Garet, et al., 2001). Under the traditional model, teachers rarely receive ongoing support in their school. Instead, opportunities for professional development may be seen as one-shot chances to learn new teaching strategies (Desimone, et al., 2002). This model sometimes situates teachers as passive participants in their own professional development with little autonomy (Little, et al., 1989). Coaching provides an alternative method for teacher professional development, which involves an expert teacher (known as the coach) who works with other teachers to provide ongoing support in one-on-one or small group meetings. Small-scale studies have shown evidence that, compared to the traditional approach to professional

development, when teachers work with a coach, they are more likely to use newly learned pedagogical strategies (Neufeld & Roper, 2003; Bush, 1984).

The instructional coaching model is the focus of the current analysis; however, the methodology is applicable to all coaching models. An instructional coach is someone who works full time[1] in a school, meeting one-on-one with teachers, before and after school and during their planning period, to implement research-based teaching strategies. On the surface, the model very closely resembles other models of coaching including peer coaching, Cognitive Coaching[SM2], differentiated coaching, or literacy coaching; however, each model is discrete, mostly in its theoretical framework. Ongoing support allows teachers more time to reflect on their own teaching practices and discover the best instructional routines. Teachers receive ongoing support from coaches who model and observe lessons, collaboratively plan with teachers and attack problems from a partnership mindset, rather than using an expert-novice relationship. Under the instructional coaching model, teachers are active leaders in their own professional development because they dictate when, why, and to what extent they work with a coach.

Defining Cost Analysis Methodology

Economic cost analysis (or cost analysis[3]) is utilized to measure the cost of the instructional coaching model. The economic cost includes the opportunity cost, defined as the value of what is given up by using a resource for one purpose, rather than using the resource for its best alternative use (Levin & McEwan, 2001). For instance, the opportunity cost of a new set of textbooks is the best alternative use of the funds used to purchase the books, or what the

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[1] In some school districts, instructional coaches also serve as part time teachers; however, instructional coaches in the sample were all working as full time instructional coaches.
[2] Cognitive Coaching[SM] is a service-marked term; however, for literary purposes, the service mark will not appear throughout the remainder of this chapter.
[3] These terms are used interchangeably; cost analysis, by definition, measures economic cost.

district gave up to purchase the books; thus economic costs are subjective. This concept of cost differs from the accounting cost, which is objective and simply includes all expenditures, rather than including the opportunity cost. Cost analysis includes all private and public costs of an intervention in order to measure the full cost to society, or the social cost (Levin & McEwan, 2001). In general, a cost analysis is performed in three steps: first, one must list all resources used to produce a desired outcome; second, a value must be placed on each resource, and finally, costs are apportioned to each party, based on who incurs the cost.

When cost analysis is employed in education research, it is useful for two primary reasons. First, understanding how and where money is spent sheds light on which activities in a school district receive the most time, money and attention; for examples, see Miles et al., (2003), Miller, et al., (1994), Little, et al., (1987) or Moore & Hyde (1981). Second, alternative education reforms or interventions can be compared based on costs, for example, Levin, Catlin & Elson (2010) compared costs of three literacy programs, Parrish (1994) compared the costs of educating students with limited proficiency in English to that of native English speakers and Rice (1994) compared three comprehensive school reform models. Some cost analyses seek to expose the hidden costs[4] of school initiatives in order to help districts implement them with fidelity (Levin, Catlin & Elson, 2010); this goal can be accomplished in either approach to cost analysis. This purpose is important because without the required monetary and personnel support, any school reform initiative is likely to fail (Levin, 2002); Levin, Catlin and Elson (2010) provide an excellent example. According to Darling-Hammond, et al. (2009), no cost or cost-effectiveness

[4] Hidden costs are defined as those costs that are not reported on any financial budget sheet, but still involve the changes to the allocation of money or time.

studies have yet been published on coaching[5]. Education research stands to gain a great deal from the tools of economic analysis. Over the past 30 years, the expenditures per pupil have risen in real terms, yet there have been little improvements in school achievement (Grubb, 2009; Hanushek, 1986).

Purpose of the Study

The purpose of this study is four-fold: first, I will present a framework for measuring the cost of coaching programs. Second, I apply this cost framework to three schools currently implementing instructional coaching and compare the estimates of costs to that of the model developer. Third, I will discuss strategies for reducing the average cost of instructional coaching. Finally, I estimate the costs of traditional approaches to professional development for comparison with instructional coaching. This is not a cost-effectiveness study because no coaching models, to date, have any rigorous measures of effectiveness that would allow for such comparison (Darling-Hammond, et al., 2009). Rather, this study lays the groundwork for cost-effectiveness studies of alternative approaches to professional development. When measures of the effectiveness of coaching can be obtained, they can be combined with costs to evaluate the efficiency of coaching programs.

[5] Miles, et al., (2003), Fermanich (2002) and Miles, et al., (1999) have provided estimates for professional development spending at the district level and at the school level, which have included school-based coaching; however, none of these studies isolated the cost of coaching.

Chapter 2: Review of the Relevant Literature

This literature review covers five broad topics. First, I review the effects of high quality teaching, the current status of professional development for teachers in the U.S., and effective practices for teacher professional development. Next, I describe the particular coaching model analyzed in the present study, the instructional coaching model. In the third section, I introduce cost analysis and cost-effectiveness analysis, review its status in the education literature and describe two broad purposes of cost analysis in education. In the fourth section, I examine several rigorous cost analyses in education and discuss the common methods employed. Finally, I describe and critique examples of how cost and cost-effectiveness analyses have been used and misused in the education literature.

Teacher Professional Development: Motivation, Effective Practices and Current Status

Why we need high quality teachers. Much debate in the educational research has revolved around the simple question: do teachers matter? Or more specifically are high quality teachers more likely to exhibit greater student learning gains in their classroom? Anecdotal evidence often points to a resounding answer: yes. While it may be a common assumption that teachers affect the quality of learning for their students, finding a correlation between teacher characteristics and student learning has proven difficult and controversial (Hanushek, 1994, 1986; Hedges, Laine & Greenwald, 1994).

Using educational production functions[6] to measure these "teacher effects" is often difficult for at least two reasons. The first involves misspecification of production functions, that

[6] An education production function uses multiple regression to estimate a relationship between at least one output, usually student achievement, and any number of inputs, usually involving school characteristics and student characteristics. This method is commonly used in the field of economics and is applicable in many research settings including education.

is, some important variables were omitted from the model. Simple characteristics of teachers such as experience and level of education rarely predict student outcomes, even when correcting for demographic characteristics (Hanushek, 1986). Often, teacher characteristics such as several years experience, significant educational attainment, and an appropriate salary are each necessary, but, in isolation, not sufficient in guaranteeing student learning gains (Grubb, 2009); therefore, these characteristics don't predict high levels of student learning. For instance, as teachers gain years of experience, some might become experts, while other might become burned out (Grubb, 2009). So without proper teacher support that has the potential to prevent teacher burnout, finding a correlation between teacher experience and student achievement can prove difficult without specifically examining which teachers are experts and which are burned out. Other school characteristics follow a similar pattern. Shapson, et al., (1980) found teachers were not altering their instructional strategies after class sizes were altered to 16, 23, 30 and 37. Thus simply lowering class size without providing additional teacher training may not have any positive effects on student achievement. Finally, even the best teacher might not be a sufficient resource for increasing student outcomes if the school building is in disarray (Corley, 2002), and without including these site specific variables in the production function, one might infer that the high quality teacher had no effect on student outcomes (Grubb, 2009).

Second, separating the effects of teacher qualities and the demographics of the classroom using districts or schools as the unit of analysis is not possible without specific classroom data. For instance, a production functions that regress average teacher characteristics of a school or district on the corresponding average student test scores for that school or district, holding other factors constant, fail to address within district or within school variations (Rockoff, 2003). Individual classrooms with more students per teacher, more students learning English as a

second language, with lower socioeconomic status or more students with special needs typically have lower standardized test scores, and teacher quality may be irrelevant to this finding.

One of the earliest uses of education production functions for U.S. primary and secondary schools was more than 40 years ago (Coleman, et al., 1966), and found student background characteristics to be far more powerful than school characteristics in predicting student outcomes. Since the Coleman Report of 1966, hundreds of studies have used education production functions to measure the effect of a high quality teacher, and found little evidence that differences in teacher characteristics affect student learning. Hanushek (1986) reviewed 147 studies showing generally no systematic significant correlation between teacher educational attainment or experience and positive school outcomes. Hanushek (2003) later reviewed 376 production function estimates and found "no strong or consistent relationship between school resources and student performances." Of the 170 that examined teacher education levels, only nine showed statistically significant positive effects on student performance, and teacher experience was found to be a statistically significant predictor of student outcomes in only 29 of the 206 studies that included this variable. Hedges, Laine & Greenwald (1994) disagreed with the "vote counting" method used by Hanushek (1989) and offered a meta-analysis, which converted the results of some of these studies to effect sizes, finding opposite conclusions. Hanushek (1994) refuted this use of meta-analysis concluding that money might matter, but only under certain conditions.

The body of research Hanushek (2003, 1992, 1989, 1986), has produced over the past 25 years has shown that, holding other factors constant, factors such as teacher salary, teacher experience, expenditures per pupil and average class size do not, by themselves guarantee improvements in student outcomes. This body of research has not called for less spending on

education nor has it stated that high quality teachers can't make a difference, rather it has pointed out that simply throwing money at schools is a policy that does not work and that teacher quality must be related to more complex, less observable characteristics of teachers. Hanushek (1992) has also shown that there exists large differences in teacher quality, and by doing so, has actually focused attention on the need for policy and research to invest in teachers. Grubb (2009) has shown that when production functions include compound variables such as the combination of several simple resources; complex variables such as school violence and leadership; and abstract variables such as school culture, the predictive power of school characteristics becomes much stronger.

An alternative approach for measuring teacher quality is using fixed effects; measuring a student's achievement caused by persistent differences in his/her teacher. Grubb (2009) and Monk (1992) have supported the use of these smaller-scale studies at the classroom level to track the effect of complex teacher characteristics on student learning. The earliest study that used fixed effects to measure classroom achievement was Hanushek (1971), who analyzed within school differences in student achievement, controlling for factors like class size, percent of students with special needs, as well as teacher characteristics. Unfortunately, teacher effects could not be separated from classroom effects because the teachers were only observed in one classroom.

In a more recent study of two school districts in New Jersey, Rockoff (2003) was able to obtain data from student test scores and teacher characteristics when data from teachers was observed in several different classrooms. Rockoff (2003) found one standard deviation of teacher quality increased student test scores by .24 of a standard deviation in math and .20 in reading. These results can be attributed solely to differences in teachers because teachers were observed

in different classrooms. Sanders and Rivers (1996) used the Tennessee Value-Added Assessment System (TVASS) to track individual student test scores in several disciplines through three years, when students would be assigned to three different teachers. Teachers from two districts were given a rating of one through five, based on the researchers own perceptions of effectiveness. Students were randomly assigned to teachers for three years during the study so that some students would be randomly assigned to three lowest quality teachers, while other students would be randomly assigned to three highest quality teachers. The differences in test scores for each group was substantial; students assigned to the highest quality teachers for all three years scored in the 96th percentile of TVAAS scores in district one and 83rd percentile in district two, while students assigned to the lowest quality teachers for all three years scored in the 44th and 29th percentiles of the TVAAS.

Studies that go into schools and classrooms to measure the effectiveness of teachers are more likely to capture the complex interaction of teaching and learning (Grubb, 2009; Monk, 1992), and strong evidence has been found that high quality teachers make a difference in student learning. Small class sizes and experienced teachers, each in isolation, might not cause higher student test scores if teachers are not altering their instructional strategies in smaller classes or if some experienced teachers are burned out, thus studies should go into classrooms to address this variation of teacher characteristics. Some limitations of these studies still exist including the ability for teachers to 'teach to the test' as well as the ability of standardized tests to accurately measure student learning and eventual student achievement; but research has made a strong argument to support the value of high quality teachers. These studies do not address the specific strategies one might employ to increase student learning, they only suggest that such strategies exist. The goal of many researchers is to identify and validate these effective teaching

strategies, however, for a variety of reasons, new or experienced teachers do not always implement research proven teaching practices (Darling-Hammond, et al., 2009). The following reviews the research on teacher professional development.

Highly qualified teachers need high quality professional development. The link between teacher quality and student achievement implies the need for expert teachers in every classroom. Improving the screening and hiring process of teachers is one strategy to address this need. In 2007, Finland began requiring all students entering a teacher-training program, such as a school of education, to first pass an examination of math, reading and problem solving skills (McKinsey & Company, 2007). New York, Chicago and Boston have also implemented programs with selective screening processes that provide additional training and guarantee teaching jobs upon graduation (Berry, et al., 2007). These programs have been found to produce stronger candidates than their respective city average, thus proving to be an effective strategy for hiring high quality teachers.

Darling-Hammond (1999, 1997) has written extensively on the topic of teacher preparation and teacher quality, finding a need for improvement in both pre-service training, as well as in-service training. Some pathways to the teaching profession ensure that a prospective teacher receives the training and support she or he will need to be an expert teacher, while some alternative paths often leave the student ill-prepared to enter the profession (Darling-Hammond, 1999). Unfortunately, even the best teacher-training programs can only take a prospective teacher so far, and beginning teachers can only learn the intricacies of their new roles through experiential learning (Darling-Hammond, 1999). While most schools of education require a student teaching component, this aspect is sometimes "tacked on the end, a short immersion into a confusing whirl of activity" (Darling-Hammond, 1999), with little chance for reflection and

refinement. Again, even the best experiential learning opportunities during a teacher training program cannot fully prepare teachers for the dynamic environment of schools, so professional development for teachers is a vital component in producing high quality teachers (Showers, et al., 1987). At the heart of this matter is the need for praxis in teacher education, that is, the application of newly learned skills in real settings, with the necessary reflection and refinement. As new standards and reforms cycle through the educational system, teacher must work with each other and other experts to update and perfect their craft (Showers, et al., 1987).

Effective practices for teacher professional development. The focus on high quality teachers has been sharpened by the No Child Left Behind Act of 2001 (NCLB), which calls for all teachers to be "highly qualified" and using "scientifically based teaching strategies" (NCLB Act of 2001). As a result, educational leaders are looking for ways to improve instruction in classrooms and schools (Darling-Hammond, et al., 2009). Many professional development strategies have resembled one of two approaches: the traditional, one-shot workshop with little to no follow-up versus an approach that is more intensive, ongoing, job-embedded and often addresses whole school reform efforts. While there are a plethora of teacher professional development strategies, and this dichotomy might not be as clear as noted, it is useful in comparing the two general groups of strategies. Several evaluations and literature reviews of evaluations of the current status of teacher professional development have revealed the shortcomings of the traditional professional development models and the strengths of more recently developed approaches (Darling-Hammond, et al., 2009; Yoon, et al., 2007; Neufeld & Roper, 2003; Desimone, et al., 2002).

In addition to requiring a highly qualified teacher in every classroom, NCLB also required that professional development be highly qualified. Guidelines were provided that

described what was meant by highly qualified, which mainly focused on the content. According to NCLB, highly qualified professional development should involve training in teaching of students with special needs or limited English proficiency, and the use of technology in the classroom. It should be an integral part of a broad school or district wide improvement plan and be aligned with state content standards. Furthermore, teacher professional development should allow for the retention of high quality teachers by improving teacher knowledge and skills, classroom management and use of data to inform classroom practices (NCLB Act of 2001). These broad requirements are consistent with research on effective practices of professional development, but say little of the context, time span or specific approach.

The strong relationship between teacher professional development and student achievement may seem obvious, but demonstrating a causal effect has proven difficult. Reviewing more than 1,300 studies of the effect of teacher professional development on student achievement, Yoon, et al., (2007) identified only nine that met the standards of evidence suggested by the What Works Clearinghouse[7]. In each of these nine studies, professional development was correlated with positive and significant student achievement gains if the teacher was involved with more than 14 teacher contact hours of professional development. Three studies failed to find statistically significant effects on student achievement, all of which included professional development strategies with fewer than 14 teacher contact hours; therefore, Yoon, et al., (2007) conclude that the amount of contact hours is a good predictor of overall impact. The actual content of each approach to professional development varied greatly, yet all but one included follow-up sessions.

[7] Established in 2002, the What Works Clearinghouse is a U.S. Government managed database of "scientifically proven" practices in education, specific requirements can be found at http://ies.ed.gov/ncee/wwc/references/standards/.

In a multi-year study commissioned by the National Staff Development Council and The School Redesign Network at Stanford University, Darling-Hammond, et al. (2009) reviewed the research on effective professional development and found similar significance with regards to the total amount of teacher contact hours. Moreover, Darling-Hammond, et al. (2009) identified four core features of effective professional development. First, professional development should be connected to practice, ongoing and intensive. When teachers attend occasional workshops lasting a day or less that each focus on a different topic, it is often difficult for the teacher to make the connection to the classroom (Darling-Hammond, et al., 2009). Instead, teachers should have substantial time to invest in cumulative study, to try new strategies in the classroom and to reflect on their performance. Second, professional development should address specific curriculum content and focus on student learning; therefore, it should address the everyday challenges in teaching, rather than broad educational principles. Third, it should be aligned with school improvement goals, and each experience should be connected to previous ones. When employees in an organizational context are exposed to too many initiatives with different goals, they become overwhelmed and more resistant to change (Abrahamson, 2004). Finally, professional development should encourage professional collaboration among teachers (Darling-Hammond, et al., 2009). Bryk, Camburn & Louis (1999) have demonstrated that professional learning communities (PLC) provide teachers with the supportive environment for instructional innovation.

A three-year longitudinal study (Desimone, et al., 2002) examined specific features of quality professional development that lead teachers to implement new strategies in three main areas: technology, instruction and assessment. Desimone, et al (2002) found that professional development experiences most likely to lead to changes in teacher behavior included those that

involved opportunities for "active learning", in which teachers play a role in their own professional development, rather than acting as "passive recipients of information". Other features of professional development that were correlated with teacher implementation at statistically significant levels included coherence between professional development experiences, collective participation among teachers and finally, the particular form. If the experience was classified as reform type, which included activities such as a mentoring relationship, teacher networks or a PLC, the professional development experience was shown to increase implementation for assessment and instruction.

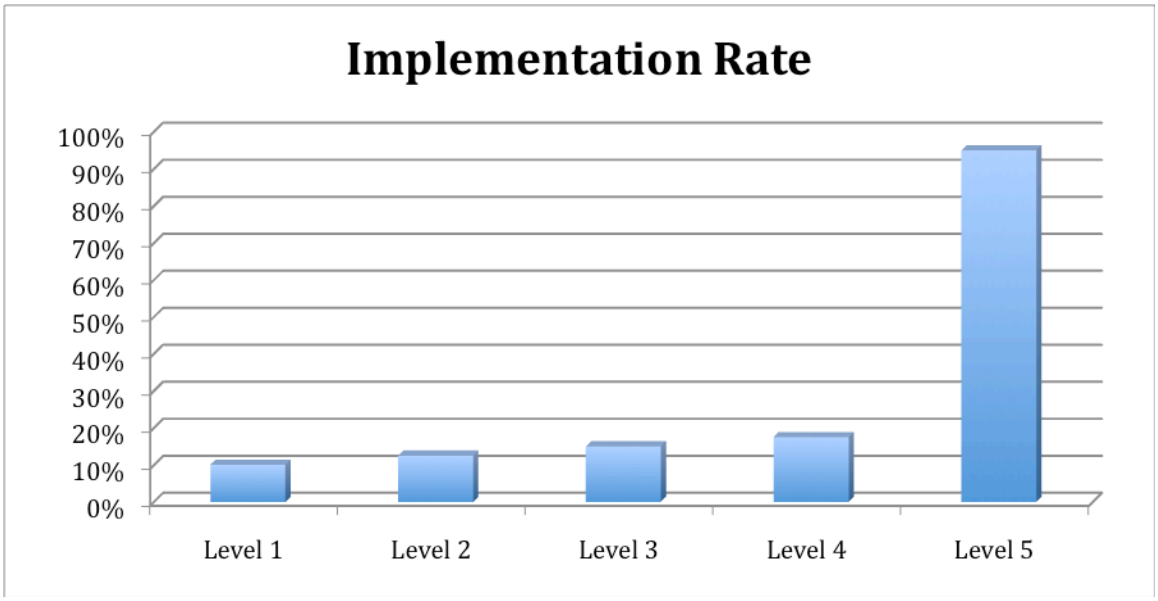
Bush (1984) examined the effect of various approaches to in-service professional development on teacher implementation rates[8]. Five levels of training were developed and tested as follows: 1) presentation of a theoretical and conceptual base; 2) modeling; 3) practice in a controlled situation; 4) feedback; and 5) assistance and application. The first and second levels of professional development are loosely defined in the literature as "traditional" professional development (Darling-Hammond, 2009; Garet, et al., 2001). For teacher professional development at level one, Bush found implementation rates for teachers to be 10% and at levels two, three and four, only an additional 2-3% of teachers implemented newly learned teaching strategies. Until level five is reached, only 16-19% of teachers implemented a strategy they learned in professional development.

[8] An implementation rate refers to the percentage of teachers who used a particular strategy in their classroom they learned through professional development.

Table 1: Levels of Professional Development and Implementation Rates (Bush, 1984)

Levels of Professional Development		Implementation Rate
Level 1	Presentation of a theoretical concept or tool by an expert in the field.	10%
Level 2	Modeling of an initiative in the classroom.	12-13%
Level 3	Practice in controlled situations.	14-16%
Level 4	Feedback from a professional developer.	16-19%
Level 5	Assistance and application in a regular school or classroom setting.	95%

Figure 2: Implementation Rates of Instructional Practice by Level of Professional Development (Bush, 1984)



Source: Bush (1984)

Current status of professional development for teachers in the United States. Bush (1984) found most staff development in U.S. schools reached level one or two at the time of his study. In their more recent review of teacher professional development in the U.S. and abroad, Darling-Hammond, et al. (2009) found that most learning opportunities for teachers still

resembled traditional workshops and conferences with duration of less than two days. In 2003-04, 91.5% of teachers surveyed by the federal Schools and Staffing Survey reported participating in a workshop or conference that year. While almost all teachers in the U.S. participated in some form of professional development, very few teachers had access to intensive learning opportunities, such as coaching or meeting with a PLC. Darling-Hammond, et al. (2009) found that only 57% of teachers reported being involved in more than 16 hours of professional development focused on their content area, while only 23% indicated that they were involved in 33 hours or more of professional development in their content area during the 2003-2004 school year. Furthermore, few teachers in the U.S. participated in intensive professional collaboration; only 17% of teachers reported high levels of "cooperative effort among staff members" (Darling-Hammond, et al., 2009). Finally, teachers received little funding and were not well supported to participate in professional development. These findings are surprising given the research on effective professional development for teachers.

