School Finance Redesign Project

center on reinventing public education

A NEW APPROACH TO THE COST OF TEACHER TURNOVER

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Working Paper 13

April 6, 2007

UNIVERSITY OF WASHINGTON

The School Finance Redesign Project

The School Finance Redesign Project (SFRP) encompasses research, policy analysis, and public engagement activities that examine how K-12 finance can be redesigned to better support student performance. The project addresses the basic question, "How can resources help schools achieve the higher levels of student performance that state and national education standards now demand?"

Check in with us periodically to see what we're learning and how that information may re-shape education finance to make money matter for America's schools. You can find us at www.schoolfinanceredesign.org.

Jacob Adams, Principal Investigator

The SFRP Working Paper Series

The Working Paper Series presents analyses that are complete but have not undergone peer review. The papers are subject to change and should be cited as working papers. Their purpose is to promote discussion and to solicit reactions.

Support from the Bill & Melinda Gates Foundation

This work was supported by the School Finance Redesign Project at the University of Washington's Center on Reinventing Public Education through funding by the Bill & Melinda Gates Foundation, Grant No. 29252. The views expressed herein are those of the authors and are not intended to represent the project, center, university, or foundation.

Foreword

From the early 1990s through today, controversies about public spending on elementary and secondary education have grown as states have adopted performance standards pledging that every child will learn enough to become an independent productive citizen and as *No Child Left Behind* has put teeth in these expectations. Some educators say that meeting higher standards requires more money. Others claim that existing resources are sufficient to pay for higher performance, if only funds were used more productively. While plaintiffs have asked courts to determine what amount of spending is adequate to get students to standards, analysts of various stripes have argued that greater expenditures alone will not lead to better results. Moreover, critics of demands for more money point to cases in states and cities where major spending increases were misspent, with little or no impact on student learning. Though no one seriously argues that more spending could never lead to school improvement, there is compelling evidence that without changes in the way resources are distributed, used, and accounted for Americans could end up with a more expensive, but not necessarily more effective, public education system.

In this environment, governors and state legislators particularly have asked two questions: How much money will it take for all students to meet standards? And how should the money be spent to ensure that result? The Bill & Melinda Gates Foundation asked the Center on Reinventing Public Education (CRPE) to create a School Finance Redesign Project (SFRP) to help elected officials, practitioners, and the public better understand how education finance systems now work and to identify new options for deploying K-12 resources to support state and national educational goals. Initiated in 2003, the project has grown to include more than 30 separate analyses.

SFRP was designed to address five questions:

- Are public education funds now focused on student learning? If not, what stands in the way?
- Are there good ideas about potentially more focused and effective uses of funds to promote student learning?
- Are there good ideas about better ways to spend money to attract and reward quality educators?
- Do we know enough now to say exactly how much money is needed to bring all children up to standards and to say how money should be spent?
- What can policymakers do to ensure that the "right amount" of money is distributed equitably, used productively, and accounted for meaningfully?

This study by Anthony Milanowski and Allan Odden addresses the third question by examining the cost of teacher turnover. The authors' focus is important because teacher turnover detracts from the nation's efforts to place qualified teachers in every classroom, and a general lack of information about the costs of this turnover makes it difficult to assess the effectiveness of new incentive programs that attempt to retain teachers already on the job. Milanowski and Odden launch their investigation by breaking down the cost of teacher turnover into its constituent parts: separating teachers from their districts; hiring, paying, and training their replacements; and calculating the value of lost productivity. The authors then use this model to

examine the central office and school-level costs associated with teacher turnover in a 90,000-student urban school district that lost 10-12% of its teachers during the past five years. This sample of schools allowed the authors to observe whether and how the cost of teacher turnover differed across elementary, middle, and high schools and across schools with different levels of student achievement.

In the end, Milanowski and Odden combine the costs of staff time and severance pay; recruiting, interviewing, and application processing; teacher compensation; induction and professional development; and lost productivity to estimate the average cost per vacancy of replacing teachers with new hires. They also describe how these costs can vary across schools and by the experience level of the teacher who leaves. Along the way, the authors also grapple with tough methodological issues that are central to future analyses, such as how to calculate productivity losses, estimate training costs, and deal with intra-district teacher transfers. At a time when education policy increasingly is focused on using educational resources productively and providing high quality teachers for America's schools, this study helps decision makers better understand and target financial and other incentives to reduce teacher turnover, thus mitigating the cost to students of losing their experienced instructors.

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Introduction

Teacher turnover has been identified as a major obstacle in staffing the nation's schools with qualified teachers. Turnover has been identified as a key reason for teacher shortages (Ingersoll 2001). Not only does excessive turnover contribute to teacher shortages, but it also makes it more difficult to build teacher learning communities within schools (Shaffer, Nesselrodt, and Stringfield 1997; Unseem et al.1997). Given the typical pattern of intra-district transfers, high levels of turnover also have led to concerns that high-poverty schools will have a higher proportion of inexperienced teachers (Price 2002; Peske and Haycock 2006). Such concerns about turnover have led some districts and states to develop financial and other incentives to increase teacher retention. About 10 percent of districts are using financial incentives to help recruit and retain teachers in shortage areas and schools (Murphy and DeArmond 2003). However, very little is known about the cost of turnover since there are few studies of the costs of teacher turnover. This lack of information makes it difficult to assess the cost effectiveness of turnover reduction programs such as financial incentives or loan forgiveness. While estimates of turnover costs have been made using 'rule of thumb' formulas (e.g., cost is 1.5 times the average annual salary), these estimates are not very convincing because it is not known how well the rules of thumb derived from private sector workers apply to teachers, nor is it clear on what data they are based. This research seeks to provide policy makers with some hard information on the costs of teacher turnover. The goal is to develop an average dollar cost per vacancy, which could also be converted to a percent of payroll, in order to compare to the rules of thumb mentioned above. This paper also contributes by exploring some important methodological issues that researchers and administrators face in estimating a cost of turnover.

Conceptual Framework

While rules of thumb appear to be used when estimating turnover costs, management scholars and industrial/organizational psychologists have developed conceptual models for estimating turnover costs. Such cost estimates are often used to justify the costs of turnover reduction efforts to cost-conscious private sector managers. The initial conceptual work in this area (Smith and Watkins 1978; Cascio 1987) identified several components of turnover costs, as shown in Figure 1 below.

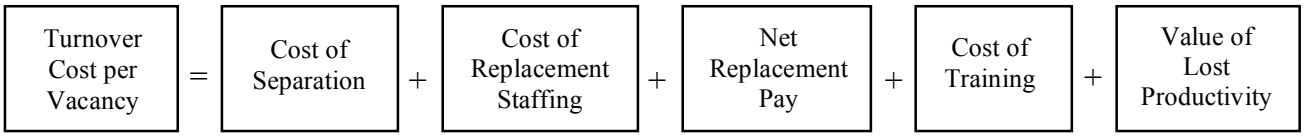

Figure 1. Components of Cost of Turnover

Separation costs include items such as time to process termination documents, payment of accrued sick leave, or severance pay. Replacement staffing costs include out of pocket recruitment and selection expenditures and staff time, as well as any monetary inducements such as a signing bonus. Net replacement pay is the difference in compensation between the worker who left and the replacement, typically a cost savings when an inexperienced worker is hired to replace an experienced one. Training costs typically include orientation, induction, and training

to a standard level of competence that is needed for adequate performance of the assigned work. These costs include materials, costs of formal instruction, costs of on-the-job training, and the compensation of the new employee during off-the-job training. The value of lost productivity is the productivity difference between the replacement worker and the worker who left. This difference is typically a loss and thus a cost when the replacement worker has a lower skill level or needs to learn the job in order to reach the level of productivity of the original worker.

This basic scheme has been followed by other writers seeking to provide guidance on estimating turnover costs (e.g., Heneman and Judge 2003; Hom and Griffeth 2001). Later work added more sophistication by attempting to account for the time value of costs (Tizner and Birati 1996) and the potential for different types of workers to have different turnover costs, primarily due to productivity differences (Darmon 1990). Given the relatively small amount that is known about the cost of teacher turnover, the model used in this study stays relatively close to the basic scheme.

Parts of this model have been used to estimate the cost of teacher turnover. The only empirical study that appears in the ERIC data base, which was performed by the Texas Center for Educational Research (2000), found costs of $3,400 and $5,200 per vacancy for two Texas districts. This study did not, however, take into account lost productivity or the difference in pay between more senior leaving teachers and the new hires.

In the case of teachers, it is important to consider differences in compensation between the teacher who left and the replacement due to the strong dependence of teacher salaries on seniority. The replacement of a highly senior teacher with a less experienced one could produce significant salary savings. Anecdotal evidence suggests that this savings is apparent to districts, and they have been accused at times of promoting turnover of senior teachers to save money.

The value of lost productivity is also an important component of the cost of turnover. In for-profit organizations, this is estimated in dollar terms primarily based on the value of the output, sales, or revenues produced by each worker. These costs tend to be the biggest portion of turnover cost in studies of turnover in private firms. While this cost is not easy to estimate for some workers in private firms, it is even harder to estimate for teachers due to the difficulty of valuing the contribution teachers make to student learning and student well being. While in principle one could try to establish the difference in the net present value of the earnings stream of students of teachers with the characteristics of the replacement and replaced teachers, empirically there is no feasible way to do so. A simpler method would be to define the productivity difference in terms of value-added student achievement:

$$\text{Net Productivity Difference} = \text{Student Achievement of Replaced Teacher} - \text{Student Achievement of Replacement Teacher}$$

This difference is likely to be positive if an experienced teacher is replaced by a relatively new teacher. That first year teachers have lower productivity, in terms of student achievement, appears fairly well accepted (Rice 2003; Goldhaber and Anthony 2003). The problem of putting a dollar value on this difference will be further discussed below.

Method

Research Site

This study collected cost of turnover data from a large Midwestern urban district with a relatively decentralized teacher hiring process. This district serves almost 90,000 students in 160 schools. It employs approximately 6,000 teachers. The student population is approximately 60 percent African American, 19 percent Hispanic, and 21 percent Caucasian and other. About 74 percent of the students are eligible for free or reduced-price lunch. The district has had a gross turnover rate of between 10 and 12 percent over the past five school years and has been hiring an average of 550 teachers per year over that period. As in most large districts, there is also considerable movement of teachers among schools. In this district, about 10 percent of teachers change schools each year. The process of separating and replacing teachers in the district involves the activities shown in Figure 2.