Similar results were found in a national survey of teachers involved in professional development funded by Title II Eisenhower state grants (Garet, et al., 2001). Teachers were asked to describe one experience they had with professional development during the previous school year. 81.3% of teachers reported a traditional professional development experience, which authors characterized as workshops and conferences, while 18.7% reported a "reform type", which included coaching, teacher study groups, and professional learning communities.

Odden and Archibald (2009) studied schools and districts that doubled student achievement, finding uniformly, a large investment in widespread, systemic and ongoing

professional development[9] for these schools. So why aren't districts implementing "research-proven" professional development practices? Unfortunately, professional development that is intensive, ongoing and well coordinated can be expensive (Odden, et al., 2002). Some case studies Odden and Archibald (2009) have examined did not have the fiscal requirements to sustain such intensive levels of professional development, even though research has suggested its necessity. Symonds (2003a) described the complex ways in which literacy coaches were funded in three San Francisco districts, which involved support from several different sources, including reallocating district office staff. District administrators, who control a major portion of the staff development money, often find hiring a short-term outside expert is far easier than a comprehensive long-term approach (Symonds, 2003b). When a district is ready to make a long-term investment in teacher professional development, they should consider one of several models of coaching (Odden & Archibald, 2009).

Models of School-Based Coaching

Several different coaching models are currently in use in U.S. schools, all of which involve onsite, full time, professional developers who work one-on-one with teachers to bring some sort of change within schools (Borman & Feger, 2006). When a school district chooses to bring in a coaching program, they first hire coaches, often from a pool of expert teachers within the district, and then select a particular coaching model. The newly hired coaches will need to learn specific strategies and tools they will use to support teachers, so each coaching model offers its own professional development, which is usually led by program developers. The

[9] Odden and Archibald (2009) recommend an investment of $450 per pupil, including $311 set aside for instruction coaches, $100 per pupil to pay trainers for workshops, and $42 per pupil that would allow teachers 10 days of student free time, based on a 500 student school with 18 teachers.

coaching models, and the training that is accompanied with it, are relatively similar on the surface, but are built upon different theoretical foundations.

While each model is rooted in adult learning theory, each takes a different perspective. For instance, instructional coaching is based on the concept of partnership, whereas Toll (2006) has written extensively on literacy coaching using Foucault's use of agency and types of power. Killion (2009) uses the Myers-Briggs personality type theory to train coaches to use what she calls differentiated coaching, while Cognitive Coaching focuses on changing the cognitive process of teachers, and content coaching (West & Staub, 2003) relies on the theory of incremental intelligence. Peer coaching, instructional coaching, numeracy coaching and literacy coaching are often applied to any instructional facilitator who coaches teachers and not all models or programs come with a special name. Many educational consulting firms offer their own training for coaches; these include the Center for Cognitive Coaching™, Marzano Research Laboratories ™, Staff Development for Educators ™ and the Coaches Training Institute. All of these consulting firms have implemented their model for programs in many districts; across the country thousands of coaching programs exist (Neufeld & Roper, 2003).

The Instructional Coaching Model

The instructional coaching model is rooted in a theory of partnership between the teacher and the coach (Knight, 2007). In order for instructional coaches to stand on solid ground, they or he must know and understand the theory behind their role. Understanding the theory allows an evaluator to understand why, when and how particular decisions are made by the instructional coach. Specifically, in analyzing the cost of the program, one must know how teachers spend their time with coaches; thus reviewing the partnership philosophy helps determine how coaches, principals and teachers interact together. The partnership philosophy involves seven core

principles: equality, choice, voice, dialog, reflection, praxis and reciprocity. Some of these core principles have some significance with regard to measuring cost-effectiveness.

Equality implies teachers and instructional coaches are on an even playing field and they interact as equals. In a partnership, what each party has to say is viewed as equally important and the teacher, as well as the coach, has opportunities to learn from each interaction. When the teacher is communicating with the coach, the focus is on listening and understanding rather than intending to persuade. Teachers always work with coaches on a voluntary basis. Choice puts the power of what and how teachers learn in the hands of teachers. Because the partners are equals, choices are made individually and decisions are made collaboratively. When it comes to instructional matters, the coach offers choices in order to ensure teachers' wants and needs are being addressed. The teacher's choice is implicit in every aspect of the professional development process. The goal of the coach is not to make teachers agree with them, but rather to come to collaborative agreements about how to improve instruction.

The third principle, voice, is related to teachers' choice, but goes a step further. Not only will teachers have choice to work with coaches and choice in what they work on, their point of view will be respected and empowered. The partnership relationship is advantages for each party because each individual has access to multiple perspectives, rather than the one perspective of the leader. Coaches are also encouraged to give voice to a variety of opinions by eliciting conversations with many teachers. Dialogue is the fourth principle, and represents the true realization of teachers' voice. When partners work hard to authentically listen and fully understand what the other partner has to say, groups can begin to think together. In this way, partners and groups engage in dialogue and coaches listen to teachers more than they talk.

When two individuals are partners in learning, they are on even ground, both individuals feel free to speak their minds because they know their opinions are equally as important. A coach, then, allows teachers to make sense of what they have learned through reflection, the fifth principle. When teachers are encouraged to reflect on what they have learned, teachers consider several ideas before implementing them. With regard to the use of teachers' time, this implies the relationship between a coach and a teacher is an evolving, intensive and an ongoing one. Praxis, the sixth principle, implies each individual is free to reconstruct content in the way they see fit, so after the coach and the teacher have worked together on a particular teaching strategy, the dialogue between them continues. Teachers continually reshape the content they have learned and through equal dialogue with their coaches, choose the strategy and structure that best fits their classroom. The final principle, reciprocity brings back the notion that everyone benefits from the success of others. Coaches are learners in the instructional coaching process and they get to know teachers, classrooms and the school culture; over time the coach gains an understanding of how to be most effective in helping teachers.

The seven core principles help an evaluator understand the structure of this particular coaching model and these principles have implications for how to analyze the cost of such a program. One of the central issues in analyzing the cost of a coaching model is how much time the teacher spends with coaches; for the instructional coaching model, this time is voluntary and will likely vary from teacher to teacher, semester to semester and from school to school. Teachers are never forced to work with coaches; if a teacher decides they are not gaining anything from a particular meeting or group session, they may leave the meeting and decide to work on something they find more effective in accomplishing their own goals. Coaches may be slow to earn time with teachers initially, but if word gets out within a school that the instructional

coach is helpful, he or she might begin to meet with more teachers over time. As teachers decide to spend more time with coaches, the total cost of the initiative will increase as more of the teachers' time is used. Similarly, as teachers and coaches develop a relationship, overall effectiveness and productivity might increase as they come to know each other. This means that overtime, one might expect the effectiveness of instructional coaches, as well as the costs, to increase; therefore, an cost-effectiveness analysis should take place over the course of at least one school year, and measurements of cost and effectiveness should be taken over the same time period.

Introduction to Cost Analysis

Cost analysis is a useful tool for examining educational interventions. Such studies that examine costs, in isolation of effectiveness, come with some limitations because without knowing how costs relate to effectiveness, minimizing costs might not be the most efficient solution. For instance, consolidating schools is one solution to dealing with district budget shortfalls because larger schools may have lower costs (although this is not a forgone conclusion); however, larger schools might have lower educational effectiveness (Lee & Smith, 1997). Therefore, cost-effectiveness analysis goes an extra step by allowing decision-makers to choose the most efficient alternative. While both forms of analysis provide useful information for educational leaders and policy makers, every situation requires a close examination of the particular context and results of such analysis should be interpreted with caution.

Economic cost analysis. A cost analysis involves measuring the cost of all the necessary resources in order to produce some output. Cost analysis in education has typically served two broad purposes; first, to describe the structure and configurations of a school district by highlighting areas that employ the most money, time and energy. These analyses use actual

salaries of employees because they reflect a percentage of the total district expenditure; they can be thought of as measuring the accounting cost of school resources. Several studies measuring the total district investment in teacher professional development have been conducted to serve this purpose (Miles, et al., 2003; Miller, Lord & Dorney, 1994; Little, et al., 1987; Moore & Hyde, 1981). Measuring the myriad positive effects of highly varied and fragmented professional development structures in school districts is extremely difficult; therefore, these studies, while informative, do not lend themselves well to cost-effectiveness analysis. The methodology, strengths, weaknesses and a number of published examples are reported in column one of Table 3 below.

Column two of Table 3 describes the second purpose of cost analysis, to measure the economic cost so that alternative educational initiatives can be compared (Levin, et. al, 2010; Parrish, 1994; King, 1994). This approach to cost analysis is used in cost-effectiveness analysis and Appendix A provides a description of this tool as well as a review of several studies that incorporate cost-effectiveness analysis. These analyses use standardized salaries so that differences in the cost of school initiatives will be reflected in "real" terms, rather than nominal differences in salaries and geographic price levels; they can be thought of as measuring the economic cost of school resources. The two purposes are mutually exclusive for analysis, although Hartman, Bolton and Monk (2001) have called for a synthesis of these two approaches, labeling the first approach the traditional downward accounting extension and the second approach the resource cost model. This second purpose of cost analysis is described in column two of Table 3. A third purpose cost analysis serves is to expose the hidden costs of educational initiatives. This purpose may be fulfilled in studies that also accomplish either of the above two purposes.

Table 3: Two Broad Approaches to Cost Analysis

Economic Cost: Comparing Alternative Programs by Cost	**Accounting Cost: Describing Structure and Configurations**
Methodology	
Value of resources described in "real" terms using national averages, standardized values and market prices. Peripheral expenditures can be left out if they were not essential to the initiative's goals.	Resources are described in nominal terms, that is, actual salaries of personnel and actual expenditures on facilities, equipment and materials.
Donated resources and volunteer time is valued at the cost it would take to replace it.	Donated equipment or resources provided in-kind such as volunteers are excluded.
Multiple programs or initiatives with relatively similar objectives are required for analysis in order to provide a useful comparison.	One particular endeavor (such as teacher professional development) is described as a percentage of the total district expenditure.
Advantages	
Programs can be compared on the basis of "real" terms such as actual required resources, so that nominal differences in salaries or geographical differences in prices are excluded.	The cost of particular endeavors (such as teacher professional development or instruction) can easily be described as a percentage of total district expenditures.
If the initiative has been subjected to evaluation of effectiveness, ratios of cost-effectiveness can be computed.	Individual districts gain knowledge of their own actual expenditures on particular endeavors.
Disadvantages	
The monetary value of volunteer time, old facilities and highly valued personnel are often difficult to measure.	Actual district expenditures may differ for reasons outside of resource allocation decisions, including different nominal prices, available volunteers or other resources provided in-kind.
Examples	
Levin, H.M., Catlin, D. & Elson, A. (2010)	Miles, K.F., Odden, A., Fermanich M., Archibald, S., & Gallagher, A. (2003)
King, J.A. (1994)	
Parrish, T. (1994)	Miller, B., Lord, B., & Dorney, J. (1994)
Levin, H.M., Glass, G. & Meister, G. (1984)*	Little, J., Gerritz, W., Stern, D., Guthrie, J., Kirst, M., & Marsh, D. (1987)
*A cost-effectiveness study.	Moore, D. & Hyde, A. (1981)

What Methods Are Used in Cost and Cost-effectiveness Analysis?

The following section describes the methods commonly used in cost analysis, and it is comprised of two parts. First, in Part A, a study by Levin, Catlin and Elson (2010) of three adolescent literacy programs is reviewed, followed by a cost analysis of instructional programs for students with limited English proficiency (Parrish, 1994). Next, a cost analysis by King (1994) of three whole school reforms is described. The three studies described in Part A fall under the first purpose of cost analysis, to compare alternative interventions. Part B describes four exemplary studies of staff development costs and configurations, which fall under the second purpose of cost analysis, to describe organizational structure and to present costs of one element, such as professional development, as a percentage of total investment. These studies reveal specific nuances in the cost analysis methodology of professional development, such as the reallocation of teacher instructional time. Odden et al. (2002), have also reviewed some of these studies and have and presented a cost framework for professional development in light of previously suggested frameworks.

The methodology of measuring cost in educational interventions. Three steps of cost analysis comprise what Levin & McEwan (2001) refer to as the "ingredients" method of cost analysis, which attempts to measure the opportunity cost of all resources used in the intervention. The first step is to list the quantity and quality of all required resources of the program or initiative. Understanding the resources required for implementing a school reform is paramount to its proper implementation. With that in mind, Levin, Catlin and Elson (2010) analyzed the cost of implementation of three literacy programs at various sites across the United States. The goal of the report was to inform school leaders of all resources required for successful implementation of the three literacy programs entitled *Read 180*, *Questioning the Author* and *Reading*

Apprenticeship, and to compare their costs. Authors begin by identifying all "ingredients" required of the intervention. Sources of this information include interviews with the sponsor or developer of the intervention, a review of all materials describing the intervention, and finally, interviews and direct observations at specific schools currently implementing the interventions. For each of the three interventions, one to three schools were used to collect actual cost data. By analyzing real examples in schools, Levin, et al., (2010) were able to show how resource allocations in literacy programs actually take place.

The cost methodology was similar for each of the three literacy programs in the study, so fully describing the methods employed for one (*Read 180*) will allow for an understanding of the methods employed to measure the cost in all three. Scholastic, the developer of *Read 180*, provided information regarding all required resources at a hypothetical school. Observations and interviews with personnel who have already implemented the reform were also necessary in order to identify how the reform was actually implemented in schools. The findings showed vast differences in implementation costs across various school districts.

Since Levin, Catlin and Elson (2010) attempted to compare costs based solely on actual activities and decisions made at the school level, all values of ingredients are standardized using market prices and national averages. All school personnel were assumed to work 1,440 hours per year and paid their respective national average salary for the given school year, which authors obtained from the Educational Research Service. Also, if districts chose to reduce class size and extend class periods (as is recommended by the developers of *Read 180*), they may only have reallocated teachers to different classes, so no explicit expense would have appeared on the school budget balance sheet. Even when this was the case, Levin, et al. (2010) calculated the number of additional teachers a district would need to hire in order to prevent the reduction of

resources devoted to other school programs. Additional teachers were measured in the full-time equivalent (FTE) amount of teacher-time, that is, the number of additional teacher hours required, divided by the number of hours one teacher is contracted to work per year, 1,440. When a district did not require purchasing additional computers, no explicit expense was incurred; however, all sites physically used computers for *Read 180*, so the implicit costs of these computers are included in the reported costs[10]. By using these "standardizing" methods, the actual cost of the specific programs can be calculated and compared to other alternatives.

Substitute costs, additional teachers' and administrators' time and class size reduction are all costs that are not included in Scholastic's advertised cost of *Read 180*, yet they were all required resources for successful implementation.

Variations in program costs at each school analyzed were largely reflected in school-based decisions regarding implementation. While Scholastic (developers of *Read 180*), recommends 90-minute class periods and class sizes of 15 students, not all schools chose to make these reforms, and this effects the overall cost. Only one district reduced *Read 180* classes to the recommended 15 students per teacher, and this reflected the largest portion of costs at that particular site. The scale each school chose to implement the programs also caused large differences in the overall cost per student. For instance, with *Read 180*, when one site reduced the amount of students involved in the program during the final year, the cost per year didn't change, but the cost per year per student rose significantly. This happens because all inputs required for the program (such as professional development, and computer hardware and software) have already been purchased in previous years and are considered fixed costs because

[10] Even when schools already have computers, the cost should still be included because the computers can be used for some other purposes.

they don't change if more students are involved. Thus lowering the amount of students causes the per student cost to increase.

Methodologically, the study emphasizes using standardized measures when comparing interventions and the importance of careful cost accounting of personnel time. It also reveals the variations in costs school districts incur as a result of how they choose to implement a reform. Finally, the report illustrates the usefulness of careful identifying hidden costs of programs for school leaders hoping to implement an educational intervention. For instance, Levin, et al. (2010) include some ingredients such as headphones and printers that have a very small affect on the overall cost per student, but are imperative to proper implementation.

A cost analysis of five instructional models for limited English proficient (LEP) students by Parrish (1994) provides another good example of the ingredients method. The study also exemplifies the analysis of marginal cost, a typical procedure involved in the ingredients method in which only costs that are in addition to the regular classroom are included. The unit of analysis was 15 exemplary schools, in terms of student performance, chosen from 11 districts so that ideal resource allocations might be examined. The results therefore are not to be generalized, but rather provide insight into the decision making of selected districts, specifically, the "tradeoffs that exemplary sites have made between different uses of resources at the local level" (258). The five models examined were Bilingual Early Exit, Bilingual Late Exit, Double Immersion, English as a Second Language and Sheltered English, all of which featured separate classrooms for LEP and non-LEP students.

Parrish (1994) used what he refers to as the Resource Cost Model; which essentially mirrors the ingredients model developed by Levin (1983). The cost model in this study takes three steps: listing the necessary ingredients required for all educational programs; determining

which school resources are required only in general education classrooms and which are required for LEP programs; and finally, placing a value on each resource used in order to determine the marginal cost incurred as a result of the LEP program. In listing ingredients for carrying out education processes, only personnel costs were included initially. This was done for two reasons; most of the costs of educational interventions lie in personnel costs, and secondly, data on facilities, equipment, materials and other sources of costs were difficult to obtain.

When comparing the costs of these add-on educational interventions, Parrish (1994) only included those costs that were incurred above and beyond what a regular classroom would. For instance, all programs evaluated involved placing students with LEP in self-contained pullout classrooms that closely resembled classrooms for students whose native language is English. The logic behind this "marginal" cost approach is that pullout LEP classrooms all contained sunk costs. In the study of decision-making, sunk costs are those costs that have already been incurred (Varian, 1990) or would be incurred by each alternative choice and should therefore be ignored. For Parrish (1994), sunk costs were those incurred both in a regular classroom and in the pullout classrooms for students with LEP, for instance classroom space, basic school supplies, desks and a classroom teacher would all be required to educate students with LEP regardless of whether or not the district implemented a specific instructional model for students with LEP. Only the marginal cost of LEP-related services were counted as a cost to an LEP program, so cost incurred as a result of LEP students in special or gifted education were not attributed to LEP programs because the goal was to measure just the cost of the LEP programs.

The ingredients of most LEP programs included additional teacher-time, bilingual and regular aides, volunteer time, the additional time required of resource teachers and administrative personnel. Average class size was also a major factor affecting the cost of various programs.

These figures were used for each model in order to calculate the per-pupil cost for each ingredient as well as the total per-pupil cost for each model. As Parrish (1994) explains, some LEP models called for decreased class size; therefore, this detail is important to include.

Since pullout classrooms decrease the class size of regular classrooms, one might expect pullout classrooms to lower the burden on general education classrooms, thus lowering the cost. Previous methodologies have chosen to adjust the cost of regular education instruction to correct for the decreased class size of regular classrooms when LEP students have been temporarily pulled out (Carpenter-Huffman & Samulon, 1981). Parrish decided to exclude this ingredient from the analysis on the basis that teachers face an added burden when students are temporarily pulled out of class, rather than a reduction in their responsibilities. Thus, when identifying ingredients that are required of an educational program, the cost analyst must make specific assumptions regarding how aspects of these programs affect student learning. The second step of the ingredients method is to place values on each of the necessary resources.

Parrish used national average market prices (salaries plus fringe benefits) of personnel to assign a cost to each individual involved in each of the instructional models. While using actual rates of compensation may provide more accurate depiction of what a district spends on a particular program, the purpose of this approach[11] to cost analysis is to measure the real cost of a model or program rather than the nominal. Real cost represents the value of a resource if it were used in its most productive alternative, that is, the market value or the cost to replace the resources used.

[11] When the goal of a researcher is to measure the cost of a specific educational endeavor such as teacher professional development (see Moore & Hyde, 1981; Little et al., 1987 and Miller et al., 1994) as a percent of total expenditures, actual salaries are used. When comparing alternative programs or interventions, market values are used.

In U.S. teacher labor markets, Parrish determined salaries were equal for bilingual and monolingual teachers, therefore, the cost of one FTE teacher for each designated LEP class and non-LEP class was the same, valued at $43,505 in 1994 dollars. Carpenter-Huffman and Samulon (1981) measured the cost of bilingual education and chose to use lower salaries for bilingual teachers on the basis that they are less experienced on average and thus are lower on the salary scale. Parish deemed this a short-term phenomenon and attempted to focus on real costs of programs, rather than on nominal costs. Although bilingual and monolingual aide salaries were also equal, the amount of aide time used in each program varied greatly; therefore, the total cost of aides in each model varied greatly as well. The time of administrators, resource teachers and volunteers was valued at their own market wage for the state of California. Including volunteers in the cost of an intervention has two implications. One, the true cost of obtaining the measured output is identified, therefore, readers of the evaluation gain a better understanding of the cost of replicating such a program. Two, the cost of the program to society is measured rather than the cost to the district or state government.

Parrish (1994) included only costs borne on the school district, so the third step of the ingredients method, in which costs are apportioned to various constituencies, was left out. Often, school interventions involve costs borne on teachers (Little, et al., 1987), students or parents (Barnet, 1985) and the third step of the ingredients method disaggregates these costs to the various stakeholders involved in the program. Because the district incurred the vast majority of costs in the LEP programs, this third step was unnecessary.

Results of Parrish's study clearly indicate the strengths of rigorous cost analysis. When one compares the total per student cost of educating LEP students relative to non-LEP students, the Late Exit Bilingual model was shown to cost only seven percent more than for non-LEP

students. The causes of cost differences are also highlighted when using the ingredients, or resource cost method. In the five models examined, the additional cost of educating LEP students is mainly represented in the cost of LEP resource specialists and program administration and support. While the cost analysis cannot directly be generalized, it succeeded in highlighting how exemplary programs have decided to allocate resources for LEP programs. When using personnel costs only[12], the Early Exit Bilingual model was found to be the least costly at $1,976 per student, or $116 per student more than students without LEP (meaning non-LEP classes cost $1,860 per student), while the ESL model was the most costly at $2,687 per student, or $1,198 per student more than non-LEP students. Unfortunately, without accurate measures of effectiveness, it is impossible to compare the efficiency of each model. For instance, the Double Immersion Model aims to teach a second language to English speaking children while at the same time teaching English to LEP students. Due to limitations with outcome data of each model, Parrish and his colleagues were unable to incorporate an effectiveness portion to this cost analysis. The report does provide a thorough methodological description of how cost of instructional models are calculated, as well as interesting findings of the costs of educating English language learners.

King (1994) attempted to measure the cost of three comprehensive school reform models: Slavin's *Success for All,* Levin's *Accelerated Schools* and Comer's *Schools Development Program*. Because each program had similar goals, raising student achievement for elementary aged students, King (1994) noted a cost-effectiveness study might have been feasible, but evaluations on each of the three models were not available, and conducting an evaluation for

[12] Authors chose to list their results first with personnel costs only because they were more consistent and represented the majority of the total costs. Other costs including facilities, materials and transportation were added in a later discussion of average costs across all models.

each model fell outside the scope of the study. Therefore, King (1994) operated under the assumption that the three models have roughly the same levels of effectiveness; so choosing the most cost-effective model for a school district simply required choosing the lowest cost. King (1994) used the "ingredients" method to estimate costs, so her first step was to list all required resources for each model.