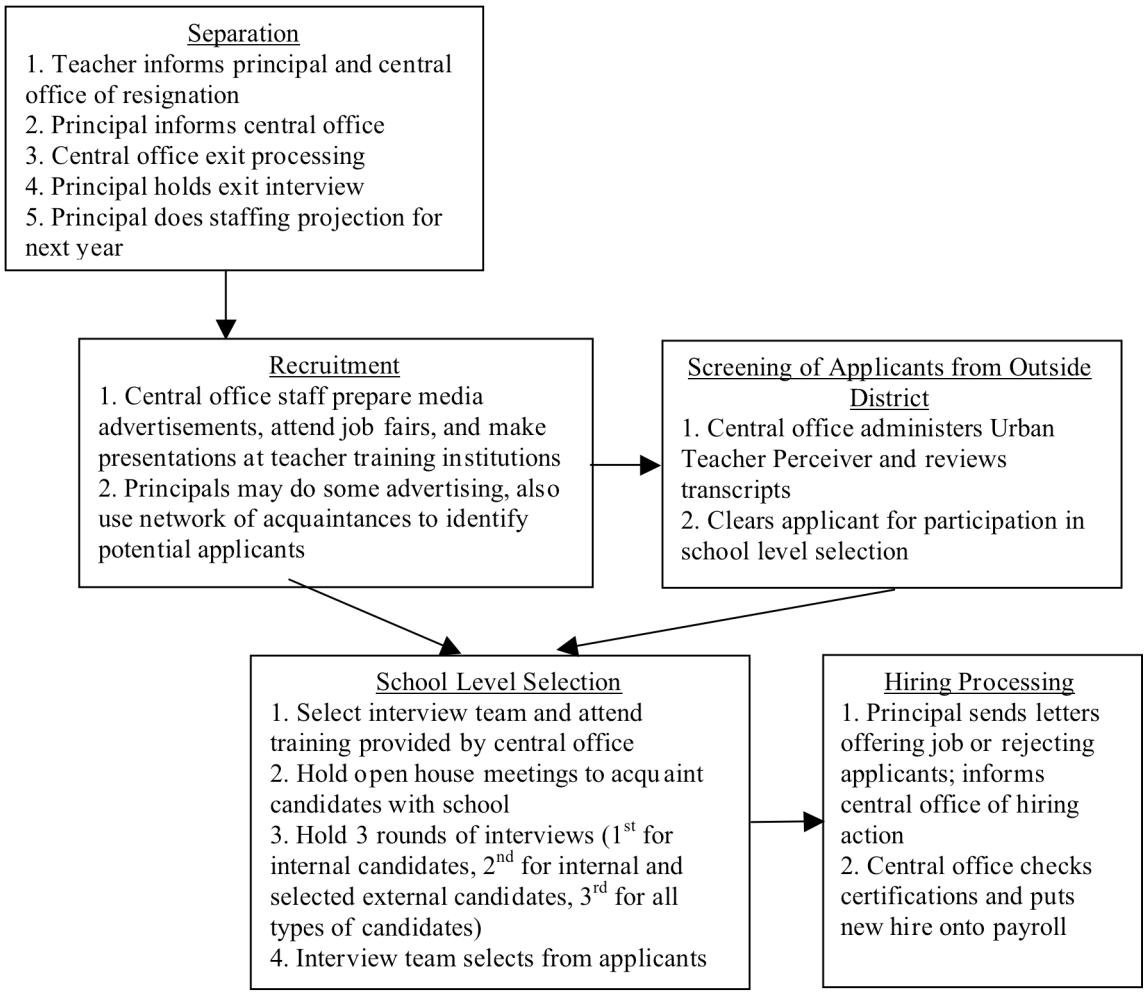

Figure 2. Study District Hiring Process

There are two notable features of this district's processes. First, final hiring decisions are made at the school level, and schools are not required to take transfers based on seniority unless they have vacancies at the end of the three interview cycles and there are surplus teachers who need jobs. By far the most vacancies are filled via the interview process. Second, the school-level activities include heavy involvement of teachers in the three-round interview process. Typically, several teachers are trained for and participate in interviews with candidates and in making the final selection. Teachers are not paid for participating in these activities, instead contributing their time on a voluntary basis. This raises a question of how this time should be accounted for in the cost of turnover. One alternative would be to estimate replacement-staffing costs without including a cost for this teacher time. However, this time is not likely to be totally costless because the teachers who volunteer could be using the same time and energy in other activities that contribute to the school or district. Further, other districts may pay teachers for such participation, and so not including these costs would limit the usefulness of the estimate. In this paper, the cost of replacement staffing is estimated both with and without this time cost.

Methodological Issues

The application of the relatively simple model of turnover costs presented above to this actual school district requires confronting several methodological questions, some of which do not have obvious answers. These include how to operationalize productivity losses, how to estimate the cost of training, and whether to include costs related to intra-district transfers. These are discussed in turn below.

Net Productivity Difference. The initial step in estimating conception was to estimate lost productivity by estimating the productivity of each leaver and their replacement, then subtracting the replacement's productivity from the leaver's. Productivity was to be defined in terms of value added achievement of the students in each teacher's classroom. There were three difficulties that were immediately encountered in attempting to carry out this conception. First, many teachers do not teach subjects in which test scores are available to estimate value added. Thus, for a substantial portion of turnover and replacement teachers, no productivity difference could be directly estimated. In this study, the assumption was made that teachers for which productivity differences could not be estimated had productivity differences proportional to those for which productivity differences could be estimated. In practice, the value-added data that are available, both from the study district and other studies, are data on reading and mathematics instructional productivity in the elementary grades. This means that the productivity lost by replacing a veteran high school music teacher with a newly hired teacher was taken as being equal to that lost in mathematics or reading by replacing a veteran fourth grade teacher with a newly hired teacher. While this is not very satisfactory, it is necessary to give some idea of lost productivity. If the reader finds this too objectionable, she or he can consider the lost productivity estimate as applying only to teachers teaching tested subjects.

Second, because many vacancies at the school level are filled with experienced teachers who transfer from other schools or between grades in the same school, it was conceptually and practically hard to determine the identity of the replacement teacher. When a vacancy is filled by a transfer, a vacancy is created in another school, which in turn might also be filled by transfer. While the ultimate vacancy will be filled from the outside, it could be at a different school or grade. Since the district could not provide us with information that would allow us to track who filled each vacancy, it was not possible to determine who actually replaced whom. Further, in the

case of filling a vacancy from within, the biggest productivity loss from the district's perspective would be between the leaving teacher and the ultimate replacement. We therefore decided to express lost productivity in terms of the difference in average productivity between first-year teachers and experienced teachers. As discussed below, experienced teachers are defined as those with six or more years of experience. This approach was motivated by the emerging empirical consensus that new, inexperienced teachers typically have lower productivity than their experienced colleagues, but that the returns to experience diminish after 3 to 5 years (Goldhaber and Anthony 2003; Rice 2003).

Third, because this district has only recently developed data systems that allow linking students to teachers, there is only limited information on the value added of teachers at different levels of experience available. To estimate the difference in productivity, we used the results of three recent studies in which an explicit estimate of the difference in productivity between new and experienced teachers was made, namely Clotfelter, Ladd, and Vigdor (2006); Hanushek et al. (2005); and Kane, Rockoff, and Staiger (2006). The effect sizes from these studies are shown in Table 1. Table 1 also shows the Kane, Rockoff, and Staiger (2006) estimates for a first- versus second-year teacher contrast. These were used in estimating the lost productivity due to the departure of a teacher after her or his first year. More information about the studies can be found in the appendix.