Publications and manuscripts by the developers of each model have described, with detail, the specific ingredients required for implementation (Center for Research on Effective Schooling for Disadvantaged Students, 1992; Hopfenberg et al., 1990; Slavin, et al., 1989). As a starting point, King (1994) reviewed all of these documents pertaining to each model and listed a low estimate and a high estimate of the required ingredients for each based on the range deemed necessary by program documents. She then interviewed the developers of each model in order to obtain a more accurate assessment of all resources required both of the school district as well as parents. A final process in this first step of the "ingredients" method, listing all the "ingredients" of each model, would be to locate specific sites in which the models have been implemented and report cost figures that reflect actual activities in schools. Unfortunately, King (1994) was not able to collect data on specific sites, so she simply reported a low and high estimate for each model based on program developer interviews. For instance, according to the *Accelerated Schools* model, the district must hire between zero and two social workers and zero to one program facilitators. This discrepancy alone causes the total cost of the low and high estimates of the total cost to differ by $150,000.

Step two of the ingredients method is to place a value on each ingredient. Each of the three models required some participation of parents, an ingredient that is often difficult to place a value on. To address this challenge, King (1994) did not convert some of the ingredients into

monetary terms; instead she chose to leave them as simple quantities since each estimate is made only for comparison purposes. While this strategy prevents tallying up a total cost for each model, King (1994) was still able to make useful comparisons, based on budgetary expenditures and required volunteers and personnel time.

Step three requires one to apportion costs to each constituency for whom the cost is borne upon. For each model, the school district incurred costs of additional personnel, training, and additional time requirements of existing personnel. All parents were required to donate a range of .25 hours, up to 6.25 hours per week across the three models and additional volunteer time was also required for a portion of parents in the *Success for All* program and the *School Development Program*. King (1994) concludes that the *Accelerated Schools* model involves the fewest additional expenditures by the district; however, the least costly model overall depends on the specific context in which it is implemented. When a significant supply of donated resources is available to the community, *Accelerated Schools* and *School Development Program* appear the least costly because they rely heavily on parental involvement. However, for the long run, King (1994) argues that the *Success for All* model would replace volunteers with professional staff who may be more productive within the schools, while parents may have a higher opportunity cost if they are more productive in the labor market. For a community with low levels of donated personnel resources, *Success for All* is preferable because districts must purchase the unavailable donated resources required of the other two models.

Because schools have the power to shape and mold comprehensive school reform models (Evans, 1996), cost analyses of these models are often largely affected by the specific context of the sampled site. To this end, the use of a specific site for analysis can be misleading when specific nuances exist such as donated parent time or highly committed teachers and principals

who are willing to donate time after school. By describing the general models and their respective costs, King (1994) provided valuable insight for districts hoping to implement a comprehensive school reform models.

The Application of Cost Methods to Teacher Professional Development

The following section provides a review of four exemplary cost analyses of whole district professional development efforts. These analyses conform to the second broad purpose of cost analyses, to describe the costs, structure and configurations of a particular initiative within the school district. This approach is used to determine actual expenditures, rather than economic cost, of a particular initiative, so resources such as volunteers are excluded from the analysis. Using actual expenditures and actual salaries, rather than national averages, allows one to express the total cost of a particular initiative, as a percentage of total investment for the district. Several studies over the past 30 years have attempted to establish a framework for measuring the total district investment in teachers' professional development. A cost framework refers to step-by-step processes developed by evaluators to measure the cost of educational interventions. This particular type of study is an ambitious undertaking considering the vast array of professional development strategies typically taking place at various levels of school districts. Four different frameworks are compared in order to highlight the strengths of each framework as well as the inconsistencies among them.

Moore and Hyde (1981) examined staff development for teachers in three urban school districts in California, using their previously developed framework (Moore & Hyde, 1978). Although nearly 30 years olds, this study is important because it is the most comprehensive of its kind and is described in great detail (Moore & Hyde 1981, 1978). Realizing the complexity of whole district staff development, Moore and Hyde used extensive interviews with many

individuals in order to fully understand each staff development routine. The study's thorough costing methodology uses the ingredients method, although the authors do not explicitly label it as such. By first fully explaining all resources involved in professional development, as well as the quality and quantity of each resource, assigning a value, and apportioning costs[13], one is successfully using the ingredients method of cost analysis.

Moore and Hyde (1981) used the concept of "organizational routines" within schools and districts as a guiding tool for which activities to include as a cost of staff development. Thus new or temporary arrangements were ignored because the evaluators attempted to measure all regularly scheduled or routine activities related to staff development. Data collection took place in five steps: 1) gaining a general understanding of the district and staff development activities; 2) understanding the district's financial system; 3) gathering specific data on staff development initiated at the district level; 4) gathering specific data on staff development initiated at the school level; 5) analyzing salary increase schedules. Understanding a school district's financial system can be lengthy process because school budgets rarely separate costs of staff development from other costs by line numbers; therefore, any rigorous study of expenditures in school districts will not rely solely on school district budget documents. Consulting fees, for instance, were paid to consultants for conducting professional development workshops, but also for consulting on building construction, and only through interviews can this information be teased out. Similarly, specific amounts of teacher-time spent in staff development are rarely recorded on the school district balance sheets; therefore, Moore & Hyde (1981) had to collect this data

[13] Moore and Hyde (1981) chose to include only those costs incurred by the district. Costs incurred by individual teachers or by outside agencies were excluded for the purposes of the study.

through interviews with those involved in staff development at all levels, from leaders at the district level to classroom teachers.

Moore and Hyde (1981) developed an operational definition of staff development to include any activity intended to prepare teachers for their current or future roles in the district. This definition came with some limitations. First, individual lesson planning was not included, while group planning among teachers and advisors was included. Second, the cost of using school facilities for staff development workshops was not included. Finally, only costs incurred by the school district were included; costs incurred by individual teachers, or by sponsoring agencies were excluded. The perceptions of interviewees often differed in quality, content, and time expended on professional development. Dealing with uncertainty is a common problem in cost analyses and Moore and Hyde (1981) used several useful strategies to overcome such problems. When a wide disparity in reporting existed from a particular role (e.g. among principals) or between various individuals (e.g. between principals and teachers) after the first round of interviews, additional individuals were interviewed in order to measure more accurately the actual, not projected or perceived time spent on staff development. When consistent figures could be reached they were applied to all individuals in that role[14].

In interviews with school staff, Moore and Hyde (1981) asked if teachers were involved with any of eight activities classified as staff development under their operational definition. Providing concrete examples helped interviewees supply accurate estimates (Moore & Hyde, 1978). Each staff member was asked to estimate the exact amount of time they, as well as their colleagues, devoted to staff development efforts for teachers. For teachers, participation time in

[14] For example, for staff development in one school district, Moore and Hyde (1981) collected data from 451.8 of the roughly 4100 FTE teachers. Findings of the sample were then applied to the population of district teachers. FTE teachers provide a measure of total full time teachers, so teachers who only work half the week, for example, are counted for .5 of a teacher.

staff development was categorized into four types: salaried work time during the normal school day, cost of hiring a substitute, stipends for attending professional development sessions and personal time devoted by the teacher (which was excluded from the study). If teachers were released from teaching duties by a substitute, only the cost of a substitute was included and stipend time took place during the summer, outside salaried work time, so no category resulted in double counting. Salary increases for university credit and payments to a leader of a workshop were also included in the broad category of personnel time. The exact categorization of activities is not important, however, the act of systematically categorizing activities helps both the researchers and the interviewees produce accurate figures (Moore & Hyde, 1978).

The cost of staff development activities within a district are often difficult to measure because researchers disagree on what activities should be counted as staff development (Odden, et al., 2002; Miller, Lord & Dorney, 1994). Moore and Hyde discussed their decisions to include specific activities and to exclude others in their handbook on staff development (1978), stressing the need for researchers to be conservative in their estimate, while including as many costs as possible. First, teachers' day-to-day planning time was not included, although Moore and Hyde acknowledge this time could be considered the most important part of staff development for teachers. Second, they did not include teachers' personal contributions in the form of money or time. When teachers spent time after school in staff development activities, it is often difficult for evaluators to judge if the time is a personal contribution, or if it is expected as part of their employment contract. To mediate this discrepancy, Moore and Hyde (1981) categorized afterschool time separately, but eventually included it as teacher salaried work time.

A third decision of Moore and Hyde (1981) in designing the cost framework was to include the present value of salary increases that resulted from professional development

activities. Because these salary increases are part of the professional development structure of the school district, Moore and Hyde (1981) believed it was inappropriate to leave these figures out. A final decision has to do with curriculum specialists, who have roles similar to instructional coaches. When curriculum specialists spent time writing curriculum guides, this time was not included as a cost of staff development of teachers because it doesn't affect teachers directly. When curriculum specialists spent time within the classroom, modeling and observing lessons, this time was included as "teachers' time devoted to professional development activities" and therefore represented a cost as a result of both teachers and curriculum specialists salaried work time.

Adding up all costs of staff development activities in three districts Moore and Hyde (1981) found district investment to be as low as 3.28% and as high as 5.72% of total district investment. This reflected expenditures from approximately $970 to $1,770 per teacher in 1980 dollars or $2,570 to $4,680 per teacher in 2010 dollars. Much of this cost was reflected in three major categories. Teacher-time represented 32-62 percent of the total cost of staff development; district staff time[15] represented 18-33 percent; and teacher salary increases comprised four to nine percent. The total cost per teacher surpassed by 50 times the estimates of district leaders who were surveyed at the time of the study.

Studying the costs of professional development activities in 30 districts, Little et al. (1987) expanded on the work of Moore and Hyde (1981) by examining the investment from public *and* private sources. Statewide surveys and districts that were randomly selected using probability proportionate to size allowed Little, et al. (1987) to compute a figure for statewide

[15] Two of the three districts Moore and Hyde (1981) analyzed had professional development offices at the district level, which included several full time professional development coordinators.

staff development investment in California. Little, et al. (1987) used a cost framework similar to that of Moore and Hyde (1981) with some important differences, particularly regarding the treatment of teachers' salaried work time. By adopting the term investment, Little, et al. (1987) attempted to measure all social costs of teachers' professional development, including that of teachers' private contributions in the form of personal time commitments and tuition payments.

The first step used by Little, et al. (1987) in acquiring accurate costing data is similar to that of Moore and Hyde (1981). Interviews of key personnel involved with staff development were conducted for each district sampled. Researchers interviewed a total of 460 teachers, 97 principals and 280 district level professional developers. Staff development program descriptions from each district were analyzed in order to gain background knowledge of the over 800 staff development activities taking place in the 30 districts. Little et al. (1987) also conducted statewide surveys to collect data on teacher participation, opinions and reactions to staff development. Like the analysis of Moore and Hyde (1981), quantifiable measures of overall effectiveness were not assessed in the study. Little, et al. (1987) also used the ingredients method by categorizing each needed ingredient for staff development activity. To measure the opportunity cost of teachers' and staff developers' time, salaries were used and time allocations were categorized into different staff development activities.

Little, et al. (1987) categorized their findings in a slightly different manner than that of Moore and Hyde (1981). Differences in categorization reveal a different orientation towards the goal of the studies. While Moore and Hyde (1981) chose to highlight the structure and costs of district-level-initiated staff development versus school-level-initiated staff development, Little, et

al. (1987) chose to divide expenditures by leaders versus learners of staff development[16]. Little, et al. (1987) were concerned with the policy implications surrounding autonomy in staff development; therefore chose to highlight different amounts of expenditures based on role. The sampling methods also allowed Little et al. (1987) to show the differences between rural, urban and suburban staff development expenditures per teacher.

The decision to classify particular costs, such as salary increases and private costs is not black and white, which is why differences in such frameworks exist. Little, et al. (1987) used several different operational definitions of investment in staff development and described each as a different "level". The first level simply reflected monetary expenditures, while the second level included the present value of future salary increases from teachers' staff development activities[17]. Level three closely resembled that of Moore and Hyde's definition of investment in staff development. Finally, the fourth level includes teachers' out-of-pocket expenses and uncompensated time spent on professional development[18]. For Little et al. (1987), level four represents the total investment by taxpayers. This system addresses some of the disagreements readers may have with regard to what is and is not counted as a staff development cost. Because

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[16] Moore and Hyde (1981) did not list costs by leaders and learners; however, the researchers acknowledge the usefulness in such a categorization scheme (1978). Moore and Hyde suggest dividing staff development activities by school initiated and district initiated efforts in order to make sense of the structure and total cost.

[17] Interestingly, Little, et al. (1978) estimated that one semester unit (which yields an average present value of $1,400 in future salary increases) takes 15 hours of class time plus 30 hours of homework, thus the teacher makes about $31 per hour, or slightly more than their normal rate of pay. District sponsored workshops awarded one semester unit for 15 hours of participation, thus compensating the teacher at a rate of $93.33. However, some arguments can be made that these salary increases are more political in nature and would eventually be bargained for in the absence of a professional development pay structure.

[18] If teachers were compensated for personal time or tuition payments through future salary increases, no cost was borne on the teacher because the district paid for this time. When the teachers invested time or money in staff development without accruing any points towards future salary increases, it was considered a personal investment made by the teacher, and including this cost represented the total investment at level-four.

the researchers provide several levels of the definition, the report can more easily be compared to the results of other studies.

Little et al. (1987) chose to express staff development expenditures without salary increases from professional development because, they argue, if salary increases did not exist, in the long run teachers would collectively bargain for increased salary which would make up for the difference. Like other studies, these authors chose not to include teachers' salaried work time when a substitute was replacing the teacher. This decision was made based on the understanding that the loss of instructional time (when the teacher is pulled out of his/her classroom for staff development) was paid for by hiring the substitute, thus authors only included the loss of *instructional* time caused by staff development as a cost; decisions such as these are deserving of a conceptual discussion.

When a substitute is hired to replace a teacher, the students, and more generally, the district, incur a cost in the form of a loss in student learning if the substitute does not perform at the level of the teacher. However, no cost frameworks reviewed for the present study have included this cost because of the difficulty in measurement. When a substitute is hired, he/she must be paid in addition to the teacher who is on salary while receiving professional development, therefore, two additional costs exist. Whether or not to include the cost of teachers' salaried time when a substitute is hired is a complex decision, cost analyses typically measure the cost of hiring a substitute as the daily rate of a substitute (Levin, et al., 2010). I would argue the cost of hiring a substitute is greater than the daily rate of the substitute, therefore, the daily teachers salary should be used, which is typically more than double the expense of hiring a substitute for a day (Levin, et al., 2010; Odden, et al., 2009).

As an extreme example, consider a program that displaces a teacher for an entire year to allow for professional development, and places a substitute in the classroom during this time. Using the daily rate of a substitute, about $120 (Levin, et al. 2010), implies the cost of a year's worth of teacher-time (devoted to staff development) would only be worth that of a year's pay for a substitute. To release teachers for staff development, a district has at least two options: hire a substitute or use a student free, staff development day. For the cost analyst, the problem with using the daily rate of a substitute as a methodological guideline for measuring the cost of hiring a substitute is that if the district wants to devote a day of the teacher's salaried work time to professional development, it is cheaper to hire a substitute than hold professional development during a student free day because substitute time is cheaper than teacher time[19].

Other methods employed by Little, et al. (1987), such as using FTE of personnel to quantify time investments, and multiplying this figure by salary and benefits, were consistent with Moore and Hyde (1981). Based on their 30-district sample, staff development activities represented 4.52% of total district expenses and 5.09% when the private uncompensated contributions of teachers were included. An inconsistent finding of Little, et al. (1987) was that the present value of salary increases resulting from additional university credits represented 61 percent of the total cost, even when personal contributions of teachers were included, while for Moore and Hyde (1981), this was four to nine percent. On the other hand, teacher-time for the three districts sampled by Moore and Hyde (1981) represented from 32-62 percent of total staff

[19] If the contract for all teachers in a district includes one student-free professional development day, and the district wants to add another day of professional development for one teacher, they would only need to hire a substitute and the expenditure would be about $120 for the day. But the cost of this substitute is higher when one considers the loss of student learning. For the purposes of cost analysis, I'm suggesting school leaders and researchers value the cost of a substitute at what it *really* costs to replace a teacher for a day, which is the daily rate of compensation for teachers. As noted earlier, accounting costs are objective, while economic costs are subjective (Stringham, 2007).

development expenses, while the same category represented only 7.2% of the 30-district average figure computed by Little, et al (1987). The large difference is largely due to methodological differences between the two studies. For instance, Little, et al. (1987) considered only professional development days to represent reallocated teacher-time, while Moore and Hyde (1981) included all scheduled meetings or routine activities whose purpose was devoted to the professional learning of teacher.

Miller, Lord and Dorney (1994) analyzed the configurations and costs of professional development efforts in four urban districts across the United States. Like Moore and Hyde (1981), Miller et, al. (1994) chose districts for their diversity in location, enrollment, budget size, and apparent investment in professional development, in order to capture a more complete picture of district investment in professional development. Researchers relied on three sources for data: documents related to professional development, written surveys, and interviews of those involved with staff development. Personnel interviewed and surveyed included superintendents, curriculum coordinators and staff development personnel at the district level; principles from five schools in each district and a sample of teachers from each of the schools examined. The samples were then used to generalize findings across all schools for each of the four districts. Miller, et al. (1994) made several departures from previously discussed studies with regard to cost methodology.

It is clear through the extensive list of ingredients and description of each component that Miller, et al. (1994) incorporated the ingredients method. Like Little et al. (1987), Miller, et al. (1994) included the personal monetary contributions of teachers, but they excluded personal time contributions of teachers, while Moore and Hyde (1981) chose to exclude both these costs. The time devoted during “salaried work time” was included as a cost and this time was valued using

the teachers' salary, but Miller, et al. (1994) did not include the fringe benefits in this figure. The authors also did not include the present value of salary increases as a cost of professional development because they believed it would overestimate the actual amount of spending. When Little, et al. (1987) included these costs they represented the largest single component of professional development.

The portion of salary costs for any personnel should reflect the exact percentage, or as close an estimate as possible, of salaried work time the individual devoted to the initiative being measured (Levin & McEwan, 2001). Another shortfall of the Miller, et al. (1994) cost methodology was revealed in the analysis of the extent to which administrator's time is devoted to professional development. Authors included a "very liberal estimate of administrative salaries" and chose to include a "portion of the salary costs for administrators who may have been only marginally involved in staff development" (17). Personnel time commitments are often a significant source of uncertainty in cost analysis and a chief obstacle in completing accurate cost analysis (King, 1997), therefore, interviews remain the best strategy for an evaluator to accurately asses time commitments of personnel. In order to maximize accuracy, an evaluator can also rely on interviews with colleagues, in order to cross-reference the self-reported time allotments (Hummel-Rossi & Ashdown, 2002), as well as direct observation (Levin & McEwan, 2001). One may also rely on documented evidence if these sources are not sufficient, as was done by Little, et al. (1987) and Moore and Hyde (1981). Evaluator estimates of these figures are never sufficient and will have significant effects on the final results,

especially because personnel in all professional development strategies represent the greatest proportion of expenditures[20].

The findings of Miller, et al. (1994) reflect that of previous ones and indicate an expense on professional development ranging from 1.8% to 2.8%. These percentages represent total expenditures in professional development of between $3.1 and $22.5 million or between $2,729 and $5,487 per teacher in 2010 dollars. Table 6 provides a summary of findings for total and per teacher professional development expenditures from these, as well as one other by Miles, et al. (2003).

Drawing on these studies of whole district professional development expenditures, Odden, et al. (2002) attempted to establish a new framework for such evaluation. Odden, et al. (2002) listed six categories of resources that comprised staff development. These categories included 1) teacher time; 2) training and coaching; 3) administration; 4) materials, equipment and facilities; 5) travel; and 6) tuition and conference fees[21]. Each category is broken down into individual resources, which can be thought of as "ingredients" (Levin & McEwan, 2001). This new framework was adopted by Miles, et al. (2003) in a study of professional development expenditures in five geographically diverse urban districts. In many aspects, the framework resembled that of other professional development cost frameworks developed over the past 30 years (Miller, et al., 1994; Little, et al., 1987; Moore & Hyde, 1981), therefore, only the important differences will be highlighted.

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[20] Personnel expenses represented the highest cost in virtually all studies of professional development activities in school districts. This finding is consistent in almost all educational initiatives (Levin & McEwan, 2001).

[21] Miles, et al. (2003) also mention two additional categories, future salary increases of teachers resulting from professional development and district level research and development in professional development, but excluded these from their analysis.

This new framework, developed by Odden, et al. (2002) and piloted by Miles, et al. (2003) had three deviations from previously suggested frameworks (Miller, et al., 1994; Little, et al., 1987; Moore & Hyde, 1981). The first affected how teacher time spent after and before school on staff development was treated. Miles, et al. (2003) included only those meetings after or before school that are regularly scheduled, and within the teacher contract time as a cost of professional development. Unlike Little, et al. (1987), who included uncompensated time as a personal investment on the part of the teacher, Miles, et al. (2003) ignored this cost, choosing to consider only *district* expenditures on professional development. Miles, et al. (2003) used a method consistent with previous frameworks to calculate the cost of regularly scheduled personnel time devoted to professional development. The total hours devoted to professional development by the individual are divided by the total contracted hours for the given year to calculate FTE devoted to professional development. This figure is then multiplied by the salary and fringe benefits of the individual. This method is similar to the method used in studies of labor supply from the economics literature (Mroz, 1987).

A second variation involved the treatment of time for curriculum specialists or school-based coaches[22]. Miles, et al. (2003) distinguished on-site facilitators, school-based lead teachers, school-based coaches and teacher mentors as each having distinct roles. In general terms, all of these individual roles involves working with teachers, one-on-one or in small groups, to improve instructional strategies. Employees in these roles are compensated in one of two ways; either through additional stipends or through a reduced teaching load. Killion (2009), who has written

[22] Both Little, et al., (1987) and Moore and Hyde (1981) define curriculum specialists as those individuals who work in schools with teachers and students and spend time individually developing curriculum guides. The term *coaching* was not widely used at the time of these publications (Darling-Hammond, et al., 2009). Killion (2009), who has written extensively on the various roles of school based coaches, has indicated that school based coaches can fulfill all of these roles.

extensively on the various roles of school based coaches, has indicated that a school-based coach might fill all of these roles. For Miles, et al. (2003), the district devoted funds to professional development if one of these individuals was given a stipend to provide training to teachers or was granted a reduced classroom-teaching load, in which case the portion of their salary specifically devoted to training teachers was classified as a cost to professional development for the district.

For some of these individuals, their contract stipulates that they devote all of their salaried work time to professional development for teachers, through activities such as developing curriculum and curriculum guides, examining data, partnering with the principal and, of course, meeting with teachers for the purposes of training. However, these individuals may also devote some time to activities not relating to professional development, even though their written contract suggest otherwise. Miles, et al. (2003) included the entire salary and benefits of school-based coaches as a cost to professional development, while other studies (Miller, et al., 1994; Little, et al., 1987; Moore & Hyde, 1981) included only the portion of time individuals reported devoting to professional development of teachers. For instance, Moore & Hyde (1981) did not include the time curriculum specialists[23] spent creating curriculum guides, and Miller, et al., (1994) included only the percentages of time these employees devoted directly to teachers' professional development, which was estimated through interviews.

Depending on the context, coaches might devote some of their salaried work time to administrative duties, subbing or lunch duty. Deussen, et al. (2007) found Reading First[24] literacy

[23] The work of curriculum specialists, school-based coaches and other learning facilitators in schools can be quite discrete, but for cost analysis purposes, their roles are treated similarly.
[24] Reading First is a federal project aimed at improving reading skills for students in Kindergarten through third grade in 5,200 low-performing schools across the nation. This program places a literacy coach in each school building.

coaches in five states spent on average between 3-12% on such activities. According to Odden, et al. (2002), while coaching positions commonly involve such activities, it is too difficult and sometimes impossible to accurately tease this time out. Following this directive, Miles, et al. (2003) included the entire coach salary as a cost of professional development to the district. Thus, one might infer that if such activities of the coach can be parsed out, the salary of the coach should be adjusted to reflect only the time devoted to teachers' professional development.

A third variation involved the time that a coach spent observing or modeling in a teachers' classroom. Miles, et al. (2003) and Little, et al. (1987) did not assume any cost to be borne during this time, while Moore and Hyde (1981) included this as teachers' salaried work time devoted to professional development. It is unclear how other frameworks reviewed for the present study have categorized this teacher-time, in part, because modeling and observing were less common practices at the time of their publication (Darling-Hammond, et al., 2009). According to Odden, et al. (2002), when teachers participated in staff development during "student time," defined as contracted work time when the teacher and students are in the classroom together, no instructional time was lost. Therefore, Miles, et al. (2003) did not include the cost of teacher-time when the coach modeled or observed lessons in the classroom. However, staff development activities during "non-student time," defined as contracted work time when no students are present, represented a reallocation of teachers' time, therefore Miles, et al. (2003) included this as a cost of professional development.

Other variations across frameworks exist, including whether to include salary increases as a result of professional development, whether to include personal monetary contributions of teachers, and how to categorize findings; however these differences are less relevant to the current study. The four frameworks described above (Odden, et al., 2002; Miller, et al., 1994;

Little, et al., 1987; Moore & Hyde, 1981) highlight the inconsistencies in methods used to measure the cost of educational professional development.

The differences in findings across the four cost analyses of professional development reviewed resulted in part from this variation in cost frameworks. Miller, et al. (1994) estimated cost per teacher of professional development and included only regular teachers, while Little, et al. (1987) included all types of teachers in a district (district-hired and federally funded). The size of the district, of course, also played a major role in the total estimated expense on professional development. That being said, examining the percent of total district investment reveals a fairly consistent finding: districts have historically invested between two and seven percent of their entire budget to the professional development of teachers, or about $2,500 to $9,400 per teacher in 2010 dollars[25]. Odden (2000) as well as Odden and Archibald (2009) have suggested an investment of about $500 per pupil in 2010 dollars, which translates to about $13,900 per teacher based on his assumed average class size of 27.8 pupils per teacher[26]. Unfortunately, while each of the studies reviewed above addressed effectiveness in qualitative ways, none attempted the type of quantitative evaluation required to compute cost-effectiveness ratios.

[25] The consumer price index is used to convert nominal dollars to current year dollars.
[26] Odden (2000) based his calculations on a school of 500 students with 18 teachers.

Table 5: Differences in Cost Frameworks Used in Studies of Teacher Professional Development

Authors	Sample	Treatment of Teacher Time and Salary				
		Fringe Benefits	Personal Time Inputs	Personal Monetary Inputs	When Coach is in Classroom	Salary Increases from P.D.
Moore & Hyde (1981)	3 districts with diverse P.D. investment	Yes	No	No	Yes	Yes
Little et. al. (1987)	30 randomly selected districts in California	Yes	Yes	Yes	No	Both
Miller, Lord & Dorney (1994)[2]	4 urban districts with diverse size and location	No	No	Yes	N/A	No
Miles, Odden, Fermanich & Archibald (2005)	5 large urban districts with diverse location	Yes	No	No	No	No

Table 6: Findings from Studies of Professional Development (P.D.) Expenditures

Authors	Total P.D. Expenditures (Nominal Dollars in Millions)	Total P.D. Expenditures (2010 Dollars in Millions)	Cost per Teacher (Nominal Dollars)	Cost per Teacher (2010 Dollars)	Percent of District Budget
Moore & Hyde (1981)	$9.368	$24.805	$1,768	$4,681	5.72%
	$4.607	$12.198	$1,124	$2,976	3.76%
	$4.069	$10.774	$969	$2,566	3.28%
Little et. al. (1987)[27]	N/A	N/A	$4,733	$9,422	5.09%
	N/A	N/A	$1,851	$3,685	1.99%
Miller, Lord & Dorney (1994)[28]	$16.499	$25.658	$4,023	$6,256	2.62%
	$8.514	$13.240	$2,128	$3,309	2.18%
	$4.286	$6.665	$3,098	$4,818	2.29%
	$2.462	$3.829	$4,313	$6,707	3.42%
Miles, Odden, Fermanich & Archibald (2005)	$11.200	$13.281	$2,100	$2,490	2.30%
	$19.500	$23.123	$5,000	$5,929	3.10%
	$8.600	$10.198	$2,700	$3,202	2.20%
	$36.300	$43.045	$7,900	$9,368	6.90%
	$19.500	$23.123	$4,200	$4,980	3.70%

[27] For Little, et al., (1987), upper row includes salary increases and lower row excludes them.
[28] For Miller et al., (1994), figures have been adjusted to include fringe benefits.

Limitations of Cost and Cost-effectiveness Studies

The following section examines some limits of cost and cost-effectiveness analysis through a discussion of two cost analyses with serious methodological flaws (Schiefelbein, et al, 1998; McKinsey & Company, 2009). The Schiefelbein et al., (1998) study shows the importance of discounting and using the correct units of measurement. The reported cost per year, per pupil and per teacher become slightly distorted causing the results to be invalid. A study by McKinsey & Compnay (2009) exemplifies the pitfalls in failing to use the ingredients method when measuring cost. The use of the term cost-effectiveness can become rhetorical when researchers refer to a particular intervention as being more cost-effective without rigorous cost and effectiveness measures (Clune, 1999).

Schiefelbein, et al. (1998) attempted to measure the cost-effectiveness of 40 possible primary school interventions, implemented in a "hypothetical country" in Latin America, which was based on average demographics of Latin American countries. The country had of population of 20 million with 2 million in grades 1-6 and a total cost of primary education of $400 million, so the cost per pupil was $200. Possible interventions included preschool for low-income students, providing bilingual education, free and reduced price lunches for low-income students, adding additional time to the school year and providing peer tutoring, among others. Rather than conducting or reviewing empirical research, Schiefelbein, et al. (1998) measured effectiveness by polling a panel of 10 international experts in education including Martin Carnoy, Steve Heyneman, Henry Levin, Himelda Martinez, Fernando Reimers and Juan Carlos Tedesco as well as 30 education planners and practitioners who attended the UNESCO/Orealc educational planning course. Each educational expert was asked to provide an estimate of how much students' sixth grade test scores would increase following the implementation of each

intervention, compared to a cohort of sixth grade students who did not received the intervention. Schiefelbein, et al. (1998) recommended this alternative methodological approach on the basis that it is far less time-consuming and because even rough estimates of cost-effective practices in education would provide a major contribution to the overall dearth of knowledge on the topic. Most of the estimates for student test score increases were consistent among all the panelists; however, flaws in cost methodology rendered the cost-effectiveness ratios invalid.

To acquire estimates of costs, Schiefelbein, et al. (1998) originally combined their own estimates[29] with the estimates of 30 educational planners and practitioners in Latin America, but disagreed with the costing methods of the Latin American educational planners who reportedly misunderstood questions, used a different definition of costs or had a lack of awareness of a particular intervention. Schiefelbein et al. (1998) spent "an entire day to come up with cost estimates", however, only brief explanations were provided as to how their estimates were made. An ideal estimate of costs involves a systematic method of reviewing documentation, conducting interviews with key personnel and direct observations of programs in which educational interventions or reforms have been implemented. This approach is time consuming and was beyond the scope of the Schiefelbein, et al. (1998) study.

Unfortunately, even with the estimates they provide, they ignore commonly used cost methodology techniques, for instance, there is widespread agreement among program evaluators that costs paid over multiple years should be discounted to present value; however, Schiefelbein, et al. (1998) did not discount costs paid over a 6-year period. A dollar today is always worth more than a dollar a year from now because for one year, the dollar can earn interest in a savings account that exceeds the rate of inflation. Schiefelbein et al., (1998) used the estimated $200 cost

[29] Schiefelbein, et al. (1998) encouraged feedback from readers regarding the adequacy of their cost estimates.

per pupil of primary education and applied this for the cost of preschool for 50% of children deemed at-risk for failure, so the total cost per pupil was estimated at $100 if half the children attend preschool. Because the effectiveness is measured in grade six, Schiefelbein et al., (1998) pro-rated the figure over six years by dividing the $100 by six to get a cost per pupil of $16.67. If the costs were incurred in the final year, they should be discounted to reflect the present value over six years, but if the costs were incurred in the first year, cost should be adjusted to the future value, when students reach grade six. In any event, the costs should be adjusted to make comparisons with other interventions appropriate.

Another intervention analyzed, providing bilingual education to indigenous 1st and 2nd graders, is estimated at $11.05 per indigenous student or $1.11 per student for all students in grades one through six[30]. However, no discussion is provided regarding pro-rating or discounting, as was done for preschool. Finally, the cost of in-service training to teachers is estimated at $18 for training plus $2 for travel and materials per teacher, for a total of $20 per teacher. Other interventions in the study assume 29 students per teacher, thus the cost per pupil should have been $.69, resulting in a .3% increase from the original estimate of $200 cost per pupil. Unfortunately, the estimated cost of $20 per teacher was not divided by the amount of students per teacher, so Schiefelbein et al., (1998) combined the cost per teacher of $20 and cost per student of $200 to conclude in-service training to teacher would result in a 10% increase in total cost per pupil. Using the estimated impact on test scores provided by the panel of experts, the cost-effectiveness of teacher in-service training was ranked 37th out of 40, but when the correct cost units are used, the intervention moves up to 12th place. If there exists uncertainty in

[30] The hypothetical country included a 10% indigenous population, so if an intervention is implemented for the indigenous population, 10% of students, the cost per student for all students is only 10% of the "per indigenous student" cost.

estimates, even when the correct calculations are used, sensitivity analysis (Levin & McEwan, 2001) can be applied to test the effect of particular estimates. By using sensitivity analysis, a researcher may select the upper and lower bounds of an estimate of costs or effectiveness and calculate the difference between the two in overall cost-effectiveness.

Schiefelbein et al., (1998) note that the study is meant to guide future research on intervention policies and cost-effectiveness in Latin American education, rather than providing definitive results of cost-effectiveness, so the reader should interpret the results with caution. As Schiefelbein et al., (1998) describe in their closing statements, the agenda for more rigorous cost-effectiveness research, which "should eventually be the basis for objective decisions on education development", was laid out. Perhaps another strength in the analysis is the separation of interventions that are clearly very cost-effective, such as assigning best teachers to first grade and establishing and enforcing an official length of the school year, from those that are not at all cost-effective for Latin American countries, such as school feeding programs and teacher salary increases.

A study by the think tank, McKinsey & Company (2009) measured the equity, effectiveness and efficiency of the United States school system relative to other developed nations around the world. The report received praise for its analysis of educational inequality in United States schools and the associated consequences (Friedman, 2009); however, the study's measures of cost-effectiveness reflect invalid estimates of costs. The study reported international rankings of test scores on the Programme for International Student Assessment[31] (PISA) math and science sections in 2006, which placed the U.S. 24th in science and 25th in math out of the 30

[31] The Programme for International Student Assessment is an assessment of math, science and reading for 15 and 16 year olds living in member countries of the Organisation of Economic Cooperation and Development. The exam has been administered every three years since 2000.

member countries of the Organisation of Economic Cooperation and Development (OECD). Test scores were combined with education expenditures for each OECD country to compute measures of cost-effectiveness, finding that the U.S. paid the highest amount per student per point on the math section of the PISA. In order to make such a claim, the costs should reflect all expenditures incurred to produce the measured outcome, but because the study only examines total public expenditures on education, there are inherent flaws.

First, educational systems do not always have the same goals (Feinberg & Soltis, 2004, Levin, 2002). A requirement of comparing cost-effectiveness of two interventions is that they have similar goals, and this holds true for cost-effectiveness comparisons of whole country educational systems. In U.S. schools, many goals are accomplished and costs incurred with no intention of raising math scores. These may involve efforts to improve students' civic engagement, drop out rates, physical fitness, or socialization, among many others (Levin & McEwan, 2001). If the sole purpose of the education system were to improve literacy in math, total expenditures[32] might be appropriate; otherwise, using total expenditures can be troublesome. Secondly, there is no evidence student demographics were controlled for in this particular aspect of the study, however, heterogeneous classrooms involve costs not incurred in homogenous classrooms, such as the need for teachers to differentiate instruction for students with different levels of background knowledge or the need for special education services. Of course geographic locations differ in their level of diversity, therefore, comparisons of costs between specific interventions or between educational systems should correct for student demographics if there is reason to believe the student demographics are significantly different.

[32] Odden et al. (2002) distinguish the difference between expenditures and a costs; the former reflects actual line items on a budget sheet, while the ladder measures the value of all resources required to produce a given outcome.

Including all expenditures for the U.S. education system assumes that other countries face similar impediments to equitable education, which may not be the case for countries like Sweden or Korea (World Bank website, 2010).

By using total expenditures, the authors inherently include costs in the American public school system that pay for students' after school tutoring, as well as music and art classes. In other OECD countries, families in the private sector often pay these expenses. Private tutoring expenses in Vietnam and Turkey are well above that of the average American family (Dang, 2007). Private expenditures on tutoring in any country should be included if they improved the scores of the measured outcome, math PISA scores. Athletics also represent a significant proportion of expenditures of the U.S. school system, and there is little evidence to supports that this expense raises math scores, or is even intended to (Ward, 2008). In order to undergo rigorous cost analysis, one must include all costs needed to produce the desired outcome, and exclude costs that were not incurred as a result of this effort, so the PISA math scores may not reflect all the expenditures of an education system.

Odden and Archibald (2009) recommend schools spend $450 per pupil for teacher professional development, which included three areas: $42 per pupil for additional professional development days for teachers, $100 per pupil for trainers and consultants and $311 per pupil for instructional coaches, all measured in 2005 dollars. Unfortunately, this estimate breaks two important rules of cost analysis. The first is in determining the value to place on the time of a coach; Odden and Archibald (2009) used at the same rate of teachers. All coaching models reviewed for this study called for coaches to be expert teachers, often holding a master's degree, with at least five years of experience, although most have more than that (Duessen, et al., 2007; Neufeld & Roper, 2003), therefore, using average teacher salaries for coaches is inappropriate.

Dealing with a similar issue, Parrish (1994) found that bilingual teachers in LEP programs were paid less on average because they had less experience and less education on average then regular classroom teachers. Parrish (1994) chose to use the standard national average teacher salaries for bilingual teachers because he identified this difference in salaries as a short-term disequilibrium of teacher salaries and because the qualifications of each group were relatively similar. This is not necessarily the case for coaches, who are required to have greater qualifications than the average teacher; thus average teacher salaries are an inappropriate value to place on the time of coaches.

The second problem is the treatment of reallocated time of teachers. Odden and Archibald (2009) recommended one instructional coach per 200 students, so for an average school of 500, 2.5 coaches are needed. To measure the cost of 2.5 instructional coaches, Odden and Archibald (2009) added 30% for fringe benefits to the average teacher salary in 2005 of $47,808 for a total compensation of $62,150.40. Multiplying this figure by 2.5 instructional coaches for the school, Odden and Archibald (2009) concluded that implementing a coaching program with a ratio of one coach per 200 students, in an average school of 500 students and 18 teachers would cost $155,376 or about $311 per pupil, based on an average class size of 27.8. Unfortunately, for a school to implement coaching, the time of the teachers, the principal and perhaps other curriculum coordinators is required, yet this reallocation of personnel time is ignored. Levin (2002) has also identified the problem of excluding allocated personnel time in the cost analyses of whole school reform models by Odden and Archibald (2001) and by Odden et al., (2000). A particularly important issue in conducting cost analysis in education is the inclusion of the reallocation of resources. Many educational interventions require the time of teachers during non-student time. These might include instructional coaching, but they may also

include after school tutoring provided by teachers, administrative meetings, or implementing whole school reform models (Levin, 2002). The implementation of any of these strategies appears costless in that teacher salaries will be paid regardless of whether their time is needed for a specific initiative; however, reallocating personnel time requires some sacrifice of other programs (Levin, 2002).

A final issue with the calculations presented by Odden and Archibald (2009) involves the exclusion of fringe benefits when calculating the cost of five additional professional development days. Odden and Archibald (2009) used an average days per contract year of teachers, 205, the average teacher salary of $47,808 to find that five extra days would cost $1,166 per teachers or about $42 per pupil, based on an average class size of 27.8[33]. Interestingly, while Odden and Archibald (2009) used 30% fringe benefits in their calculation of the cost of hiring coaches into a coaching program, they made no mention of fringe benefits for additional professional development days, and did not explain why they were left out for this part of the analysis. Including 30% for fringe benefits raises the estimate to $52.43 per pupil. One explanation might lie in how teacher contracts are written. Teachers are classified as 100 percent full time for benefits purposes and districts already pay the full health care and retirement account payments, so adding additional time to their contract at the end or beginning of the school year does not increase fringe benefits payments; perhaps for this reason, they are excluded. The numbers presented by Odden & Archibald (2009) are not based on actual implementation sites, rather on theoretical or hypothetical situations. While this strategy can be useful in estimating the general pattern of costs, using actual programs as well as employing the ingredients method will ensure the evaluation includes all costs of model.

[33] $47,808 * (5 extra days / 205 initial days) = $47,808 * (2.44%) = $1,166 per teacher. Next, $1,166 is divided by 27.8 pupils per teacher, so $1,166 / 27.8 = $41.94 or about $42 per pupil.

In a comprehensive review of cost-effectiveness studies in education Clune (1999) used the Educational Resources Information Center (ERIC) to find roughly 9,000 articles that contained cost-effectiveness as a key word. By narrowing his search to studies published between 1991 and 1996, and ones that focused solely on elementary and secondary education, Clune was able to examine 541 studies closely. Of these, only 1% of them were found to have used rigorous cost methods. Clune concluded that over 80% of the studies, which claimed to use cost-effectiveness analysis, contained no evidence of a systematic methodology. Furthermore, very few studies in education overall claimed to use cost-effectiveness analysis. The low number of cost-effectiveness studies, coupled with the low quality of many of the published studies points to a major gap in the literature of education research and makes a strong case for cost-effective analyses to come. Errors in most cost analysis studies stem from the failure to incorporate the ingredients method in which all inputs required to produce a given output are listed and described in detail (Levin and McEwan, 2002). When an evaluator leaves out important aspects of an educational intervention, there can be major flaws in the cost and cost-effectiveness results.

As one can infer from the studies discussed in this literature review, the methods of economic cost analysis in education have been developed over the past 40 years, yet because of its subjectivity, a general consensus has yet to be fully reached. While the methodological debates are still present, many years of research in the subject area, summarized with useful texts (Levin & McEwan, 2001) has provided cost analysts with a useful tool for educational evaluation. At the same time, the need for additional cost analyses in education has certainly been agreed upon. Because the quality of the teacher is such a strong predictor of student success, because professional development has been proven to raise teacher quality and because

professional development can be very expensive, cost analysis of teacher professional development is vital for the United States to move forward on educational progress and reform.

Chapter 3: Methodology of Cost Analysis

Introduction to the Methodology of Cost Analysis

This chapter will provide a discussion of how the study took place, drawing on the methods of cost analysis described in chapter 2. The methodology involved the use of the "ingredients method" (Levin & McEwan, 2001; Parrish, 1987; Moore & Hyde, 1978), which has been described in three basic steps. This chapter describes those steps and then discusses several nuances that arose in the present study. I chose the ingredients method because it most closely resembles the economic cost, that is, the value to replace the resources used by the program or intervention (Hartman, Bolton & Monk 2001). The average cost *per teacher* was used to compare the four approaches to teacher professional development. The general method of cost analysis (the "ingredients method"), the method for discounting ingredients that last multiple years, the analysis of total costs, average costs and marginal costs, the framework developed to conduct a study of the cost of coaching and the economic model[34] created by this framework are discussed in the following sections.

The Data Sources

The sample for this study included five instructional coaches working in a Midwestern school district with approximately 14,200 students, 1,200 full-time teachers and 34 schools. In the 2009-10 school year, 71 percent of the students received free and reduced price meals, 54 percent were classified as ethnic minorities, including 23 percent classified as African American, 21 percent Hispanic, six percent multi-ethnic, two percent American Indian or Alaskan native and one percent Asian. The instructional coaches were supported by a grant from the U.S.

[34] Throughout this paper, the term *model* has been used to describe several different approaches to coaching and it referred to a specific set of guidelines designed to direct the actions of a coach. Here, model is meant, in the economic sense, to represent a set of variables with logical, quantitative relationships between them.

Department of Education. The grant was awarded to a nearby university that hired and facilitated the implementation of the program by providing on-going training for instructional coaches. The district and university worked as partners to implement the instructional coaching program. The instructional coaches worked full time at three different sites; two schools had one instructional coach each. These schools are referred to as School 1 and School 2. The third school had three instructional coaches and is referred to as School 3.

Applying the "Ingredients Method"

In general, the "ingredients method" involves three steps: indentifying the ingredients, placing a value on the ingredients and finally, apportioning costs to each party for whom costs are incurred.