Table 1. Estimated Effect Size of Differences in Student Achievement Between First-Year and Experienced Teachers

Study	Contrasts	Reading Range	Math Range
Clotfelter, Ladd, and Vigdor (2006)	New vs. 6-12 New vs. 13-20 New vs. 20-27 New vs. 28+	.05 - .07 .07 - .08 .08 - .09 .07 - .09	.08 - .09 .08 - .09 .09 .09 - .10
Hanushek et al. (2005)	New vs. 6+	NA	.16
Kane, Rockoff, and Staiger (2006)	New vs. 7+ New vs. 1 year	.04 - .05 .02	.05 - .13 .03 - .05

To the extent that the differences in value-added found in those studies is representative of teachers in the study district and of teachers of other subjects or grades, a reasonable estimate of the productivity difference is between 0.07 and 0.10 standard deviations of student achievement.

The next step was developing a way to value this productivity difference. To get some idea of the value of this size effect, it can be compared to the effect sizes reported for interventions such as class size reduction and comprehensive curriculum designs such as Success for All, for which costs are available or can be estimated. The approach taken was to develop an estimate of cost per unit of effect size from these two interventions, then multiply that cost by the effect size estimate of 0.07 to 0.10 standard deviations for an experienced versus new teacher. The resulting cost estimates, of course, apply best to students below the high school level, since both the effect sizes for teacher experience and the comparison interventions come from research with such students.

Cost of Training. In this study, two types of training costs are included. One is the cost of induction, both in terms of staff time and materials for formal induction activities, and costs associated with more informal mentoring and support, such as assignment of a buddy teacher, when these can be estimated. Such costs seem directly related to teacher productivity, given the well-known difficulties new teachers have translating skills learned in preparation programs to independent responsibility for their own classrooms.

The second is the cost of the ongoing, post-induction professional development that is needed to bring the new teacher to the productivity level of the teacher she or he replaces. There are two related issues that make this hard to estimate. The first is whether that cost should include the cost of all professional development activities provided for the teacher who has left over the course of her or his career. The second is deciding how much training is needed to get a new teacher "up to speed." The two are related, because using the cost of all the professional development that has been provided to the teacher who leaves appears to be a straightforward way to estimate the cost of bringing the replacement to a comparable level of productivity. This would mean counting the total professional development investment in the teacher that left as a cost of turnover.

There are two considerations however, that suggest that this approach would substantially overstate the cost of turnover. First, the knowledge imparted by professional development depreciates over time. Some becomes obsolete, especially that pertaining to curriculum or district policies that change over time. Districts may in fact want teachers to forget some of this earlier learning. Teachers are also likely to forget some professional development content, and new professional development programs repeat content covered by older ones. Second, given the general consensus that much professional development is not effective (Corcoran 1995; Darling-Hammond 1997; Borko 2004), there is not much value to be lost after several years.

Given the evidence cited above that teacher productivity does not continue to improve in a linear manner over time, it was decided to include five years' worth of training costs for every turnover with five or more years of experience and a number of years equal to the years of experience for those with less than five years. So training costs are estimated as induction cost plus yearly training costs, up to five years.

Intra-District Transfers. Another issue is how to include the costs associated with interviewing and processing interschool transfers in the cost of turnover. On one hand, replacing transfers is a cost of turnover at the school level, and transfers also are likely to require processing time at the central office level. On the other hand from the district-wide point of view, this type of activity is not turnover in the sense of teachers leaving the district. And, in some cases, this sort of activity is desirable when transfers lead to a better match between schools and teachers. Also, transfers are likely to have considerably lower costs from the district point of view, since they do not require recruiting or screening and may not affect aggregate productivity (since, in the absence of a substantial matching effect, the transfer's productivity is simply moved to a different school). From the district perspective, transfers are not associated with a difference in replacement pay (unless the teacher transferring is replaced by a new teacher) since the transferee brings her or his pay to the new assignment. Because transfer costs are likely to be substantially lower than costs of new hires, turnover costs associated with transfers are estimated separately.

Data Collection

Data collection was done in two stages: the first for central office costs, the second for school-level costs. First, the district provided data about the hourly compensation of those involved in recruiting and hiring teachers at the central office level and the number of hours these staff spent on teacher recruitment and hiring. The district also provided information on recruitment costs such as advertising and attending job fairs. The type of data the district was able to provide dictated that most of the central office costs per re-filled vacancy be calculated by dividing the reported costs by the number of vacancies filled. The district provided data files containing teacher names, school assignments, and compensation for five years so that a representative number of vacancies and new hires could be calculated. These data also allowed calculation of the difference in pay between leaving teachers and new hires. Discussions with several central office staff were also held to clarify this data and the district's hiring processes.

At the school level, cost information was collected from a sample of eight schools, chosen to represent both different grade levels and levels of student achievement, to take into account the possibility that schools with higher-achieving students would have an easier time (and therefore lower costs) hiring replacement teachers. The sample consisted of two high schools, one combined high and middle school, one middle school, and four elementary schools. Information on the time spent in specific activities, recruitment costs, and professional development budgets was collected during semi-structured interviews using a standard set of activity categories (see Appendix 2). Principals and other staff involved in the hiring process were interviewed at the school or by phone. The time spent in each activity was multiplied by the average hourly rates of the appropriate staff, as provided by the district. Estimates for each school were then averaged across schools.

Results

Cost of Separation

The main costs of separation in this district are the compensation of staff processing separations and severance pay for retiring teachers. The district was not able to provide data that would allow the estimation of staff processing costs at the central office level. Based on interviews with the processors, about 0.08 hours per vacancy are spent in processing separations, giving a processing cost of $3 per vacancy. At the school level, separation processing is somewhat greater, mostly in principal time, for a cost of $21 per vacancy. The total is thus $24 per vacancy. Severance pay is provided to teachers who retire based on the value of days of unused sick leave. Based on data from the 2004-2005 and 2005-2006 school year, about 30 percent of the teachers who leave the district are retirees. The average severance pay amount was $10,667. The average severance per vacancy is thus $3,200 (30 percent of $10,667).[1]

[1] It could be argued that this in not true severance pay, but rather a retirement benefit paid. Also, this cost would actually be saved if a teacher leaves before retiring. On the other hand, this is an out-of-pocket cost the district pays when some teachers leave. This sort of conundrum illustrates some of the problems in defining a cost of turnover.