Step 1: identifying the ingredients. In order to identify the resources (ingredients) involved in instructional coaching, I reviewed selected documents and administered interviews with each of the instructional coaches. Documents included research syntheses of school-based coaching by Darling-Hammond, et al., (2009), the RAND Corporation (Birman, et al., 2007) and by Neufeld and Roper (2003), as well as the book *Instructional Coaching* (Knight, 2007), an unpublished journal article on instructional coaching (Knight & Cornet, 2007) and workbooks on instructional coaching that are provided to attendees of Instructional Coaching Institutes[35]. Reviewing documents allowed me to gain background knowledge of the model, particularly regarding the typical resources required of a coaching program. From a resource use perspective, coaching models are quite similar. One should expect any coaching program that uses the instructional coaching model to involve instructional coaches themselves (referred to as "coach

[35] Instructional Coaching Institutes provide current or new instructional coaches with training to help them master their roles as instructional coaches. Instructional Coaching Institutes are hosted by the University of Kansas, Center for Research on Learning. For more information see www.instructionalcoach.org.

time"), time commitments of principals and teachers, the use of a copy machine, procurement of workbooks for coaches and some opportunities for professional learning for the instructional coaches in the program.

After becoming familiar with the resources required for the instructional coaching model, I reviewed financial documents specific to the three target schools to gain more information regarding what resources had actually been used. These documents included invoices, expenditure spreadsheets prepared by the university grant administrators, school calendars and school personal job descriptions and job postings. Grant-related documents indicated that workbooks and copies were common expenses for the coaches in the program. Teacher stipends were also provided to teachers who worked with instructional coaches. According to district job descriptions, teachers and coaches were contracted to work 1,464 hours per year and the principal and other administrators were required to work 1,820 hours per year; this data allows for hourly wage calculations.

As the next step, I interviewed the five instructional coaches in the program[36] who could provide further insight regarding resource use. During the interviews, instructional coaches described the materials and equipment they used in their role as coaches, as well as their own professional development experiences. They were also asked to list all school staff with whom they interacted, the estimated total amount of school staff contact hours for each individual staff member and the total amount of hours they devoted to coaching ("coach time"). The instructional coaches were unable to estimate accurately staff contact hours and coach time right way, so after the initial interviews, I corresponded with each coach through email and provided

[36] Instructional coach interviews took place following the last week of the 2009-10 school year and the coaches provided data for the past school year. This helped ensure their estimates of teacher and principal contact hours would be as accurate as possible.

templates for coaches to input this data. Coaches went through their yearly calendar (on their own) and recorded how many contact hours they had with each teacher, the principal and other school administrators, as well as the total amount of coach time. Through this process of correspondence, the coaches reported that the following resources were required for their roles: the salaried work time of teachers, principals and curriculum specialists[37], their own salaried work time ("coach time"), laptops, workbooks and copies, and professional development provided to them.

An example of the total teacher contact hours for one coach is presented in Table 7, which describes the duration of interactions between all collaborating teachers[38] and the instructional coach at School 1 during the 2009-10 school year. The first column lists each teacher. Names have been hidden for confidentiality purposes. Next, column A shows the total amount of time, measured in hours, each teacher devoted to coaching. Column B, one-on-one coaching, involves teacher meetings in which the coach went through the traditional components of coaching: enroll, identify, explore and reflect, with each teacher. Column C involves the time teachers spent in small group meetings with an instructional coach. This time can include leading a professional learning community, or gathering a small group of teachers who have identified a similar goal. Column D includes times the coach met with large groups, in workshop-type settings; at School 1, the coach did not hold any large group meetings. Column E is an estimate

[37] One coach had several meetings with the curriculum specialist in the school building. The curriculum specialist in this school focused on *what* was being taught, while the instructional coach worked with teachers to improve *how* this content was taught.

[38] A collaborating teacher is a teacher who voluntarily chooses to work with the coach. According to the instructional coaching model, teachers who work with the coach do so on a voluntary basis, thus any teacher the coach has a scheduled meeting with is referred to as a collaborating teacher.

of how much time the teacher spent preparing for meetings[39]. Finally, column F shows the amount of time the coach spent inside the teachers' classroom, observing the teacher and modeling lessons. Similar data for Schools 2 and 3 is included in the Appendix.

[39] Due to the difficulty I faced in contacting individual teachers, coaches provided this data. This time is included because one of the promises of a coaching program is that the coach will have a large impact on instruction in the school and teachers will implement new teaching strategies. Without preparation for meetings with coaches, teachers would not have time to plan to implement new strategies and effectively use their time with the coach.

Table 7: Total Amount of Teacher Time Devoted to Instructional Coaching at School 1

Teacher	A. Total Hours Devoted to Coaching (B + C + D + E)	Coaching Activities (hours)				
		B. One-on-one Coaching	C. Small Group Coaching	D. Large Group Coaching	E. Teachers' Meeting Preparation	F. Modeling and Observing
Teacher 1	8	5	3	0	0	2
Teacher 2	38	33	3	0	2	13
Teacher 3	6	3	3	0	0	0
Teacher 4	5	2	3	0	0	9
Teacher 5	5.5	2.5	3	0	0	2
Teacher 6	13.5	9.5	3	0	1	14
Teacher 7	1	1	0	0	0	0
Teacher 8	6	5.5	0	0	0.5	11
Teacher 9	16.5	15.5	0	0	1	16
Teacher 10	16.5	12.5	3	0	1	14
Teacher 11	4.5	4.5	0	0	0	6
Teacher 12	8.5	8.5	0	0	0	8.5
Teacher 13	1.5	1.5	0	0	0	2.5
Teacher 14	1	1	0	0	0	1
Teacher 15	1.5	1.5	0	0	0	3
Teacher 16	2	1.5	0	0	0.5	2
Teacher 17	7	6	0	0	1	5
Teacher 18	8	8	0	0	0	5
Teacher 19	5	4.5	0	0	0.5	6
Teacher 20	1.5	1.5	0	0	0	0
Teacher 21	5	4	0	0	1	1
Teacher 22	3	3	0	0	0	0
Teacher 23	6	3	3	0	0	0
Total Hours	170.5	138	24	0	8.5	121
Total FTE	11.65%	9.43%	1.64%	0.00%	0.58%	8.27%
FTE / teacher	**0.51%**	0.41%	0.07%	0.00%	0.03%	0.36%

Note column F is not added to the total amount of teacher contact hours. When the coach is observing or modeling inside the teachers' classroom, no cost is incurred from the teacher because students are still receiving instruction; this time is referred to as "student time". Alternatively, "non-student time" refers to any contracted time the teacher is not with students. When non-student time is devoted to coaching, a cost is incurred; however, when student time is altered or changed is some way, the objective of instructing students is still fulfilled, so only the coach's time is considered a cost. Once this data was collected for each teacher, the total and average amount of teacher contact hours were calculated to determine the full-time equivalent (FTE) teachers' time required at each school for each coach.

During the interviews and follow up emails, coaches also reported the amount of time they devoted to their roles as coaches ("coach time"). Because each coach worked full-time in their role, this was close to 100% FTE; however, all coaches in the sample reported devoting some of their salaried work time to grant-related activities[40]. Grant-related activities included meetings with principal investigators and giving presentations to other coaches outside their district. The time devoted to grant-related activities was discounted from their salary and benefits; for instance, one coach reported a total of 51.5 hours devoted to grant-related activities during the school year. This comprised 3.5% of the total salaried work time for the school year; so, only 96.5% of their salary and benefits was counted as a cost to the coaching program.

Principal time was treated slightly differently. Only the time in which the principal was physically meeting with the coach, or directly preparing to meet with the coach was included; the

[40] Coaches had some quarrels with this reporting because the time they perceived as coaching was only that time directly meeting with teachers; however, for cost analysis purposes, the background work of coaching is also included. The only time counted as "not coaching" took place when coaches were pulled away from their regular routine for something that produced a benefit outside their role as a coach. Checking email, setting up an office or resolving computer problems were all classified as costs to the coaching program.

behind the scenes activities of principals which were arguably "devoted" to the coaching program were excluded[41]. The same method was also used for measuring contact hours with other administrators such as curriculum coordinators or specialists. Coaches in the sample met with the principal for as little as four total hours during the school year, to as much as 45 minutes per week. Only one coach reported meeting with other administrators, which included a curriculum specialist and a department head.

Equipment was comprised of laptops supplied to each coach[42]. Coaches reported workbooks and copies were also necessary as a way to create tools for teachers; these expenses are categorized under materials. Other costs incurred in the production and implementation of the coaching model included additional energy and utilities used in schools by coaches, but these costs were economically insignificant in the overall findings and were excluded in the final analysis.

Coaches and developers of the instructional coaching model continually stressed the importance of professional learning for coaches in order for coaches to be effective in their role, so including the cost of professional development of instructional coaches was essential. Coaches took part in two forms of professional development, initial start-up professional development and ongoing professional development. These experiences were described in full detail during instructional coach interviews and follow up correspondence. The ongoing professional development for instructional coaches in the sample was unlike other coaching

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[41] Some research has demonstrated that the extent to which principals see themselves as instructional leaders affects how much time they will devote to the coaching program (Killion, 2007); however, this time is very difficult to measure, and it is arguably part of their contract anyway.

[42] Coaches reported the laptops were vital to their jobs. By definition, all resources that were regarded by coaches as integral to the process of coaching are considered "ingredients", so their own professional development, which took place during salaried work time, and hardware supplied to them were included in the analysis.

programs because of the coaches' affiliation with the sponsoring university. Rather than attending large coach-training workshops, the coaches met for two hours bi-weekly with an instructional coach facilitator, for a total of approximately 80 total hours per year. At each meeting, seven coaches met with one facilitator, who was a qualified professional developer of coaches.

The pre-service professional development was different for each coach, depending on when the coach joined the program. The program began with only three instructional coaches, and there was not an established method for training new coaches. These coaches met intensively with university faculty prior to the first year of implementation. After two years, one coach left the program and during the following year, three new coaches were hired. At this point, the program developers had established a method for training new coaches, which involved attending the Instructional Coaching Institute, levels one and two, attending two days of Strategic Instruction Model (SIM)[43] Professional Learning sessions, attending the Instructional Coaching Conference and shadowing a coach for three days. Lodging and transportation had to be provided for each coach, which included an average of 60 miles per coach per event (four total) and a total of eleven nights of lodging per coach. The total salaried work time for each coach was three days each for level one and level two Instructional Coaching Institutes, two days for the SIM workshop, three days to attend the Instructional Coaching Conference and three days of coach shadowing, totaling 14 days or 112 hours of salaried work time. The start-up professional development experienced by newer instructional coaches most accurately reflects

[43] SIM professional learning sessions are administered through the University of Kansas, Center for Research on Learning. These sessions are designed to train teachers to use research based teaching practices.

what is required for a new coach, so it was used as the cost of start-up professional development for all coaches.

A final cost involved in the coaching program was teacher stipends for participating in the instructional coaching program. According to the financial documents provided by grant administrators, teachers were compensated at the rate of $14 per hour for any meetings they had with instructional coaches. During the last two school years, very few teachers decided to turn in the required paperwork for reimbursement of this time. Also, the total expense was quite minor, ranging from $53 to $1,130 per coach. Because these stipends were so rarely submitted and because they are idiosyncratic to the particular sampled instructional coaching program, they were left out of the analysis[44].

In order to obtain data on traditional professional development for comparison, I located two sources. Associates at Marzano Research Laboratories™ and at Staff Development for Educators™ supplied data regarding the cost of hosting presenters and attending conferences. These figures are presented in order to allow for a comparison between traditional approaches to professional development and the instructional coaching model. High and low estimates of cost are provided to express the varied scale school districts procure and deliver different approaches to professional development (King, 1994). Unfortunately, cost figures for traditional approaches to professional development are not based on specific school sites; rather, they reflect a general guideline described by associates of each organization.

Step 2: assigning a value to ingredients. United States market wages, measured by national average salaries, were applied to each personnel member. Citing the National Education

[44] Parrish (1994) dealt with similar stipends for teacher aides and also elected to exclude them from his analysis for the same reason.

Association, Snyder and Dillow (2010)[45] reported elementary and secondary public school teachers across the U.S. were paid an estimated average base salary of $53,910, for the 2008-09 school year (Snyder & Dillow, 2010). Fringe benefits were added to this figure at an estimated 25% for total compensation of $67,388 for the 2008-09 school year. In order to reflect wages from the 2009-10 school year, a final adjustment is required that adjusts for inflation. To account for inflation, Snyder and Dillow (2010) used the Consumer Price Index (CPI), specifically the *All Items Consumer Price Index for All Urban Consumers for the U.S. City Average* (CPI-U), with the base year as an average of three years, 1982-84 = 100 (Bureau of Labor Statistics, 2010)[46]. Snyder and Dillow (2010) then converted this index to a "school year CPI", by averaging the monthly CPI beginning in July of the first year of the school year through June of the second year in the school year[47] (Snyder & Dillow, 2010). The school year CPI for 2008-09 and 2009-10 were 214.6 and 216.7, so 2008-09 salaries should be adjusted by a factor of 1.0101. The reported nominal teacher compensation of $67,388 for school year 2008-09 (Snyder & Dillow, 2010) was adjusted to school year 2009-10 prices for a total compensation of about $68,068 in 2009-10 dollars.

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[45] Each year, the Institute for Education Sciences (IES) publishes the *Digest of Educational Statistics*, which is currently compiled by Snyder and Dillow (2010).

[46] The adjusted school year CPI represents only a minor change from the CPI published by the Bureau of Labor Statistics, but since it was used by the IES publication, it was also used for the present study.

[47] Inflation adjustments usually use the average CPI-U for the calendar year; however, Synder & Dillow (2010) used the average CPI-U for the school year, measured in twelve months from July through June of the following year.

Table 8: Average CPI for Selected Years and the Corresponding Adjusted School Year CPI

School Year	Calendar Year CPI (2004 to 2009)	School Year CPI (2004-05 to 2009-10)	Conversion Factor to School Year 2009-10
2004-05	188.9	191.7	1.1307
2005-06	195.3	199.0	1.0892
2006-07	201.6	204.1	1.0617
2007-08	207.3	211.6	1.0241
2008-09	215.3	214.6	1.0101
2009-10	214.5	216.7	1.0000

Table 8 shows the difference in the conventional calendar year CPI and the adjusted school year CPI, used for the present study and by Snyder and Dillow (2010). The final column in Table 8 shows the calculations made to adjust previous year dollar figures to the 2009-10 school year; these "conversion factors" are simply a ratio of the school year CPI for 2009-10 to the school year CPI for the year of the given nominal salary. Conversion factors are calculated by dividing collumn three by collumn two for each row. For example, to adjust the nominal salary of $67,388 in 2008-09 dollars to 2009-10 dollars, I multiplied the nominal salary by the conversion factor for that year, 1.0101 (216.7/214.5 = 1.0101), so $67,388 * 1.0101 = 68,068.

By incorporating the total teachers' time devoted to coaching (Table 7), one can compute the total cost of teacher time by multiplying by the teacher hourly wage. Teacher hourly wage is computed by dividing the adjusted national average salary and fringe benefits of $68,068, by the total amount of hours worked per year, 1,464. So, the estimated hourly compensation for teachers during the 2009-10 school year was $68,068 / 1,464 hours = $46.49 per hour. Table 9, below, shows teacher time converted to a dollar figure for School 1. Similar data for Schools 2 and 3 is included in the Appendix B. Bold typeface numbers in all tables indicates that the figure

is used later for another table. Note that column F results in a total cost of zero dollars. Meeting with teachers during “student time” does not reflect a reallocation of time, and therefore does not involve a cost to the coaching program.

Table 9: Cost of Teacher Time at School 1

Teacher	Total Cost = (Hourly wage * A)	A. Total Hours Devoted to Coaching (B + C + D + E)	Coaching Activities (hours)				
			B. One-on-one	C. Small Group	D. Large Group	E. Teacher Prep.	F. Model and Observe
Teacher 1	$371.96	8	5	3	0	0	2
Teacher 2	$1,766.79	38	33	3	0	2	13
Teacher 3	$278.97	6	3	3	0	0	9
Teacher 4	$232.47	5	2	3	0	0	2
Teacher 5	$255.72	5.5	2.5	3	0	0	14
Teacher 6	$627.68	13.5	9.5	3	0	1	11
Teacher 7	$46.49	1	1	0	0	0	16
Teacher 8	$278.97	6	5.5	0	0	0.5	14
Teacher 9	$767.16	16.5	15.5	0	0	1	6
Teacher 10	$767.16	16.5	12.5	3	0	1	8.5
Teacher 11	$209.23	4.5	4.5	0	0	0	2.5
Teacher 12	$395.20	8.5	8.5	0	0	0	1
Teacher 13	$69.74	1.5	1.5	0	0	0	3
Teacher 14	$46.49	1	1	0	0	0	2
Teacher 15	$69.74	1.5	1.5	0	0	0	5
Teacher 16	$92.99	2	1.5	0	0	0.5	5
Teacher 17	$325.46	7	6	0	0	1	6
Teacher 18	$371.96	8	8	0	0	0	1
Teacher 19	$232.47	5	4.5	0	0	0.5	0
Teacher 20	$69.74	1.5	1.5	0	0	0	0
Teacher 21	$232.47	5	4	0	0	1	0
Teacher 22	$139.48	3	3	0	0	0	0
Teacher 23	$278.97	6	3	3	0	0	0
Total Cost	**$7,927.33**	170.5 hours	$6,416	$1,116	$0	$395	$0
FTE / teacher		**0.51%**	0.41%	0.07%	0.00%	0.03%	0.36%
Cost / teacher	$344.67		$279	$49	$0	$17	$0

Coaches were contracted to work the same amount of hours per year as teachers, and were compensated according to the same salary schedule; however, coaches had more experience and higher educational attainment. Because coaches and teachers are compensated according to the same salary schedule, it might be tempting to assign the same salary for coaches and teachers, even though coaches were higher on the salary schedule than the average teacher. When faced with a similar issue, Parrish (1994) assigned the same salary for teachers in LEP classrooms and regular classroom teachers; however, the wage differential between teachers and coaches is not analogous to the wage differential between LEP classroom teachers and regular classroom teachers noted by Parrish (1994) and others[48]. The wage differential between teacher and coaches exists because of permanent differences in qualifications, so using the same wage to value their time is inappropriate.

Snyder and Dillow (2010) do not provide average salaries for instructional coaches, so the average qualifications of the coaches in the sample were applied to the appropriate teacher's salary for such qualifications. All coaches in the sample had at least a master's degree and some were working towards a PhD; they also had between eight to 20 years of experience as a classroom teacher. The national average salary for teachers with master's degree and six to ten years experience was $50,540 and for 11 to 20 years experience, $56,770 for the most recent school year available, 2007-08 (Snyder & Dillow, 2010). These two average salaries were averaged to reflect the range of experience levels of instructional coaches in the sample, and then adjusted for inflation to reflect 2009-10 school year prices. So, the base salary of coaches was

[48] Parrish (1994) as well as Carpenter-Huffman and Samulon (1981) both found wage differentials between bilingual teachers and general education teachers because the teachers were younger and less experienced and therefore lower on the salary step schedule. Parrish (1994) treated the differential as a short-term disequilibrium because the bilingual teachers require roughly equal qualifications as their general education colleagues.

$53,655 in 2007-08 dollars and $54,948 in 2009-10 dollars. Adding an estimated 25% for fringe benefits yields a total salary of $68,685. The coaches' reported estimated full-time equivalent percentage of time devoted to coaching was multiplied by their yearly salary and fringe benefits to determine the total cost of coach time.

Some questions arise surrounding why the entire coaches salary is not included as a cost. Since this study measured the economic cost, the focus is on measuring the cost of the outcome that the coaching program produces, rather than the expenditures the coaching program caused for the district. Different coaching programs will have different outcomes and a wide range of variables influences these outcomes. One of these variables is, of course, the amount of time the coach is able to devote to his / her role, which is often not one hundred percent. For example, a particular coach in a coaching program might be required to commit extra time to other school needs such as lunch duty or substituting, one might expect the coaching program to be less effective because it would no longer have an FTE coach, but the coach is producing other benefits for the district, outside of the coaching program. In this example, the coach's "non-coaching" activities would be recorded as the cost of providing lunch supervision, or of providing a substitute teacher; such a school devotes less of its resources to the coaching program than a school that allows their coach to commit all of their time to coaching. The framework suggested by Odden, et al. (2007) supports this approach. While Odden, et al. (2007) include the entire coach salary as a cost to professional development, they acknowledge that the coach may devote some time to other endeavors. The authors conclude these time commitments are too difficult to parse out for each coach, thus if this is possible, Odden, et al. (2007) would recommend doing so.

Principals in the sample were contracted to work a total of 1,840 hours per year and the most recent national average salary available from Snyder and Dillow (2010) was for school year 2007-08 and equal to $85,700. Adjusting for inflation and adding fringe benefits increases this salary to $109,707, in 2009-10 dollars. So, hourly wage of principals was equivalent to $109,707 / 1,840 hour per year = $59.62 per hour.

The price of the laptop provided to each coach was ascertained from the Apple website. Because equipment lasts several years, this cost was annualized using a 5% discount rate[49]. Assuming a piece of equipment last for five years, this purchase was first divided over five years, then the opportunity cost of undepreciated value of the equipment during subsequent years was added. The explicit method for annualizing ingredients that last multiple years is as follows: the value of the ingredient, $1,099 for laptops, was divided by the number of years it lasts, estimated at 5 years, to obtain the amount of depreciation each year the laptop is used, which was about $220. Next, the undepreciated value of the equipment for each year was multiplied by the discount rate (.05), to compute the opportunity cost each year of investing in the laptop, rather than using the money on other resources (or putting the funds into a savings account with a 5% interest rate). For instance, during the first year of use, a cost of $55 was incurred by spending $1,099 on the laptop; the next year, the laptop had depreciated to a value of about $880, so the second year of use involved an opportunity cost of $44. Finally, adding the total annual cost of depreciation, $220, and the annual interest forgone by investing in a laptop gives the total cost of the laptop. This figure is divided by the number of years of lifetime use, five, to give the annual cost. This process can be summarized by the formula:

$$\text{Annualization factor, } A(r, n) = (r(1 + r)^n) / ((1+r)^n - 1),$$

[49] While a wide range of discount rates is acceptable, 5% is commonly used in cost analysis (Levin & McEwan, 2002).

where r represents the discount rate and n represents the lifetime of the equipment. Plugging in a 5% discount rate and 5 years of life yields an annualization factor of .231, so the annual cost of a laptop that costs $1,099 is $253.87.

Start-up professional development was also annualized because it was used during the entire seven years of the life of the program. The cost of the Instructional Coaching Conference, the Instructional Coaching Institutes, level one and level two, and two days of SIM workshop training were all obtained from the model developers. The instructional coaching institutes and conference registration fees were both $450 each and the SIM workshop training registration fee was $500[50]. In addition to registration fees, mileage fees for 240 miles per coach and eleven nights of lodging were included at $120 and $1,100 respectively. The cost of instructional coach shadowing was measured as three days of salaried work time for each new coach. The total salaried work time for pre-service professional development was 14 days, or 112 hours, which was valued using the instructional coach salary; this led to a cost of $4,128.61. Adding each component of the start-up professional development yields a total cost of $7,198.61 in 2002-03 dollars. Adjusting for inflation increases this total to $8,482.13 in 2009-10 dollars. Another adjustment involves the cost of turnover for instructional coaches. Since one coach left the program during the seven years of its lifetime, the turnover rate over seven years was 14.3 percent, which raises the total cost of start-up professional development to $9,693.86 per coach. Finally, this cost is annualized over the seven years for which coaches used this training at a five percent discount rate yielding a cost of $1,675.29 per coach per year.