Cost of Replacement Staffing

The cost of replacement staffing includes both central office and school-level activities. In this district, central office costs include recruiting costs (staff time spend in recruiting activities, costs of advertising and materials, and travel to recruitment sites, primarily local job fairs) and staff costs involved in processing applications, screening applicants, training school-level interview teams, and processing hires made at the school level. Central office replacement staffing costs were estimated to be $1,136 per vacancy filled. The estimate here was based on dividing the compensation costs of the hours spent on staffing activities and recruitment costs such as advertising by the average number of vacancies staffed per year over the five-year period.

School-level costs include staff time and money spent on recruitment, as well as staff time involved in training and preparing for interviews, holding interviews, and deciding on candidates. Schools with lower levels of achievement spend more time recruiting, typically in the form of principals using contacts to try to influence experienced district teachers to apply. Recruitment for schools with high levels of student achievement is less expensive because experienced district teachers want to transfer in without extra work from the principal. Only one school in the sample, a Montessori school, spent a significant amount of time or money recruiting at job fairs or advertising to supplement the efforts of the central office. As mentioned above, teachers are involved in various stages of the recruitment and selection process but are not compensated for their time. Costs at the school level were estimated both with and without this time cost. School-level costs, based on averaging interviewee estimates of time spent in staffing activities and average compensation costs for the type of staff involved, including teachers, were estimated at $2,588 per vacancy filled. Excluding teacher time costs, the estimate was $1,144.

Net Replacement Pay

Recall that net replacement pay was defined as the difference in compensation between the teacher who left and the replacement teacher. The assumption here is that the replacement is an inexperienced teacher, who will start at the bottom of the pay schedule. Since teacher pay is so strongly driven by experience, this cost is likely to be negative, indicating a savings for the district from the turnover.

A complicating factor in calculating and interpreting the cost of replacement pay is that turnover is often bi-modally distributed, with a peak in the first few years of teaching and another at high levels of experience, often dominated by those retiring. The study district exhibits this pattern. Table 2 shows the average distribution of turnover by salary step (largely based on experience), calculated using data from five years of teacher payroll snapshot files.

Table 2. Distribution of Turnover in Study District

Year	Average Number of Teachers Turning Over	Proportion of Turnover
Before starting year 2	62.6	9.0%
Before starting year 3	45.2	6.5%
Before starting year 4	42.8	6.1%
Before starting year 5	46.2	6.7%
Before starting year 6	34.6	5.0%
Before starting year 7	29.8	4.3%
Before starting year 8	25.0	3.6%
Before starting year 9	26.6	3.9%
Before starting year 10	18.4	2.6%
Before starting year 11	17.8	2.6%
Before starting year 12	17.0	2.4%
Before starting year 13	17.4	2.6%
Before starting year 14	15.8	2.2%
Before starting year 15	37.0	5.3%
Before starting year 16	45.8	6.6%
Before starting year 17	11.0	1.6%
After starting year 17	203.0	29.0%

Given this distribution of turnover, the average net replacement pay was calculated by subtracting the compensation cost of a new hire (first year annual salary and benefits) from the average compensation for teachers at each year of the seniority distribution, from 0 years to 16+ years (the top of the experience steps of the district's pay schedule), then multiplying this by the proportion of turnover in that year group. The results were summed to get an average compensation difference. The result was a net replacement salary estimate of -$28,149. The district saves an average of over $28,000 in the first year after a teacher leaves the district and is replaced by a beginning teacher.

It is important to note that the net replacement pay is strongly influenced by the distribution of turnover by years of service. Turnover in the first four to five years, where the first mode of turnover is located, saves relatively small amounts of compensation, while turnover at the top of the pay schedule, the second mode, saves a substantial amount. Turnover before the second year begins actually saves nothing, because (disregarding salary schedule adjustments) new teachers will, on the average, be hired at the same salary as those who left before starting year two.

It should also be noted that when the district is unable to fill a vacancy, it may use a long-term substitute for class coverage. If this substitute is a former district teacher, that person is paid the difference between the rate they would have earned as a regular teacher and the substitute teacher rate. In practice, this substantially reduces compensation cost savings but does not directly affect the estimates made here because of the assumption that a leaver is replaced by a teacher new to the district.

Cost of Training

Two types of training costs were estimated: first-year teacher induction and the annual cost of training received over the first five years. In this district, little training is provided or funded at the central office level. The district's high level of commitment to decentralization has led it to give schools the flexibility to develop their own induction programs, contract with external professional development vendors, and provide school-level embedded professional development. The district went as far as to abolish the central office professional development department. This means that most professional development expenditures are made at the school level, although some induction activities are provided by central office staff. (Limited ongoing training is done by central office staff as requested by schools, but since these staff have other primary duties and the district was unable to estimate time spent on training teachers by these staff, these costs are not included.) Due to decentralization, no useable individual professional development records were available at the district level.

The average cost of induction was estimated at $4,518 per vacancy at the school level and $7 per vacancy at the central office level. The cost of ongoing professional development per year was estimated by taking the school professional development budget for teachers and dividing it by the number of teachers, then averaging across the eight schools in the sample. This figure, $788, was then multiplied by five to represent the cost of the professional development needed to bring a teacher to proficiency. While this is a relatively crude measure, in that some sorts of teachers are likely to receive more professional development than others, most schools in the sample did not keep records that would enable them to break down costs to specific individuals. By this method, the cost of lost professional development was estimated as $3,940 per vacancy.

It should be noted that these costs varied substantially among the eight sample schools, with induction costs ranging from $990 per year per new hire to $10,794. Professional development costs per teacher per year also varied widely, from $107 per year to $2,273 per year. Higher induction and professional development costs were not strongly related to the achievement level of the schools' students. Some high-achieving schools had low costs because they are able to attract experienced teachers from within the district.

Value of Productivity Loss

As discussed above, productivity loss was estimated based on the difference in productivity between a new, inexperienced teacher and a teacher with six or more years of experience, using estimates of the effect size of this contrast from three large-scale studies. To the extent that the differences in value added found in those studies is representative of teachers in the study district and of teachers of other subjects or grades, a reasonable estimate of the productivity difference is between 0.07 and 0.10 standard deviations of student achievement. To get some idea of the dollar value of this effect, two methods were used. First, the costs and effect sizes associated with two interventions, class size reduction and introducing comprehensive curriculum designs such as Success for All, were used. The "cost per unit of effect" was developed, and that ratio used to estimate the dollar value of lost productivity due to turnover. These estimates, of course, apply best to students below the high school level since both the effect sizes for teacher experience and the comparison interventions come from research with such students.