[50] Levin and McEwan (2001) note that tuition fees for private schools are rarely an accurate indicator of the true cost of providing schooling, thus registration fees are not the best indicators of the economic cost of a workshop or conference. Registration fees were appropriate because they provide the best estimate for measuring the true cost per coach to administer these professional development sessions. Also, the cost of start-up professional development is only about two percent of the total yearly cost of the coaching program at each school.

The ongoing professional development for coaches in the sample was repeated each year, so the costs of the coaches' ongoing professional development were assessed without annualization. The salaried work time instructional coaches spent in ongoing professional development was factored into their own total time spent in their coaching role, so it is not included here. The coach facilitator who led the bi-weekly professional development meetings was compensated according to the same salary schedule as teachers and coaches, but had sixteen years of teaching experience, four years as a curriculum coordinator and five years as an instructional coach prior to becoming the coach facilitator. Snyder and Dillow (2010) provide the estimated average salary of a teacher with a master's degree and 11-20 years of teaching experience of $56,770 for the 2007-08 school year. After adjusting for inflation using the school year CPI, and adding an estimated 25 percent fringe benefits, the total compensation for the coach-facilitator was $72,673, which translates to an hourly wage[51] of $49.64 per hour. Since coaches met for 80 hours of professional development, the total leader cost (cost of the facilitator's time) was $3,971.19. Each meeting involved seven coaches, so the leader costs of professional development for each individual coach was $567.31[52].

Step 3: apportioning costs. In the final step of the cost analysis, each cost was apportioned to the constituency for whom the cost is borne. The school district, which paid the salary of teachers and administrators and the university, who funded the coaching program through a federal grant, both incurred costs as a result of the instructional coaching model. As indicated in Table 10, the university incurred the bulk of the cost of the instructional coaching program, roughly 90 percent at each school. While the school district incurred no explicit

[51] The coach facilitator was also contracted to work 1,464 hours per year.
[52] This figure is simply $3,971.19 / 7 = $567.31. The facility costs for meetings were excluded because the value of a conference room for this short period of time is negligible (Levin & McEwan, 2001).

expenses as a result of the coaching program, some of their teacher and principal time was allocated to the instructional coaching program, so the district incurred a cost. Teachers in the study sample did not report devoting any personal time towards the coaching program, so only two entities, the district and the university, incurred a cost.

A final cost adjustment in the analysis involved dividing the total cost by the number of teachers who collaborated with the coach to compute the average cost per teacher. Coaches in the sample each worked with different numbers of teachers during the school year, so their total and average costs are of varying sizes.

Summary and Conclusions of Cost Methodology

By establishing a standard method of measuring the cost of coaching programs, further research can capture the variability in the actual cost of coaching programs, rather than in methodology. Figure 14 walks through the steps of completing such a cost analysis. The process for measuring the cost of an instructional coaching program is straightforward and does not require specific expertise in the field of accounting or economics, thus school practitioners can use the established framework to assess the cost of their own coaching program.

Using the basic design of the instructional coaching model, an evaluator can create a "predictive" economic model to reflect the true average cost per teacher of coaching, holding some variables constant while allowing one to vary. While this model will not perfectly measure the total cost of coaching at a specific site, it is a close resemblance. A model for the total cost, average cost and marginal cost of one instructional coach at one school is depicted below[53]. The

[53] The equations are most easily interpreted as reflecting the cost at one school and for one instructional coach; however, they can also be used for an entire program. For instance, if there are five coaches, one would input 5 into FTE_C and follow the same logic for other personnel.

average total cost measures the total cost per collaborating teacher. The marginal cost represents the additional cost incurred when a coach collaborates with an additional teacher.

$$\text{Total Cost (TC)} = (P_C * FTE_C) + (P_A * FTE_A) + [(P_T * FTE_T) * Q] + PD \quad (1)$$

$$\text{Average Cost (ATC)} = [([P_C * FTE_C] + [P_A * FTE_A] + PD) / Q] + (P_T * FTE_T) \quad (2)$$

$$\text{Marginal Cost (MC)} = (P_T * FTE_T) \quad (3)$$

Where P_C is the average yearly salary for the coach, P_T is the average yearly salary for teachers, P_A is the average yearly salary of the principal or curriculum coordinator, FTE_C is the percentage of time the coach devotes to coaching, FTE_T is the average percentage of time teachers meet with the coach during "non-student time", FTE_A is the percentage of time the principal or other administrators devote to coaching, PD is the annualized cost of professional development, materials and equipment required for coaches, and Q is the number of collaborating teachers. All salaries include fringe benefits and reflect national averages.

Figure 10: A Framework for Measuring the Cost of a Coaching Program

Component	Ingredient	How the Data is collected	How Cost is Calculated
Teacher Time Devoted to Coaching	Student free time within the regular contract, before and after school and during the planning period meeting with the coach.	Coaches provide the amount of hours they spent with each teacher. Teachers are also surveyed through email or phone to verify coach estimates.	Teachers' hourly wage multiplied by the total amount of hours. This represents a cost to the district.
	Student free time within the regular contract, in which the teacher prepared to meet with the coach.	Coaches provide an estimate; teachers are also surveyed through email and phone.	Teachers' hourly wage multiplied by the total amount of hours. This represents a cost to the district.
	Time outside the contract in which the teacher prepared to meet with the coach.	Teachers' responses from email and phone.	Teachers' hourly wage multiplied by the total amount of hours. This represents a cost to the individual teacher.
Coaches' Time	All time counted as coaching, except when an activity was outside the realm of coaching and created additional utility for the school or district.	Coaches provide estimate. [Examples include bus duty, lunch duty, subbing for another teacher, or teaching a class part time.]	Coaches' hourly wage multiplied by the amount of hours, or salary multiplied by FTE devoted to coaching.
Professional Development for the Coaches	Travel costs for coaches to attend P.D.	Coaches provide estimate; financial clerks are also contacted to verify coaches' estimates.	Travel reimbursements for the coach.
	Fees for coaches to attend P.D. (Time spent of P.D. included in above.)	Coaches provide estimate.	Total amount of P.D. fees paid. P.D. costs are annualized if it is effective for several years.
Principals' Time Devoted to Coaching	Time the principal met with the coach. Time the principal prepared to meet with the coach.	Coaches provide estimate.	Principals' hourly wage multiplied by the amount of hours.
Materials & Equipment	Manuals and copies the coaches needed to support teachers.	Check with financial administrative assistant.	Estimated amount by the coach, or total expensed amount.
	Laptops for the coaches.	Price ascertained via internet stores.	Price of the laptops, annualized according to their lifetime use, at a 5% discount rate.

Chapter 4: Findings

Findings are presented in five sections. First, the steps involved in the instructional coaching process, originally described by Knight (2007), are described according to the required amount of time for each step. Based on this planned framework as well as a description of other required resources, a cost is attached to all ingredients to measure the average cost per teacher[54] as planned prior to implementation. In section two, this planned framework is referred to as the Model School and the average cost per teacher at the Model School is compared to that of the three schools analyzed. The third section separates costs according to the party by whom they are incurred and reveals the "hidden costs" of instructional coaching. In the fourth section, each cost of coaching in the Model School is described as either fixed or variable. Using this framework, the average cost per teacher is described as a function of the number of collaborating teachers per coach. The number of collaborating teachers was examined closely because it was found to be the most important factor in determining the average cost per teacher. Finally, the average cost per teacher of several traditional approaches to professional development is provided in order to allow for a comparison to instructional coaching.

Time Requirements for the Instructional Coaching Model

Model developers estimated that eight hours and 20 minutes of non-student time (when the teacher is not with her or his students) would be required for each collaborating teacher. During this time, the coach walks through the traditional components of coaching[55]. First, the

[54] The focus of this study was on the average cost per teacher because school district budgets and funding decisions are determined on a per pupil basis. Studies of cost in education have typically focused on costs per pupil or costs per teacher (Miles, et al., 2003; Parrish, 1994).

[55] The steps involved in the coaching process are called the "components of coaching" (Knight, 2007) and they include enroll, explain, model, observe and explore. They are fully described in the full-length text on instructional coaching (Knight, 2007), so only a brief description is

coach *enrolls* the teacher, that is, elicits their participation, during non-student time. Next, the coach *explains* a new teaching strategy during non-student time. After the teacher understands the new strategy, the coach *models* a lesson using the new teaching strategy and then *observes* the teacher trying out the newly learned strategy. These two activities take place during student time, so no additional cost is incurred during the modeling and observing components. Finally, the teacher and coach reconvene and *explore* how the teacher can further develop this newly learned teacher strategy, during non-student time. Table 11 describes the time commitments of each stage in a coach-teacher dyad.

Table 11: The Components of Coaching as Described by Model Developers

Components	Low Estimate	High Estimate	Two Cycles with High Estimates
Enroll	10 minutes	20	20
Explain	20	180	360
Model	40	125	250
Observe	40	125	250
Explore	30	60	120
Teacher Time (student time plus non-student time)	2.33 hours (140 minutes)	8.5 hours (510 minutes)	13.76 hours (820 minutes)
Teacher Time (non-student time only)	1 hour (60 minutes)	4.33 hours (260 minutes)	**8.33 hours** (500 minutes)

The purpose of Table 11 is to describe the estimated amount of non-student teacher-time required to collaborate with each additional teacher, as planned prior to implementation. For one coaching cycle, four hours and 20 minutes of non-student time (when there are no students present) is required. Model developers suggested that completing two cycles of coaching with each collaborating teacher is appropriate and the high estimates were likely to be closer to

provided here. The estimated amount of time required for each component was described during interviews with the model developer.

reality, so eight hours and 20 minutes is the estimated amount of non-student time required to collaborate with one teacher. The total teacher time required for two cycles of coaching is about 14 hours; however roughly half of this time takes place during student time, when no cost is incurred, thus the teacher devotes only eight hours and 20 minutes of non-student time in order to collaborate with a coach. This time results in a cost of $387.44[56] and this estimate facilitates a later discussion of fixed and variable costs of coaching. Coaches are also expected to lead small groups or professional learning communities, yet this is not reflected here. In such a situation, if the coach meets with a group of four teachers, the coach would have four times as much time to explain and explore the content in order to stay within suggested time frames.

Cost for the Model School and at Schools 1, 2 and 3

The developer of the instructional coaching model provided data to reflect the cost as planned by the model, prior to implementation. During interviews with the instructional coaching model developer, it was suggested that meeting with 40 teachers during a school year was appropriate, which would require 333 total hours of non-student teacher time at a cost of $15,498. Meeting with the principal and other administrators for about an hour per week, or 3 percent FTE was also recommended. The recommended startup professional development was the same as what coaches in the sample received, and resulted in a cost of $9,694 or $1,675 annualized over seven years. Recommended ongoing professional development involved attending a three-day workshop twice per year at a cost of $1,320 each[57]. Finally, equipment and

[56] Multiplying the teachers' hourly salary of $46.49 by 8.33 hours yields a cost of about $387. An alternate method is to multiply the yearly salary, equal to $68,068, by the FTE which is equal to 8.33 / 1,464 = 0.569%, so .0057 * $68,068 = $387.

[57] The details of professional development costs are described in Chapter 3. This figure includes registration fees, lodging, mileage and per diem, and is estimated based on expenses from instructional coaches in the sample.

materials involved the use of a laptop and manuals, and the costs of these ingredients are described in Chapter 3.

Combining the cost of all ingredients and dividing by the number of collaborating teachers yielded a cost per teacher of the coaching programs at Schools 1, 2 and 3 of $2,644.68, $2,737.31 and $4,259.19 per teacher per year, respectively. The data provided by the developer of the instructional coaching model reflected the lowest cost per teacher of $2,239.18. The ingredients method solicits empirical data from schools; however, Levin, et al. (2010) also provided estimates of ingredients and their costs from model developers and I have made an attempt here to repeat this strategy. Comparing the cost as planned by model developers with the actual cost for the three schools reveals the important ways schools can shape school reform initiatives when they are actually implemented. Table 12 provides some descriptive statistics of how coaching took place at each of the three schools and how it was planned by the model developers. Each ingredient and its cost is expressed in Table 13, which presents the cost of the coaching program at Schools 1, 2 and 3 and the cost as planned by the instructional coaching model developers. The first column lists the ingredients; the cost of one unit of each ingredient is listed in the next column. The third column, labeled "FTE", shows the full-time equivalent amount, as a percentage of salaried work time,[58] that each personnel category devoted to coaching. Model developers suggested eight hours and 20 minutes of non-student time would be required of each teacher, thus according to the model, each teacher would devote 8.33 hours out of 1,464 total hours per year, or 0.57 percent[59] full-time equivalent (FTE). Column four, labeled "Inputs", shows the quantity of each ingredient that was used, so multiplying column two, three

[58] No employees in the sample reported working during personal time. Also, the FTE column pertains only to the personnel category.
[59] The figure of 0.57 percent represents 8.33 / 1,464 = 0.00569 or about 0.57 percent FTE.

and four together, gives the total yearly cost of that ingredient, which is reported in column five. The total cost and the average cost per teacher are reported in the final three rows of the table.

Table 12: Teacher Collaboration Data by School

	Model School	School 1	School 2	School 3
Number of instructional coaches at the school	1	1	1	3
Number of collaborating teachers	40	23	30	42
Number of teachers at the school	40	37	30	66
Percent of teachers at the school who collaborated with a coach	100%	62%	100%	64%
Total teacher hours spent collaborating[1] with an instructional coach	333.3	170.5	565.25	515.5
Total FTE of all teacher time[1] spent collaborating with an instructional coach	22.76%	11.65%	38.61%	35.21%
Average number of hours per teacher spent collaborating with an instructional coach	8.33	7.41	18.84	12.27
Average FTE per teacher spent collaborating with an instructional coach	0.57%	0.51%	1.29%	0.84%

[1]Non-student time only, which means this time does not include modeling or observing.

Table 13: Total Cost and Average Cost Per Teacher for a Model School and for Schools 1, 2 and 3

		Model School			School 1			School 2			School 3		
Ingredients	Cost of One Input	FTE	Inputs	Yearly Costs of Ingredient	FTE	Inputs	Yearly Costs of Ingredient	FTE	Inputs	Yearly Costs of Ingredient	FTE	Inputs	Yearly Costs of Ingredient
Personnel													
Teachers	$68,068	0.57%	40	$15,497.58	0.51%	23	$7,927.29	1.29%	30	$26,281.10	0.84%	42	$23,967.97
Coach	$68,685	100.00%	1	$68,685.11	96.48%	1	$66,268.93	97.30%	1	$66,830.61	90.00%	3	$185,449.79
Principal	$109,707	2.50%	1	$2,742.67	0.22%	1	$241.35	1.88%	1	$2,057.00	1.03%	1	$1,129.98
Other Administrators	$68,068	0.50%	1	$340.34	0.00%	0	$0.00	0.00%	0	$0.00	0.17%	3	$348.71
Materials													
Manuals / Copies	Varies			$100.00			$119.96			$65.00			$852.39
Equipment													
Laptop	$1,099		1	$253.87		1	$253.87		1	$253.87		3	$761.61
Professional Development (P.D.) for Coaches													
Ongoing P.D.	$7		0	$0.00		80	$567.31		80	$567.31		240	$1,701.94
Start-Up P.D.	$1,675		1	$1,675.29		1	$1,675.29		1	$1,675.29		3	$5,025.87
3-Day Workshop	$1,320		2	$2,640.00		0	$0.00		0	$0.00		0	$0.00
Total Cost				$91,934.86			$77,054.00			$97,730.18			$219,238.26
Collaborating Teachers			40			23			30			42	
Cost Per Teacher				**$2,298.37**			**$3,350.17**			**$3,257.67**			**$5,219.96**

Some of the costs of the instructional coaching program were consistent across all three schools. As noted, the cost of start-up professional development for each coach and ongoing professional development were consistent for each of the five coaches, totaling $1,675 and $2,640 per coach per year, respectively. According to model developers, ongoing professional development for coaches can be accomplished by attending two instructional coaching three-day workshops per year, so the number of bi-weekly meetings in the Model School is recorded as zero. The annualized cost of the coach's laptop was $253.87, and all five coaches were supplied a laptop.

At School 1, one coach was employed who collaborated with 23 teachers for an average of 7.41 hours each, or about 0.51 percent FTE, based on the 1,464 hours teachers were contracted to work each year. This teacher time resulted in a total cost of about $7,927 or about $345 per teacher. There was considerable variation in teacher time for each of the 23 collaborating teachers at School 1. The coach at School 1 collaborated with teachers during student time and non-student time for as little as one hour to as much as 54. All of these data are reported in Table 9 in Chapter 3: Methodology of Cost Analysis. During our interview, this coach provided some insights to explain this wide variation. First, the coach reported being encouraged by the principal to work with certain teachers, which led to a greater amount of contact hours. Second, the coach was relatively new to the school and had not yet been formally introduced to all teachers at the school. As more teachers came to know the instructional coach, more teachers became interested in collaboration, but teachers who collaborated earlier in the school year ended up with far more contact hours. Third, some teachers at School 1 expressed interest in meeting with the coach more intensively, but were unable to do so due to time

constraints of both the coach and teacher. Finally, some teachers collaborated with the coach initially, but later decided to pursue their own individual professional learning.

The coach at School 1 was required to commit a total of approximately 3.52 percent of the school year, or 51.5 hours to grant-related activities. Grant-related activities involved participating in ongoing research studies, meetings with grant officers and giving presentations that fulfilled requirements of the grant. This caused slightly less than the full amount of the coach's salary to be attributed to the coaching program. I interpreted the 3.52 percent of the salary, or about $2,418, as being *spent* on grant-related research endeavors that fulfilled grant requirements. The remaining 96.5 percent ($66,269) was attributed to the coaching cost. Finally, the coach spent a total of $119.96 on workbooks and copies, or $5.23 per teacher.

The coach at School 2 collaborated with 30 teachers, the most of any of the five coaches in the sample, and the coach met with these teachers for a greater amount of time, an average of approximately 18 hours per teacher or 1.29% of the teachers' yearly salaried work time. Nine of the teachers who met with the coach were part of a Professional Learning Community[60] and this group met consistently for a total of 27 hours during the year, which led to a considerable cost in the form of teacher time. All teacher time and cost data for School 2 are reported in Appendix B. A total of approximately 40 hours, or 2.3 percent FTE was devoted to grant related-activities, so 97.3 percent of the coach's salary was attributed to the coaching program. The coach at School 2 met with the principal for 45 minutes per week of a 40-hour workweek, thus the principal devoted 1.88 percent of salaried work time to the coaching program. This time commitment

[60] Professional Learning Communities in schools have been defined in many ways, but generally involve a group of teachers meeting regularly to discuss of a wide variety of topics surrounding curriculum and instruction in their school.

caused 1.88 percent of the principal's salary to be attributed to the cost of the coaching program. Finally, the coach at School 2 spent $65 for workbooks and copies, or about $2.17 per teacher.

School 3 was unique in the sample because three instructional coaches were employed at the school. Two of the coaches at the school collaborated with 11 teachers each, and the third coach collaborated with 20 teachers, for a total of 42 collaborating teachers, during the 2009-10 school year. A specific breakdown of teacher time and cost for each of the three coaches at School 3 are included in Appendix B. These coaches had difficulty reporting the number of hours devoted to coaching and to grant-related activities, so the coach-facilitator provided clarification on the matter. By identifying and tallying all grant-related activities, the coach facilitator estimated that each coach at School 3 devoted approximately 146 hours, or ten percent FTE, to grant related-activities, thus 90 percent of salaried work time was devoted to the coaching program. School 3 had both the highest cost and the highest average cost per teacher. Coaches at School 3 spent the most on workbook and copies, totaling $852.39, or about $20.30 per teacher.

Cost Incurred by the School District

Next, it is useful to separate costs by the parties to whom they are incurred; Table 14 displays the costs accrued to each party. While the instructional coaching program was fully funded by an external grant, the school district still incurred some costs in the form of personnel time. Although it was the original intent to incorporate the personal costs incurred by teachers and other staff when they devoted personal time, no teachers in the sample reported spending any amount of personal time to prepare for coach meetings or to prepare materials developed through collaboration with the coach. The school district and the university grant were the only two entities to incur a cost as a result of the coaching program.

Table 14: The Total Cost of Instructional Coaching for School 1, by Funding Source

Ingredients	Total Yearly Costs	Cost to School District	Cost to External Grant
Personnel			
Teachers	$7,927.29	$7,927.29	$0.00
Coach	$66,268.93	$0.00	$66,268.93
Principal	$241.35	$241.35	$0.00
Other Administrators	$0.00	$0.00	$0.00
Materials			
Manuals / Copies	$119.96	$0.00	$119.96
Equipment			
Laptop	$253.87	$0.00	$253.87
Professional Development for Coaches			
Ongoing P.D.	$567.31	$0.00	$567.31
Start-Up P.D.	1675.29	$0.00	1675.29
Total Cost	$66,242.78	$6,469.62	$59,773.16
Cost per teacher	$2,880.12	**$281.29**	$2,666.14

For this example, School 1 is presented; however other schools in the sample followed the same pattern: the bulk of the program costs were borne by the university grant[61]. This finding was not surprising because the university grant funded the coaches' salaries, equipment, materials and professional development, and these ingredients represented the bulk of the costs at each school. That being said, it is important to note that the use of personnel time, a vital resource within schools[62], comes at a cost to the school districts.