With respect to class size reduction, Erhenberg et al. (2001) reviewed studies of the Tennessee STAR experiment, concluding that an effect size of 0.20 for young children and 0.10 to 0.20 for older children seem plausible from reducing class size from about 24 to 15. For the following cost estimates, an effect size of 0.15 was chosen to represent the class size reduction effect. The primary cost of reducing class size in the study district would be the addition of teachers. The target elementary school class size in the study district was 25 to 27. A reduction to 15 would require 0.73 teachers to be added per each elementary teacher (26 divided by 15 = 1.73). Given a compensation cost (salary and benefits) of $82,882, this gives a cost of $60,503 to obtain the additional teacher resource needed to reduce the size of one class. This would produce about twice to one-and-a-half times the productivity gain of retaining an experienced teacher (0.15 s.d. effect size versus 0.07 to 0.10 for an experienced teacher). Thus the value of the extra productivity per classroom of an experienced teacher would be valued at $30,252 to $40,445 (1/2 and 2/3 of $60,503, respectively). The midpoint, $35,349, can then be used as an estimate of the value of lost productivity due to turnover when an experienced teacher is replaced by a novice. This is likely to be a conservative estimate given that materials and other additional overhead from increasing the number of classrooms has not been included.

With respect to comprehensive school reform implementation, the meta-analysis by Borman et al. (2003) obtained an effect size of 0.18 for Success for All. A report by Borman and Hewes (2001) on the costs of Success for All estimated a yearly cost of $612 (in 2000 dollars) per student. In 2005 dollars, this would be approximately $688 per student. Using the $688 per student cost and an average class size of 26, the cost for the 0.18 effect size would be $18,576. Using the ratios of the effect sizes for experienced teachers to that for Success for All (0.07/0.18 and 0.10/0.18), the value of the extra productivity per classroom of an experienced teacher can be valued at $7,224 to 10,320, with a midpoint of $8,772.

Clearly there is a substantial difference in cost per unit of effect between class size reduction and Success for All. The difference in the cost-effectiveness ratios of different ways to foster student achievement complicates the approach of estimating the value of lost productivity using alternatives to retaining experienced teachers. Another complicating factor is that the class size reduction and Success for All effect sizes were not estimated from a comparison of new teachers using these programs with experienced teachers not using them. Success for All effects and especially class size reduction effects are likely to be smaller with new teachers, so the value estimates above may be biased downward.

Due to these complexities, a second strategy to estimate the value of lost productivity was used. This is to simply consider the difference in productivity as "worth" the difference between the replacement teacher's compensation and the compensation of the experienced teacher who left. The rationale here is that the district is paying the difference and receiving, on average, a productivity increment of 0.07 to 0.10. One estimate of the value of this productivity is thus the difference between the compensation of the new teacher and the teacher who left. This is of course the same amount as the net replacement pay, $28,149. It might be argued that this is an overestimate of the value of the lost productivity, since the research cited above suggests that productivity does not increase with experience after 5 to 7 years, while compensation does. A range of estimates of total turnover costs are made below, using productivity value estimates from this strategy, and from considering the costs and effects of class size reduction and Success for All.

Summary of Costs

Table 3 summarizes the estimated average cost per vacancy for replacing a teacher with an inexperienced new hire. This table shows estimates based on the three methods for estimating the value of lost productivity.

Table 3. Summary of Dollar Costs Per Vacancy—Vacancies Filled with New Hires

Cost Element	Cost Per Vacancy (Cost of Teacher Staffing Time Included)	Cost Per Vacancy (Cost of Teacher Staffing Time Not Included)
Cost of Separation		
Central Office Processing	$3	$3
School Processing	$21	$21
Severance Pay	$3,200	$3,200
Cost of Replacement Staffing		
Central Office	$1,136	$1,136
School	$2,588	$1,144
Cost of Training		
Central Office	$7	$7
School – Induction	$4,518	$4,518
School – Ongoing	$3,940	$3,940
(subtotal)	$15,413	$13,969
Net Replacement Pay	-$28,149	-$28,149
Value of Lost Productivity		
Based on Class Size Reduction	$35,349	$35,349
Based on Salary Difference	$28,149	$28,149
Based on Success for All	$8,722	$8,722
Total Dollar Costs		
Based on Class Size Reduction	$22,613	$21,169
Based on Salary Difference	$15,413	$13,969
Based on Success for All	-$4,014	-$5,458

The cost of separation, replacement staffing, and training comes to $15,413 (including cost of teacher time) or $13,969 (without teacher time). These costs, while substantial, are not the major factors in the cost of turnover. The net replacement pay (the savings from hiring inexperienced teachers when veteran teachers leave) and the value of lost productivity are the most important costs.

One way costs of turnover are often conveyed is as a percent of payroll. Table 4 shows how the cost estimates in Table 3 convert to a percent of the study district's average teacher compensation cost as of September 2005.

Table 4. Cost of Turnover Estimates as Percents of Average Compensation*

Estimate	With Teacher Time Included	Without Teacher Time Included
Based on Class Size Reduction	27%	26%
Based on Salary Difference	19%	17%
Based on Success for All	-5%	-7%

* Average wage and benefit cost = $82,882.

Because of the large difference in net replacement pay when early- versus late-career teachers leave the district, it is also useful to estimate the cost of turnover for a teacher who leaves after the first year and after the fifth year. These costs are shown in Table 5. Note that the costs here include the value of teacher time spent in the staffing process.

Table 5. Summary of Dollar Costs Per Vacancy for Turnover After the First and Fifth Years

Cost Element	After First Year	After Fifth Year
Cost of Separation		
Central Office Processing	$3	$3
School Processing	$21	$21
Severance Pay	$0	$0
Cost of Replacement Staffing		
Central Office	$1,136	$1,136
School	$2,588	$2,588
Cost of Training		
Central Office	$7	$7
School – Induction	$4,518	$4,518
School – Ongoing	$788	$3,940
(subtotal)	$9,061	$13,969
Net Replacement Pay	-$3,648	-$15,915
Value of Lost Productivity		
Based on Class Size Reduction	$17,675	$35,349
Based on Salary Difference	$0	$15,915
Based on Success for All	$4,361	$8,722
Total Dollar Costs		
Based on Class Size Reduction	$23,088	$33,403
Based on Salary Difference	$9,061	$13,969
Based on Success for All	$9,774	$6,766

In the case of a teacher leaving after the first year, the costs of separation (minus severance), replacement staffing, and induction are the same, and the cost of training is lower (just one year of training costs rather than five, an average of $788 in this district). The net replacement salary is the difference between the beginning salary (plus benefits) and the salary (plus benefits) the teacher would have earned starting in the second year, $3,648. An estimate of the lost productivity can be made based on the Kane, Rockoff, and Staiger (2006) study. Kane, Rockoff, and Staiger found effect sizes for a contrast between teachers with zero and one year of experience that were about one-half of what they found for the first year versus sixth year contrast. Thus, we can simply halve the estimates of lost productivity made using the class size reduction and Success for All costs and effects in Table 3. The value of lost productivity based on salary difference is again the same as the net replacement pay. Combining these estimates gives a low cost of turnover of $9,061, a middle estimate of $9,774, and a high estimate of $23,088.

In the case of a teacher leaving after the fifth year, the costs of separation and replacement staffing are the same as for leavers after their first year, the cost of training is the same as in Table 3, but the net replacement pay is reduced to the difference between the average compensation of leavers after the fifth year and the new teacher ($15,915). This yields a high estimate of turnover cost of $33,403, a low estimate of $6,766, and a middle estimate of $13,969. Comparing these results to the average cost of turnover shows that losing teachers with about five years of experience is likely the most costly for a school district. At this level of experience, the compensation saved by replacement with a new teacher is outweighed by the lost teacher productivity.

Discussion

The results reported suggest that the biggest contributions to the costs of teacher turnover are training costs, costs of lost productivity, and salary savings when senior teachers leave. While the costs of administering the separation and hiring systems are not negligible, it is the lost human capital and the related productivity loss that should be of most concern to policy makers. These results also suggest that the cost of turnover varies by the experience (and compensation) level of the teacher, with the most costly turnover being for experienced, but not highly senior teachers. In a decentralized system, the cost of turnover is also likely to vary substantially among schools, making an overall cost estimate less useful than one might like. The costs estimated here are substantially higher than the $3,400-$5,200 estimates from the Texas study, but that study did not include severance pay and included only one year of training costs and costs for more limited induction activities. The directly comparable cost here would include separation processing, replacement staffing, and induction, and total $6,829 -$8,273, quite comparable given the differences in salaries between an urban Midwest district and Texas and inflation during the years between the studies. The costs estimated here are also substantially less than the "rule of thumb" of 1 or 1.5 times the leaving employee's annual salary.

This study has also illuminated a number of interesting complexities involved in estimating the cost of teacher turnover. First, it is clear that estimating the costs of training and lost productivity is not as straightforward as estimating administrative costs and requires the use of assumptions that are arguable. It is recognized that the assumptions made for the present set of estimates are not the only plausible ones. Part of the goal of this project was to work through the

estimation process to force assumptions to be made explicit so that they can be debated by researchers, administrators, and policy makers. This study has also simplified the estimation of net replacement salary and productivity loss by assuming that experienced teachers are always ultimately replaced by beginning teachers, justified in this case because the district appears to hire very few experienced teachers. A smaller suburban district, however, may hire a larger proportion of such teachers. Second, it is likely that every district has idiosyncrasies in its teacher replacement processes that make administrative costs vary across districts. The study district carried out an extensive program of school-based hiring, which located a lot of the costs of replacement staffing at the school level. Also given the decentralized nature of the district, induction and professional development costs varied substantially among the eight schools in the sample. There is thus a need to study costs in diverse districts in order to provide both more estimates to average and to see what effects district characteristics such as size, degree of decentralization, student achievement, wealth, and location have on turnover costs.

There is also a need for more research on measuring lost productivity. As in private sector studies, it is this cost element that contributes most to the cost of turnover and should be of most interest to school districts. There are many data sets that have characteristics needed to look at teacher learning curves in terms of value-added student achievement, but few published studies provide the estimates needed. An estimate of the linear effect of experience is not sufficient given the findings of Hanushek et al. (2005) and Kane, Rockoff, and Staiger (2006) that teacher experience effects may decrease after some initial period. There is also a need for more studies of the cost effectiveness of educational interventions so that the cost of reducing teacher turnover can be compared to the costs of other ways to boost student achievement. This study used only two alternatives. If more cost effectiveness studies were available and reported the needed cost and effect size information, one could develop a more reliable estimate of the cost of lost productivity. Of course, this is not to claim that this cost can ever be completely established. Like the benefits of medical interventions that save lives, the benefits of leaning, especially for younger students, may be inherently invaluable.

Given the uncertainty of the turnover cost estimates reported here, is there anything policy makers can take away? Arguably, there are three implications that are likely to be relatively insensitive to the uncertainties of these estimates. First, it is likely that efforts to reduce turnover should be targeted at teachers who have some experience but are not near the top of the pay schedule. The current teacher pay schedule, by deferring so much of teachers' lifetime compensation to near the end of the career, makes turnover of senior teachers less costly when these teachers are replaced by much lower paid individuals. Secondly, there is reasonable scope for a case to be made for financial and other incentives to reduce turnover. Even added to induction program costs averaging over $4,000 per vacancy, there is room to add incentives in the range of $2,000-$5,000 per teacher. The question is, of course, whether incentives of this size will be effective. Hopefully, some of the programs with which states and districts are experimenting will include a quality evaluation so that some quantitative estimate of the effects of incentives in reducing turnover can be made. Thirdly, efficiencies in the replacement staffing process can help reduce the cost of turnover, but since these costs are not the major part of the cost of turnover, this is probably not a promising strategy for reducing turnover costs, although such improvements may be valuable on other grounds.

References

Borko, H. 2004. Professional Development and Teacher Learning: Mapping the Terrain. *Educational Researcher* 33(8):3-15.