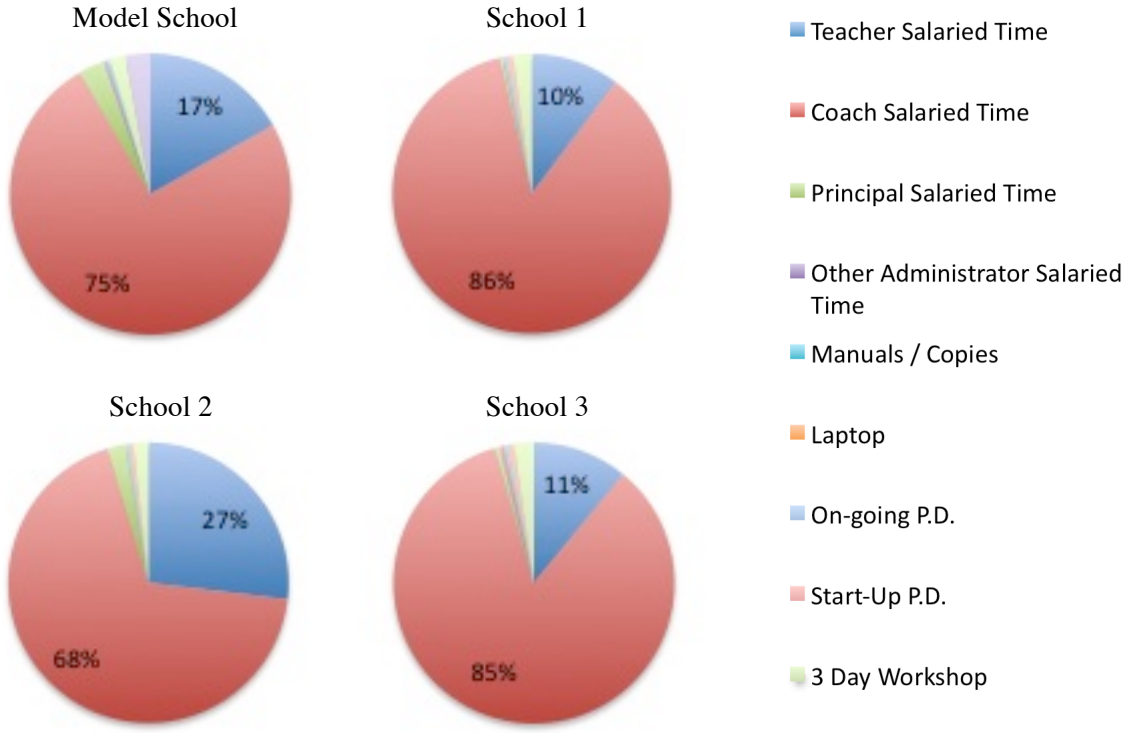
[61] Obviously, not all coaching programs are funded by external grants. Odden and Picus (2004) describe how instructional coaches can be funding through a school district's general fund and Symonds (2006) provides examples of how coaching programs in California have been funded.
[62] Miles, et al. (2003) thoroughly discuss the cost of personnel time in schools and Darling-Hammond, et al. (2009) analyze the importance of time for professional development for teachers.

Hidden costs. An alternate way of examining the factors that affect the average cost per teacher is to break down the percentage of the total cost that each ingredient represents according to how the model has been implemented in actual schools. The purpose of examining the cost this way is to show that the coaches' salary is only a portion of the total cost of an instructional coaching program. The cost of personnel time is not often considered by school-leaders who plan and implement professional development programs (Miles, et al., 2003). Table 15 displays the cost of each ingredient as a percentage of the total cost for the Model School as well as for each of the three schools. Figure 16 displays the same information using pie charts. In each pie chart, two sections are labeled: the cost of the coaches' salary, which is typically considered the only cost of instructional coaching program (Odden & Archibald, 2009), and the cost of teacher's salaried non-student time, which is the largest hidden cost identifying for the sample coaches.

Table 15: Cost of each ingredient as a percentage of total cost for the Model School and for Schools 1, 2 and 3

Ingredients	Model School	School 1	School 2	School 3
Personnel				
Teachers salaried time	16.86%	10.29%	26.89%	10.93%
Coach salaried time	74.71%	86.01%	68.38%	84.59%
Principal salaried time	2.98%	0.31%	2.10%	0.52%
Other Administrator time	0.37%	0.00%	0.00%	0.16%
Materials and Equipment				
Manuals / Copies	0.11%	0.16%	0.07%	0.39%
Laptop	0.28%	0.33%	0.26%	0.35%
Professional Development for Coaches				
Ongoing P.D.	0.00%	0.74%	0.58%	0.78%
Start-Up P.D.	1.82%	2.17%	1.71%	2.29%
3 Day Workshop	2.87%	0.00%	0.00%	0.00%
Total	100.00%	100.00%	100.00%	100.00%

Figure 16: Cost of each ingredient as a percentage of total cost for the Model School and for Schools 1, 2 and 3



Fixed Costs and Variable Costs of Instructional Coaching

To measure the cost of instructional coaching at a prototypical school, which I have referred to as the Model School, interviews were held with model developers to determine all required ingredients as planned, prior to the model being implemented. Next, a cost is placed on each ingredient, so the total and average cost per teacher can be compared to programs in which the model has actually been implemented in schools[63]; this method has been used to measure the cost of literacy programs (Levin, et al., 2010) and comprehensive school reforms (King, 1994). Alternatively, using these estimated figures, costs can be separated as either fixed or variable relative to the number of collaborating teachers, which is reported in Tables 17 and 18. Separating costs in this way will facilitate a later discussion of the relationship between the number of collaborating teachers and the average cost per teacher.

Table 17: Fixed Cost for One Coach in an Instructional Coaching Program

Ingredient	Amount	Yearly Cost per Coach
Coach salary time	100% FTE	$68,685
Principal salary time	One hour per week (2.5% FTE)	$2,743
Other Admin time	Nine hour per year (0.5% FTE)	$340
Materials	Workbooks and copies	$100
Equipment	Laptop	$254
Coach's P.D.	Start-up and Ongoing	$4,315
Total		$76,437

[63] The method is similar to, yet different from, the Evidence-Based approach to cost analysis, originally designed by Odden and Picus (2003), in which researchers use evidence-based practices to describe the required resources at a prototypical school. The Evidence-Based approach to cost analysis measures the whole cost of an adequate education, as defined by researchers, while my approach simply measures the cost of one professional development strategy, instructional coaching.

Table 18: Variable Cost for One Coach in an Instructional Coaching Program

Ingredient	Amount	Yearly Cost per Coach
Teacher Time	8.33 hours per teacher for 40 teachers	$15,498 ($387.44 per teacher)
Total		$15,498

During the interview process, the coaches helped determine which costs were fixed and which costs were variable relative to the number of collaborating teachers. Coaches indicated that some of the ingredients were exogenous to how many teachers they collaborated with, so these ingredients are considered fixed. Coaches stated that while meeting with the principal helped them collaborate with more teachers, there is a ceiling effect after about one hour per week, meaning that meeting with the principal is helpful, but only to a certain point. One principal only met with the coach for four hours during the course of the year, and this coach indicated that more time with the principal would have been helpful. Other ingredients were also relatively fixed, with regards to the number of collaborating teachers: the amount of materials and copies required did increase as a coach collaborated with more teachers; however, this resulted in an economically insignificant amount of additional cost. Other ingredients, including professional development and the use of a laptop did not change at all as coaches collaborated with more teachers. The total amount of teacher time is a cost that can be considered variable, determined by the number of collaborating teachers; however, the amount of non-student teacher time for each collaborating teacher is considered fixed at eight hours and 20 minutes.

Number of Collaborating Teachers per Coach and Average Cost per Teacher

The largest variation among the three schools was the number of collaborating teachers, and this figure made the largest impact on the average cost per teacher. The number of

collaborating teachers per coach and the average cost per teacher has an important and predicable relationship: as the coach collaborates with more teachers, the average cost per teacher of the coaching program decreases. While the model specified collaborating with 40 teachers was appropriate, no coaches in the sample were able to reach this mark.

In Chapter 3: Methodology of Cost Analysis, the cost of coaching was described as a function of all required ingredients. Equation (1) described the total cost per year of a coaching program, equation (2) described the average cost per teacher per year of a coaching program and equation (3) described the marginal cost of collaborating with one additional teacher. The functions were described as follows:

$$\text{Total Cost (TC)} = (P_C * FTE_C) + (P_A * FTE_A) + [(P_T * FTE_T) * Q] + PD \quad (1)$$

$$\text{Average Cost (ATC)} = [([P_C * FTE_C] + [P_A * FTE_A] + PD) / Q] + (P_T * FTE_T) \quad (2)$$

$$\text{Marginal Cost (MC)} = (P_T * FTE_T) \quad (3)$$

Where P_C is the average yearly salary for the coach, P_T is the average yearly salary for teachers, P_A is the average yearly salary of the principal or curriculum coordinator, FTE_C is the percentage of time the coach devotes to coaching, FTE_T is the average percentage of time teachers meet with the coach during "non-student time", FTE_A is the percentage of time the principal or other administrators devote to coaching, PD is the annualized cost of professional development, materials and equipment required for coaches, and Q is the number of collaborating teachers.

The costs estimated by Model developers and reported in Table 13 can be plugged in to equations (1), (2) and (3) as follows:

(1) Total Cost per year for one coach = \$76,437 + (\$387 * Q)

(2) Average Cost per teacher per year for one coach = (\$76,437 / Q) + \$387

(3) Marginal cost of collaborating with one additional teacher = \$387

where Q is the number of collaborating teachers. Figures 19 and 20 show the average cost per teacher per year for one coach in an instructional coaching program, holding the fixed costs constant at the amounts[64] specified in Tables 17 and 18. The fixed costs held constant are: amount of teacher time per teacher per year, at 8.33 hours; the amount of principal time per year, at one hour per week (2.5% FTE); administrator time, at 45 minutes per month (0.5% FTE); materials and equipment, at $354; and professional development at $4,315. These costs are considered fixed because it is assumed that as a coach collaborates with more teachers, these costs do not change substantially. The variable cost of coaching is teacher time, calculated by multiplying the number of collaborating teachers by the cost of collaborating with one teacher, which is assumed to be eight hours and 20 minutes per teacher per year, or approximately $387 per teacher per year. Thus the marginal cost of a coaching program for each coach, that is, the cost of collaborating with one additional teacher, is equal to $387. Note that when the coach collaborates with 40 teachers, as was suggested by model developers, the average cost per teacher is $2,298, which is the figure presented in Table 13. The average total cost decreases as a coach works with more teachers, and this functions approaches the marginal cost as the number of collaborating teachers approaches infinity.

The purpose of Figures 19 and 20 is to explain how the number of collaborating teachers for one coach interacts with the average cost per teacher per year of a coaching program. The assumption that some costs are fixed implies that no additional resources will be needed as the coach collaborates with more teachers, yet this is not necessarily suggested by the data[65]. On the other hand, the data shows that as these variables change, the total and average cost are not

[64] By holding other variables constant in Figures 19 and 20, an assumption is made that the proportion of costs will remain constant as the coach collaborates with more teachers.
[65] In each school sampled, coaches who collaborated with more teachers required more time with the principal, and devoted more of their own salaried work time towards coaching.

affected substantially, thus holding all other variables constant is appropriate and provides meaningful information. Figure 19 describes the average cost when the coach collaborates with between one and fifty teachers, while Figure 20 narrows the x-axes down to collaborating with ten to fifty teachers, providing a close-up view of the declining average cost per teacher.

Figure 19: Average total cost per teacher of one instructional coach, as a function of the number of collaborating teachers, while holding constant the fixed costs

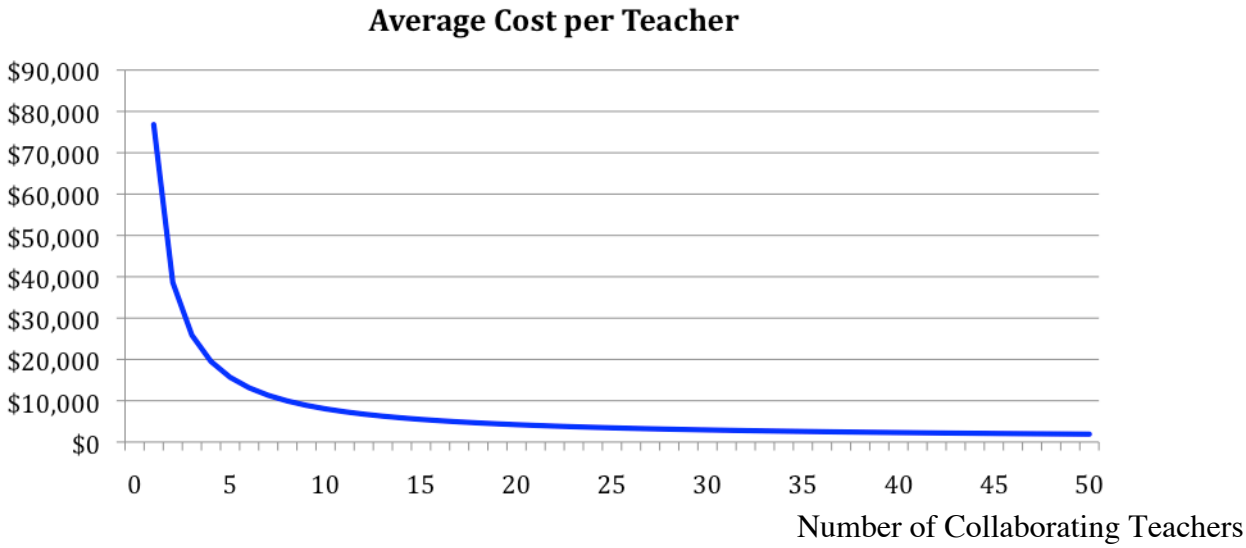
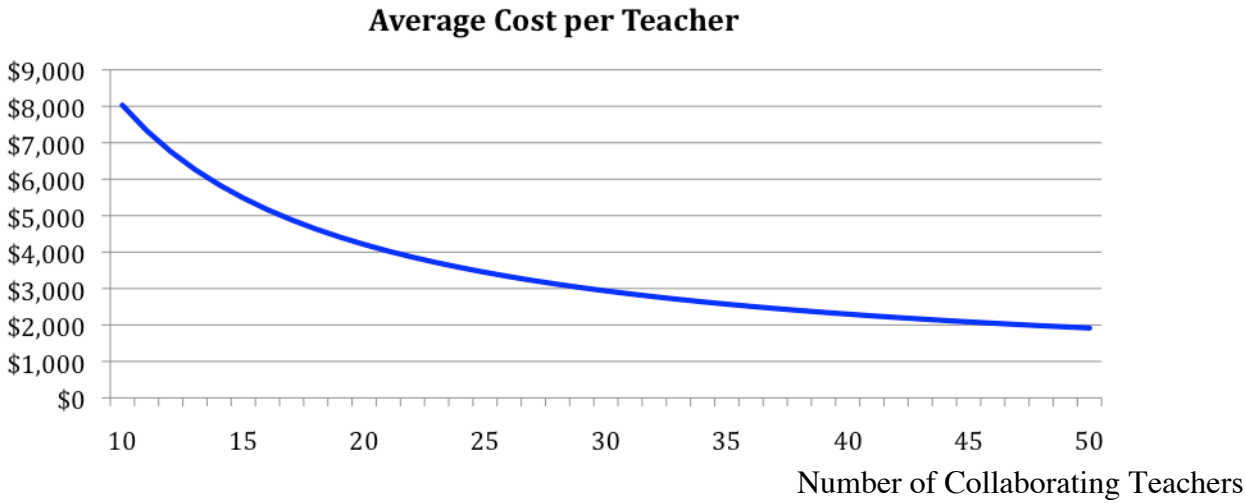


Figure 20: Average total cost per teacher of one instructional coach, as a function of the number of collaborating teachers, while holding constant the fixed costs (adjusted axes)



Cost of Traditional Professional Development

For comparison, estimates of the costs of traditional approaches to professional development are also presented in Tables 21, 22 and 23. First, Table 21 describes the costs involved in sending teachers and other school leaders to a Marzano Research Laboratory™ (MRL) workshop. Next, Table 22 describes the costs to a school district of hosting a professional development associate from MRL. Finally, Table 23 provides estimates for the cost of sending select school leaders to a train-the-trainer style workshop, hosted by Staff Development for Educators™, and having these individuals lead a workshop for teachers at their own district. These provides of professional development workshops were selected as models of traditional professional development workshops, although certainly many other approaches exist.

It is of course, arguable that school leaders do not choose between professional development workshops and instructional coaching. It may be more likely that most, if not all, school districts implement some form of professional development workshop and then decide if instructional coaching is necessary and affordable. To that end, it is still useful to see estimates of the cost of professional development workshops in order to see how the cost of instructional coaching compares.

Table 21: Off-Site Professional Development: Teachers sent to *On Excellence in Teaching Summit*, Belleview WA, October 13-16, 2010, During a District Professional Development Day.

Ingredients	Cost	Low Estimate[1]		High Estimate[4]	
		Inputs	Total Cost	Inputs	Total Cost
Personnel					
Attendance Fees	$619.00	6	$3,714.00	6	$3,714.00
Substitute Fees[2]	$120.00	15	$1,800.00	15	$1,800.00
Travel					
Lodging[3]	$159.00	9	$1,431.00	9	$1,431.00
Mileage	$0.50	360	$180.00	270	$135.00
Airfare	$400.00	0	$0.00	6	$2,400.00
Total Cost			$7,125.00		$9,480.00
Cost Per Teacher			**$1,187.50**		**$1,580.00**

[1] Low Estimate: 6 teachers from a district 180 miles from Bellevue, WA, each way, traveling in one van.
[2] Half-day substitutes for Wednesday, and a full day on Thursday and Friday, equal to 2.5 per teacher.
[3] Three rooms for three nights, for a total of nine rooms.
[4] High Estimate: 6 teachers from a district 45 miles from the local airport, traveling in three cars. Round trip mileage is 90 miles for three cars or 270 miles total.

Table 24: On-Site Professional Development: Outside Consultant from Marzano Research Laboratory ™ Leads a Workshop During a District Professional Development Day

Ingredients	Cost	Low Estimate[1]		High Estimate[3]	
		Inputs	Total Cost	Inputs	Total Cost
Personnel					
Leader Fees	$5,000	1	$5,000.00	2	$10,000.00
Teacher Time[2]	$372	500	$185,978.45	100	$37,195.69
Travel					
Mileage (10 mi)	$0.50	500	$2,500.00	100	$500.00
Total Cost			$193,478.45		$47,695.69
Cost Per Teacher			**$386.96**		**$476.96**

[1] Low Estimate: 500 teachers attend an on-site (within the district) one-day workshop.
[2] One day of teachers time equals 1/183 FTE = 0.546%, valued at $68,068 * 0.546% = $371.96
[3] High Estimate: 100 teachers attend an on-site (within the district) two-day workshop.

Table 25: On-Site In-House Workshops: Differentiated Instruction: 'Theory Into Practice' Train-the-Trainer Institute, Chicago, IL, August 2-6, 2010, (offered at four other locations).

Ingredients	Cost	Low Estimate[1]		Middle Estimate[3]		High Estimate[4]	
		Inputs	Total Cost	Inputs	Total Cost	Inputs	Total Cost
Personnel							
Attendance Fees	$1,500	1	$1,500.00	1	$1,500.00	2	$3,000.00
Teacher Time[2]	$372	500	$147,295.00	100	$29,459.00	50	$18,597.85
Leader Time	$372	1	$371.96	1	$371.96	2	$743.91
Daily Stipend	$300	5	$1,500.00	5	$1,500.00	10	$3,000.00
Travel							
Lodging[4]	$150	5	$750.00	5	$750.00	5	$750.00
Mileage (10 mi)	$0.50	500	$2,500.00	100	$500.00	50	$250.00
Airfare	$150	1	$150.00	1	$150.00	2	$300.00
Total			$192,750.41		$41,967.65		$26,641.76
Cost Per Teacher			**$385.50**		$419.68		**$532.84**

[1] Low Estimate: One lead teacher attends the workshop, and then leads a one-day workshop at his/her district for 500 teachers.
[2] One day of teachers time equals 1/183 FTE = 0.546%, valued at $68,068 * 0.546% = $371.96
[3] Middle Estimate: One lead teacher attends the workshop, and then leads a two-day workshop at his/her district for 100 teachers.
[4] High Estimate: Two lead teachers attend the five-day workshop, and then each leads a two-day workshop at her/his district for 50 teachers each.

A final comparison, shown in Table 26, presents the average cost of instructional coaching at the Model school and at three different schools with the cost of traditional approaches to professional development. Clearly, instructional coaching requires a larger investment than any of the three approaches to traditional professional development. According to the results presented in Table 26, instructional coaching would have to be as little as 2.1 times more effective (using the lower bound of coaching cost and upper bound cost of traditional professional development) to as much as 13.5 times more effective (comparing the upper bound cost of instructional coaching to the lower bound cost of traditional professional development) in order to be more cost-effective than the selected traditional approaches to professional development. In order to make such a claim, it would also have to be established that each model shares the same objectives, and all positive outcomes would have to be measured.

Table 26: Comparing the average cost per teacher of instructional coaching with traditional approaches to professional development

Approach to Professional Development		Cost per Teacher
Instructional Coaching	Model School	$2,298
	School 1	$3,350
	School 2	$3,258
	School 3	$5,220
Traditional Off-Site P.D.	Low Estimate	$1,188
	High Estimate	$1,580
Traditional On-Site P.D. (outside consultant)	Low Estimate	$387
	High Estimate	$477
Traditional On-Site P.D. (in-house)	Low Estimate	$386
	High Estimate	$533

Chapter 5: Discussion and Implications

The following chapter is composed of four sections. First, the discussion section interprets the principal findings of the study. Next, the limitations of the data and analysis are discussed. Third, the significance of the study is reiterated. Finally, the directions for further research are established with concluding remarks. As researchers continue to define what an effective and cohesive professional development program in schools looks like, knowledge and understanding of the cost of various approaches to professional development will be crucial.

Discussion

Three principal findings emerged from the data collection and analysis. First, consistent with the school reform literature (Evans, 1996; McLaughlin, 1990), the coaching program was not implemented exactly how the model developers had planned in any of the three schools, especially with regards to the number of collaborating teachers. Moreover, all but one of the five coaches had fewer teacher contact hours than was planned by model developers. This is consistent with the findings of Deussen, et al. (2007), who found literacy coaches were spending far less time with teachers than was called for in their contracts. Second, the scale of implementation was the most important factor in determining average costs per teacher, which is consistent with previous literature on school reform implementation (Levin, et al., 2010). Finally, a framework for measuring the cost of coaching programs was established, fully described, and applied to three schools. Going forward, it will be imperative that measures of effectiveness continue to be investigated for various approaches to professional development so that schools can employ more cost-effective strategies for teacher professional development.

Differences in implementation. Table 13 in Chapter 4: Findings highlights the resources required to implement instructional coaching as planned by model developers, as well as the

different ways programs were actually implemented in three different schools. The biggest difference between schools was the number of collaborating teachers. No coach was actually able to collaborate with 40 teachers, which was the number suggested by model developers. Also, the amount of time coaches collaborated with each teacher was highly variable. Model developers provided a general guideline for how each coach-teacher interaction during a school year might take place. The model involved a total of 8.33 hours of non-student time for each teacher. For each of the five coaches, individual teachers' non-student time contact hours ranged from one hour to 35.25 hours, and the teachers per coach ranged from 11 to 30 teachers per coach. While school reforms are meant to shape and improve the schools in which they are implemented, it is important for school leaders to be cognizant of the fact that school have agency and can shape school reforms models like instructional coaching.