Borman, G.D., and G.M. Hewes. 2001. *The Long-Term Effects and Cost-Effectiveness of Success for All*. CRESPAR Report No. 53. Baltimore, MD: Center for Research on the Education of Students Placed at Risk.

Borman, G.D., G.M. Hewes, L.T. Overman, and S. Brown. 2003. Comprehensive School Reform and Achievement: A Meta-Analysis. *Review of Educational Research*, 73(3):125-250.

Cascio, W. F. 1991. *Costing Human Resources: The Financial Impact of Behavior in Organizations (3rd ed.).* Boston: PWS-Kent.

Clotefelter, C. T., H.F. Ladd, and J.L. Vigdor. 2006. Teacher-Student Matching and the Assessment of Teacher Effectiveness. NBER Working Paper 11936. Cambridge, MA: National Bureau of Economic Research.

Corcoran, T.B. 1995. *Helping Teachers Teach Well: Transforming Professional Development.* CPRE Policy Brief 16-06. New Brunswick, NJ: Consortium for Policy Research in Education.

Darling-Hammond, L. 1997. *Doing What Matters Most: Investing in Quality Teaching*. New York: National Commission on Teaching and America's Future.

Darmon, R.Y. 1990. Identifying Sources of Turnover Costs: A Segmental Approach. *Journal of Marketing* 54:46-56.

Erhenberg, R.G., D.J. Brewer, A. Gamoran, and J.D. Wilms. 2001. Class Size and Student Achievement. *Psychological Science in the Public Interest* 2(1):1-30.

Goldhaber, D., and E. Anthony. 2003. *Teacher Quality and Student Achievement*. New York: ERIC Clearinghouse on Urban Education.

Hanushek, E.A., J.F. Kain, D.M. O'Brien, and S.G. Rivkin. 2005. The Market for Teacher Quality. NBER Working Paper 11154. Cambridge, MA: National Bureau of Economic Research.

Heneman, H. G. III, and T.A. Judge. 2003. *Staffing Organizations, 4th Ed.* Madison, WI: Mendota House.

Hom, P.W., and R.W. Griffeth. 2001. *Retaining Valued Employees*. Thousand Oaks, CA: Sage Publications.

Ingersoll, R. M. 2001. Teacher Turnover and Teacher Shortages: An Organizational Analysis. *American Educational Research Journal* 38(3):499-534.

Kane, T.J., J.E. Rockoff, and D.O. Staiger. 2006. What does certification tell us about teacher effectiveness: Evidence from New York City. NBER Working Paper 12155. Cambridge, MA: National Bureau of Economic Research.

Murphy, P., and M.M. DeArmond. 2003. *The Teacher Shortage and Its Implications for Recruitment Policy*. Seattle: University of Washington, Center on Reinventing Public Education. Available at http://www.crpe.org/pubs/pdf/TeacherShortage_reportweb.pdf.

Peske, H.G, and K. Haycock. 2006. *Teaching Inequality: How Poor and Minority Students Are Shortchanged on Teacher Quality*. Washington, DC: Education Trust.

Price, C. D. 2002. Attracting Well-Qualified Teachers to Struggling Schools. *American Educator* (Winter):16-21.

Rice, J. K. 2003. *Teacher Quality: Understanding the Effectiveness of Teacher Attributes*. Washington, DC: Economic Policy Institute.

Shaffer, E., P. Nesselrodt, and S. Stringfield. 1997. *Impediments to Reform: An Analysis Destabilizing Issues in Ten Promising Programs*. Arlington, VA: Educational research Service.

Smith, H.L., and W.E. Watkins. 1978. Managing Manpower Turnover Costs. *Personnel Administrator* 23(4):46-50.

Texas Center for Education Research. 2000. The Cost of Teacher Turnover. Paper prepared for the Texas State Board for Educator Certification. Austin, TX: Author.

Tizner, A., and A. Birati. 1996. Assessing Employee Turnover Costs: A Revised Approach. *Human Resource Management Review* 6(2):113-122.

Unseem, E., J. Christman, E. Gold, and E. Simon. 1997. Reforming Alone: Barriers to Organizational Learning in Urban School Change Initiatives. *Journal of Students Placed at Risk* 2:55-78.

Appendix 1. Studies Used to Estimate Productivity Differences by Years of Teacher Experience

Authors	Sample Location	Teacher Sample Size	Grades	Models
Clotefelter, Ladd, and Vigdor (2006)	State of North Carolina	3,223 (1,287 for some analyses)	5th	Test scores as a function of prior year student test scores and student demographics; some models include more extensive student controls such as parental education and time spent on homework, and school fixed effects.
Hanushek et al. (2005)	Large Texas District	Not stated	4th – 8th	Standardized gains as a function of year and grade dummies and student demographic characteristics; some models include student fixed effects
Kane, Rockoff, and Staiger (2006)	New York City	10,040	4th – 8th	Test scores as a function of prior year student test scores and student demographics; some models including teacher and cohort fixed effects and interactions.

Appendix 2. School Level Activity/Cost Categories

Element	Cost Basis
Cost of Separation	
Administrative costs of processing separation at school level (if any)	Hours per vacancy at participating staffs' rates
Exit interview	Hours per vacancy at participating staffs' rates
Cost of Replacement Staffing	
Recruitment materials & advertising	Cost of materials, services
Recruitment Planning	Hours per vacancy at participating staffs' rates
Recruitment Activities (e.g. job fairs)	Hours per vacancy at participating staffs' rates
Training of interview teams	Hours at participating staffs' rates
School-level review of applications	Hours per vacancy at participating staffs' rates
School-based interview	Hours per vacancy at participating staffs' rates (principals & teachers)
School-based meetings to make selection decision	Hours per vacancy at participating staffs' rates (principals & teachers)
Verifications/reference/background checks	Hours per vacancy at participating staffs' rates
School-based administrative scheduling & processing	Hours per vacancy at participating staffs' rates
Cost of Training	
Orientation/induction materials (handouts, books, videos)	Cost per induction session/cost per teacher
Orientation/induction-formal instruction	Hours at instructor's rate/number of teachers
Orientation/induction-informal coaching or mentoring	Hours at mentor's rate/number of mentees
New employee attendance at orientation/ induction sessions	Hours at new employee's rate
Professional Development Budget	Annual budget for all professional development