Factors affecting the average cost per teacher. The second major finding of the study was identification of the ingredients that contribute most to the average cost per teacher of an instructional coaching program. The number of collaborating teachers played the largest role in determining the cost per teacher of the instructional coaching program. When a coach collaborates with as many as 40 teachers, the average cost per teacher decreases significantly, *ceteris paribus*. Because the coach at School 1 collaborated with 23 teachers, rather than 40 teachers, the average cost per teacher was higher than at the Model School. At School 2, the coach collaborated with 30 teachers; the most of any coach in the sample, and School 2 had the lowest per teacher cost. Two of the coaches at School 3 collaborated with 11 teachers each, the third coach collaborated with 21 teachers and in total, the three coaches at School 3 collaborated with a total of only 42 teachers, an average of 14 each. It is not surprising that this low teacher to coach ratio resulted in the highest per teacher cost.

The reason the number of collaborating teachers has such a large influence on the average cost per teacher is illuminated in the discrepancy between fixed and variable costs. In the Model School, as well as in all three of the sample schools, the fixed costs were far greater than the variable costs. Interventions with high fixed costs relative to variable costs are more sensitive to scale of implementation, that is, the number of participants involved (Levin & McEwan, 2001). When a school intervention has high fixed costs relative to variable costs, the scale of implementation plays a larger role (Levin & McEwan, 2001). If the variable costs are large relative to the fixed cost, implementing an intervention on a large scale[66] will not lower the average cost significantly. For instructional coaching, which is an intervention with high fixed costs relative to variable costs[67], school leaders must be sensitive to the number of teachers the coach will collaborate with. Odden and Picus (2004) have suggested one instructional coach per 200 students, or about seven teachers per coach when there is an average class size of 27.8 students[68]. At this high level of intensity, the coaching program will be more costly for the district on a per teacher basis. When school leaders decide to implement an instructional coaching program, the most important decision with regard to cost is the ratio of teachers per coach.

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[66]The scale of implementation has received a great deal of attention from research by the RAND Corporation (Vernez, et al., 2006). In their studies, scale refers to the number of schools a reform is being implemented; however, in the above discussion, I refer to scale as the intensity in which it is being implemented, that is, the number of coaches per teacher that are hired. In either definition of scale of implementation, one can define the scale of implementation as the number of participants (students) involved, and the cost implications discussed above are the same.

[67] This is true in part because of the way I have chosen to define the fixed cost and the variable cost. Another method might be to consider all costs variable since no major capital purchases are required, and coaches could be hired part time. I chose to define the hiring of a full time coach as a fixed cost because this is called for in the instructional coaching model (Knight, 2007).

[68] In their analyses, Odden and Picus (2004) have examined the cost of educational adequacy, using a prototypical school with 500 students and 18 teachers, which results in a class size of 27.8 students.

How many teachers an instructional coach should collaborate with over the course of a school year is a complex decision that involves many factors. It is impossible for instructional coaches or other school leaders to have complete control over how many teachers collaborate with each instructional coach because of time constraints the coach faces and the voluntary nature of teacher collaboration. Teachers typically collaborate on a voluntary basis and for coaches, enrolling teachers is often their biggest challenge (Knight, 2007). Furthermore, collaborating with as many teachers as possible is not necessarily the best option for a coach because the goal of a coaching program should not be to minimize costs, but rather to maximize the difference between the total benefit and the total cost, if each can be measured monetarily. Economic theory suggests the ideal ratio of teachers per coach could be identified by determining the number teachers that causes the marginal cost of working with an additional teacher, roughly $387, to be equal to the marginal benefit of working with an additional teacher (Varian, 1990). Research has suggested that as coaches are spread out over more teachers, their effectiveness may decrease (Odden & Archibald, 2009), thus the marginal benefit would be a deceasing function with respect to the number of collaborating teachers. Measuring the total and marginal benefit of the coaching program is beyond the scope of the present study. While this discussion is more theoretical than practical, it provides a new way to think about strategies for maximizing the efficiency of a coaching program.

Limitations

The study has two main limitations. First, the cost of traditional approaches to professional development was not based on empirical data, rather, data was collected through interview with associates from two professional development companies, Marzano Research Laboratories and Staff Development for Educators. The strategies school districts use to

implement these traditional approaches to professional development may be different from what these companies envision. The second limitation is the lack of data on the effectiveness of each approach to professional development. It has been widely accepted in the literature that school-based coaching is more effective in supporting teachers to implement new teacher strategies than are short-term workshops with no follow-up (Darling-Hammond, et al. 2009; Garet et al., 2001; Neufeld & Roper, 2003; Bush, 1984); however, without a rigorous study of effectiveness, no statements can be made with regard to the cost-effectiveness of each model.

Significance to Educational Research and Conclusion

Among the contributions of this study, two warrant particular note. First, a framework for measuring the cost of coaching is described in full detail and results from three schools in one district are reported. A framework for measuring districts' total investment of professional development has been developed over the past 30 years; (Rice, 2003; Odden et al., 2002; Miller et al., 1994; Little et al., 1987; Moore & Hyde, 1978) however, literature searches for the present study revealed no explicit cost framework and virtually no rigorous cost analyses on instructional coaching. Other studies have highlighted the dearth in knowledge surrounding the cost of instructional coaching programs (Darling-Hammond et al., 2009; Neufeld & Roper, 2003).

Second, educational leaders can gain an understanding of all costs involved in implementing a coaching program, including the hidden costs. School staff should have a full understanding of all resources required of a school program to ensure proper implementation (Levin et al., 2010). Also, by revealing what resources have the largest impact on the average cost of coaching, school leaders can use strategies to lower the average cost of coaching in their district. Finally, school leaders gain an understanding of the economic costs of various approaches to professional development, so that they can make more informed decisions.

Clearly, the coaches' salary is the highest cost as a percentage of the total cost of instructional coaching, but there are other, hidden costs of running a successful coaching program such as teacher salaried work time and professional development for coaches. Moreover, analyzing the cost of each ingredient as a percentage of total cost also clarifies which costs have the biggest influence on the *total* cost, rather than the average cost. For instance, some resources (laptops, workbooks, and principals' time) should always be provided to a coach because while providing these resources may increase effectiveness, not doing so will not save a considerable amount of money.

Economic analysis in education continues to be an emerging line of inquiry, and this study adds to that literature. The economics of teacher training and professional development is a particularly important area because personnel are consistently the largest portion of any school budget (Levin & McEwan, 2001). Professional development for school leaders and teachers is one part of a cohesive strategy to provide highly qualified teachers in every classroom that are better equipped to reach the unique needs of every student, every day.

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APPENDIX

Appendix A: List of Tables Figures

[69] Figures represent all elementary and secondary public school teacher salaries in the U.S. plus an estimated 25% fringe benefits. Compensation for extra curricular activities is excluded.

Appendix B: Teacher Time Data for Schools 2 and 3

Table 1B: Cost of Teacher Time at School 2

Teachers	Total Cost = (Hourly Wage * A)	A. Total Hours Devoted to Coaching [B + C + D + E]	Activities measured in hours			
			B. One-on-one	C. Small Group	D. Large Group	E. Teacher Prep
Teacher 1	$418.45	9	1.5	0	7.5	0
Teacher 2	$418.45	9	1.5	0	7.5	0
Teacher 3	$348.71	7.5	0	0	7.5	0
Teacher 4	$383.58	8.25	0.75	0	7.5	0
Teacher 5	$418.45	9	1.5	0	7.5	0
Teacher 6	$418.45	9	1.5	0	7.5	0
Teacher 7	$395.20	8.5	0.75	0	7.5	0.25
Teacher 8	$348.71	7.5	0	0	7.5	0
Teacher 9	$348.71	7.5	0	0	7.5	0
Teacher 10	$348.71	7.5	0	0	7.5	0
Teacher 11	$348.71	7.5	0	0	7.5	0
Teacher 12	$348.71	7.5	0	0	7.5	0
Teacher 13	$488.19	10.5	3	0	7.5	0
Teacher 14	$523.06	11.25	3.75	0	7.5	0
Teacher 15	$523.06	11.25	3.75	0	7.5	0
Teacher 16	$557.94	12	4.5	0	7.5	0
Teacher 17	$674.17	14.5	6	0	7.5	1
Teacher 18	$709.04	15.25	6.75	0	7.5	1
Teacher 19	$860.15	18.5	9	0	7.5	2
Teacher 20	$1,185.61	25.5	15	0	7.5	3
Teacher 21	$1,604.06	34.5	0.75	27	7.5	0
Teacher 22	$1,604.06	34.5	0.75	27	7.5	0
Teacher 23	$1,604.06	34.5	0	27	7.5	0
Teacher 24	$1,604.06	34.5	0	27	7.5	0
Teacher 25	$1,604.06	34.5	0.75	27	7.5	0
Teacher 26	$1,638.93	35.25	0.75	27	7.5	0
Teacher 27	$1,638.93	35.25	0	27	7.5	0
Teacher 28	$1,638.93	35.25	0.75	27	7.5	0
Teacher 29	$1,638.93	35.25	0	27	7.5	0
Teacher 30	$1,638.93	35.25	0	27	7.5	0
Total Cost	**$26,281.07**	565.25 hours	$2,929	$12,554	$10,461	$337
Average FTE		**1.29%**	0.14%	0.61%	0.51%	0.02%
Cost per Teacher	$876.04		$98	$418	$349	$11

Table 2B: Cost of Teacher Time at School 3 for Coach 1

Teachers	Total Cost = (Hourly Wage * A)	A. Total Hours Devoted to Coaching [B + C + D + E]	Activities measured in hours			
			B. One-on-one	C. Small Group	D. Large Group	E. Teacher Prep
Teacher 1	$534.69	11.5	0.5	0	11	0
Teacher 2	$534.69	11.5	0.5	0	11	0
Teacher 3	$534.69	11.5	0.5	0	11	0
Teacher 4	$557.94	12	1	0	11	0
Teacher 5	$534.69	11.5	0.5	0	11	0
Teacher 6	$534.69	11.5	0.5	0	11	0
Teacher 7	$557.94	12	1	0	11	0
Teacher 8	$534.69	11.5	0.5	0	11	0
Teacher 9	$523.06	11.25	0.25	0	11	0
Teacher 10	$546.31	11.75	0.75	0	11	0
Teacher 11	$557.94	12	1	0	11	0
Teacher 12	$534.69	11.5	0.5	0	11	0
Teacher 13	$523.06	11.25	0.25	0	11	0
Teacher 14	$627.68	13.5	2.5	0	11	0
Teacher 15	$685.80	14.75	3	0	11	0.75
Teacher 16	$650.92	14	2.5	0	11	0.5
Teacher 17	$604.43	13	2	0	11	0
Teacher 18	$802.03	17.25	4.75	0	11	1.5
Teacher 19	$929.89	20	6	0	11	3
Teacher 20	$1,034.51	22.25	7.75	0	11	3.5
Total Cost	**$12,344.32**	**265.5 hours**	$1,685	$0	$10,229	$430
FTE / teacher		0.91%	0.12%	0.00%	0.75%	0.03%
Cost / teacher	$617.22		$84	$0	$511	$22

Table 3B: Cost of Teacher Time at School 3 for Coach 2

Teachers	Total Cost = (Hourly Wage * A)	A. Total Hours Devoted to Coaching [B + C + D + E]	Activities measured in hours			
			B. One-on-one	C. Small Group	D. Large Group	E. Teacher Prep
Teacher 1	$441.70	9.5	0.5	0	9	0
Teacher 2	$441.70	9.5	0.5	0	9	0
Teacher 3	$464.95	10	1	0	9	0
Teacher 4	$464.95	10	1	0	9	0
Teacher 5	$464.95	10	1	0	9	0
Teacher 6	$511.44	11	2	0	9	0
Teacher 7	$511.44	11	2	0	9	0
Teacher 8	$511.44	11	2	0	9	0
Teacher 9	$650.92	14	3	0	9	2
Teacher 10	$557.94	12	3	0	9	0
Teacher 11	$790.41	17	6	0	9	2
Total Cost	**$5,811.83**	**125 hours**	$1,023	$0	$4,603	$186
FTE / teacher		0.78%	0.14%	0.00%	0.61%	0.02%
Cost / teacher	$528.35		$93	$0	$418	$17

Table 4B: Cost of Teacher Time at School 3 for Coach 3

Teachers	Total Cost = (Hourly Wage * A)	A. Total Hours Devoted to Coaching [B + C + D + E]	Activities measured in hours			
			B. One-on-one	C. Small Group	D. Large Group	E. Teacher Prep
Teacher 1	$464.95	10	1	0	9	0
Teacher 2	$464.95	10	1	0	9	0
Teacher 3	$464.95	10	1	0	9	0
Teacher 4	$511.44	11	2	0	9	0
Teacher 5	$511.44	11	2	0	9	0
Teacher 6	$511.44	11	2	0	9	0
Teacher 7	$511.44	11	1	0	9	1
Teacher 8	$557.94	12	3	0	9	0
Teacher 9	$604.43	13	4	0	9	0
Teacher 10	$557.94	12	3	0	9	0
Teacher 11	$650.92	14	3	0	9	2
Total Cost	**$5,811.83**	**125 hours**	$1,069	$0	$4,603	$139
FTE / teacher		0.78%	0.14%	0.00%	0.61%	0.02%
Cost / teacher	$528.35		$97	$0	$418	$13

Table 5B: Combining the Cost of Teacher Time for Coaches 1, 2 and 3 at School 3

Teachers	Total Cost = (Hourly Wage * A)	A. Total Teacher Contact Hours [B + C + D + E]	Activities measured in hours			
			B. One-on-one	C. Small Group	D. Large Group	E. Teacher Prep
Coach 1	$12,344.32	265.5	36.25	0	220	9.25
Coach 2	$5,811.83	125	22	0	99	4
Coach 3	$5,811.83	125	23	0	99	3
Total Cost	**$23,967.97**	515.5 hours	$3,778	$0	$19,435	$756
FTE / teacher		**0.84%**	0.13%	0.00%	0.68%	0.03%
Cost / teacher	$570.67		$90	$0	$463	$18

Appendix C: Teacher Salaries

National Average Teacher Salaries. United States market wages, measured by national average salaries, were applied to each personnel member. This strategy allows different interventions to be compared based on real variables such as required time commitments, rather than nominal variables such as a particular individuals' salary or other idiosyncrasies. Each year the Institute for Education Sciences (IES) publishes the *Digest of Educational Statistics*, which is currently compiled by Snyder and Dillow (2010). Citing the National Education Association Snyder and Dillow (2010) report that elementary and secondary public school teachers across the U.S. were paid an estimated base salary of $53,910, for the 2008-09 school year (Snyder & Dillow, 2010). Fringe benefits are added to this figure at an estimated 25% for total compensation of $67,388 for the 2008-09 school year. In order to reflect wages from the 2009-10 school year, a final adjustment is required that adjusts for inflation, which is discussed in Chapter 3: Methodology of Cost Analysis. After adjusting for inflation, the reported nominal teacher compensation of $67,388 for school year 2008-09 (Snyder & Dillow, 2010) becomes approximately $68,068 in 2009-10 dollars.

The figure of $68,068 is roughly consistent with teacher salaries used by Levin, et al., (2010) and by Odden and Archibald (2009). Levin, et al. (2010) used national average teacher salaries in 2004-05 school year of $45,884 plus 25% fringe benefits, citing the Educational Research Service, while Odden and Archibald (2009) also used national average salaries in 2005 of $47,808 plus 30% fringe benefits, citing the National Education Association. Parrish (1994) did not specifically cite the source for his teacher salary data, but used $43,505 as a figure for total compensation during the 1991-92 school year. Table 9 provides a comparison of teacher salaries used by Levin, et al., (2010), Odden and Archibald (2009), Parrish (1994) and for the

present study. Using the *Digest of Educational Statistics* (Snyder & Dillow, 2010), the corresponding years are reported in order to provide a comparison among the different studies and their sources.

Table C1: Differences in the Estimated National Average Teacher Salaries and Reported Sources in Three Other Cost Analyses

Author	Source	Year	Base Salary	Fringe Benefits	Total Compensation (Nominal Dollars)	Total Compensation (2009-10 Dollars)
Knight (2010)	*Digest of Educational Statistics*. IES, NCES, 2010	**2008-09**	$53,910	25%	$67,388	$68,068
		2004-05	$47,516	25%	$59,395	$67,158
		1991-92	$34,063	25%	$42,579	$66,772
Levin, et al. (2010)	Educational Research Service, 2005	**2004-05**	$45,884	25%	57,355	$64,851
Odden & Archibald (2009)	National Educational Association, 2005	**2005**	$47,808	30%	62,150	$70,273
Parrish (1994)	Not indicated	**1992**	Not indicated	N/A	43,505	$68,225

Teacher Salaries Through History. Since the 1970-71 school year, teacher salaries have increased marginally, 7.65%, at an average[70] of about .24% per year for 39 years, when correcting for inflation. After decreasing for six straight years during the 1990s, teacher salaries have remained stable growing a total of less than 2% since 2000 (Snyder & Dillow, 2010). Goldhaber (2001) has used the employment cost index (Bureau of Labor Statistics) to show that

[70] This figure represents the geometric mean, since using arithmetic mean with growth rates is inappropriate.

teacher salaries have increased relative to all other civilian salaries since 1980. Actual salaries of personnel in the sample were lower than national average salaries because the cost of living in the sampled district is lower than the national average, which drives down the areas salaries (Goldhaber, 2001).

Figure C2: Estimated National Average of Total Compensation of Teachers[71] Since 1960

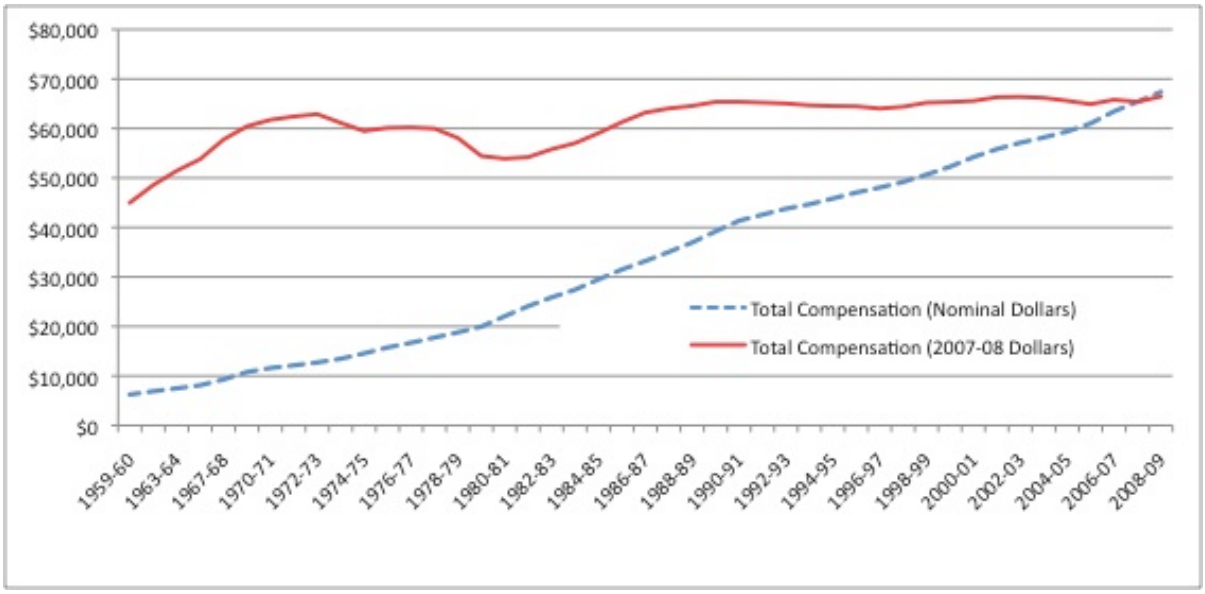

Table C3: Estimated National Average Teacher Salaries Since 1960

School Year	Base Salary (nominal dollars)	Total Compensation (nominal dollars)	Total Compensation (2007-08 Dollars)	Percentage Change from Previous Year
1959-60	$4,995	$6,244	$44,986	n/a
1969-70	$8,626	$10,783	$60,429	4.62%
1974-75	$11,641	$14,551	$59,479	-2.70%
1979-80	$15,970	$19,963	$54,436	-6.26%
1984-85	$23,600	$29,500	$59,048	3.54%
1989-90	$31,367	$39,209	$65,371	1.27%
1994-95	$36,675	$45,844	$64,526	-0.23%
1999-00	$41,807	$52,259	$65,350	0.22%
2004-05	$47,516	$59,395	$65,595	-0.89%
2005-06	$48,804	$61,005	$64,901	-1.06%
2006-07	$50,758	$63,448	$65,799	1.38%
2007-08	$52,308	$65,385	$65,385	-0.63%
2008-09	$53,910	$67,388	$66,460	1.64%

Source: Snyder (2010) for both figures.

[71] Figures represent all elementary and secondary public school teacher salaries in the U.S. plus an estimated 25% fringe benefits. Compensation for extra curricular activities is excluded.

Teacher Salaries for Sample Schools. For personnel in the sample, the national average salaries were higher than the salaries they actually received. This was likely due to districts location, the Midwestern region of the United States. Because of the lower cost of living, salaries for a particular job and set of qualifications are often lower than that of the national average. Figure C4 shows the salary schedule actually applied to all coaches and teachers in the study sample.

Figure C4: The Base Salary Schedule for the Sampled District

STEP	BS	BS+10	BS+20	BS+30	MA	MA+15	SPEC MA+30	SPEC+15 MA+45	DOC
A	35,040	36,040	37,240	38,440	40,440	41,840	43,240	44,640	46,640
B	35,540	36,540	37,740	38,940	40,940	42,340	43,740	45,140	47,140
C	36,040	37,040	38,240	39,440	41,440	42,840	44,240	45,640	47,640
D	36,540	37,540	38,740	39,940	41,940	43,340	44,740	46,140	48,140
E	37,040	38,040	39,240	40,440	42,440	43,840	45,240	46,640	48,640
F	37,540	38,540	39,740	40,940	42,940	44,340	45,740	47,140	49,140
G	38,040	39,040	40,240	41,440	43,440	44,840	46,240	47,640	49,640
H	38,540	39,540	40,740	41,940	43,940	45,340	46,740	48,140	50,140
I	39,040	40,040	41,240	42,440	44,440	45,840	47,240	48,640	50,640
J	39,540	40,540	41,740	42,940	44,940	46,340	47,740	49,140	51,140
K	40,040	41,040	42,240	43,440	45,440	46,840	48,240	49,640	51,640
L		41,540	42,740	43,940	45,940	47,340	48,740	50,140	52,140
M		42,040	43,240	44,440	46,440	47,840	49,420	50,640	52,640
N		42,540	43,740	44,940	46,940	48,340	49,740	51,140	53,140
O			44,240	45,440	47,440	48,840	50,240	51,640	53,640
P			44,740	45,940	47,940	49,340	50,740	52,140	54,140
Q			45,240	46,440	48,440	49,840	51,240	52,640	54,640
R				46,940	48,940	50,340	51,740	53,140	55,140
S				47,440	49,440	50,840	52,240	53,640	55,640
T				47,940	49,940	51,340	52,740	54,140	56,140