

TEACHER INCENTIVE PAY PROGRAMS:  
CHARACTERISTICS AND ASSOCIATION WITH INSTRUCTIONAL PRACTICES

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In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy

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by  
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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

TEACHER INCENTIVE PAY PROGRAMS:

CHARACTERISTICS AND ASSOCIATION WITH INSTRUCTIONAL PRACTICES

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## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	ii
LIST OF TABLES .....	vii
LIST OF FIGURES .....	viii
ABSTRACT.....	ix
Chapter 1 Introduction .....	1
Background of the Studies .....	1
Purpose of the Studies.....	3
Research Questions.....	5
Significance of the Studies.....	6
Summary .....	8
Chapter 2 Performance-Related Pay: District and Teacher Characteristics .....	9
Literature Review.....	13
Definition of <i>Performance-Related Pay</i> (PRP) .....	13
Empirical Studies on Performance-Related Pay .....	14
Characteristics of Teachers Targeted in PRP Programs .....	17
Applying the Principal-Agent Model to Teacher Performance-Related Pay....	20
Method .....	22
Data .....	22
Variables .....	23
Analysis.....	25
Results.....	26
Trends of Teacher Performance-Related Pay From 1999 to 2007 .....	26

Characteristics of Districts Offering Performance-Related Pay Programs.....	27
Characteristics of Teachers Receiving Performance-Related Pay .....	29
Discussion .....	32
Policy and Leadership Implications.....	37
Chapter 3 Teacher Incentive Pay Programs and District Characteristics .....	39
Literature Review.....	43
Theoretical Framework.....	43
Characteristics of Teacher Incentive Pay Programs .....	44
Characteristics of Districts Offering Teacher Incentive Pay Programs .....	47
The Current Study.....	50
Method .....	53
Data .....	53
Measures .....	55
Analysis.....	57
Results.....	58
Percentage of Districts Offering Teacher Incentive Pay Programs .....	58
Characteristics of the Teacher Incentive Pay Programs .....	59
Characteristics of the Districts Offering Teacher Incentive Pay Programs .....	67
Discussion .....	69
Policy and Leadership Implications.....	75
Chapter 4 Teacher Evaluation, Performance-Related Pay, and Constructivist Instruction	77
Literature Review.....	81
Theoretical Framework.....	81

Teacher Evaluation and Performance-Related Pay .....	82
Performance-Related Pay and Teacher Practice of Constructivist Instruction .	91
Method .....	94
Data .....	94
Measures .....	95
Analysis.....	98
Results.....	99
Percentage of Teachers Receiving PRP and the Amount .....	99
Performance Evaluation in Determining Performance-Related Pay .....	101
Performance-Related Pay and Improvement in Constructivist Instruction ....	105
Discussion .....	107
Policy and Leadership Implications.....	111
Chapter 5 Discussions and Implications .....	113
Summary Findings from the Three Studies .....	113
Discussions of the Three Studies .....	115
Policy and Leadership Implications of the Three Studies.....	117
REFERENCES.....	119
APPENDICES .....	132
Appendix A: Descriptions of the SASS Variables .....	132
Appendix B: Descriptive Statistics of the SASS Variables.....	134
Appendix C: Cover Letter for the Teacher Compensation Programs Survey .....	136
Appendix D: Teacher Compensation Programs Survey .....	137
Appendix E: Descriptive Statistics of the Variables in the TCP Study .....	140

Appendix F: Excerpts of the 2009-10 Teachers' Opportunity to Learn Survey .....	141
Appendix G: Descriptive Statistics of the Variables in Teacher Evaluation, PRP, and Improvement in Constructivist Instruction .....	143
VITA .....	144



## LIST OF TABLES

Table	Page
1. Summary of the Three Studies.....	4
2. Characteristics of School Districts That Offered PRP in 2007-08 .....	28
3. Characteristics of the Teachers Who Received PRP in 2007-08.....	30
4. Incentive Pay Programs in School Districts in Missouri in 2009-10.....	58
5. Types of Teacher Incentive Pay Programs Used by School Districts in Missouri in 2009-10 .....	60
6. Decision Makers in the Teacher Incentive Pay Programs .....	62
7. Number of School Districts in Missouri That Offered Teacher Incentive Pay Programs and the Average Amount of the Awards in 2009-10.....	65
8. Characteristics of the School Districts in Missouri that Used Teacher Incentive Pay Programs in 2009-10.....	68
9. Percentage of Middle School Mathematics Teachers in Missouri Who Received PRP in 2008-09 and the Average Amount of the Awards .....	100
10. Teacher Evaluation Used in Determining PRP for Middle School Mathematics Teachers in Missouri in 2008-09 .....	103
11. PRP and Improvement in the Practice of Constructivist Instruction .....	106

## LIST OF FIGURES

Figure	Page
1. Percentages of School Districts That Used PRP and Teachers Who Received PRP in 1999-2000, 2003-04, and 2007-08.....	26

TEACHER INCENTIVE PAY PROGRAMS:  
CHARACTERISTICS AND ASSOCIATION WITH INSTRUCTIONAL PRACTICES

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ABSTRACT

This dissertation research examined the characteristics of teacher incentive pay programs in the state of Missouri and across the nation in the United States. The purposes of this study were (a) to examine the characteristics of districts that offered performance-related pay (PRP) programs and teachers who received PRP awards in 2007 using the Schools and Staffing Survey (SASS) datasets; (b) to examine the characteristics of incentive pay programs to recruit new teachers and reward existing teachers and the characteristics of the districts that offered the incentive pay programs in 2009 based on a statewide district survey; and (c) to examine the characteristics of teacher evaluation used to determine PRP, and the association between PRP and improvement in the practice of constructivist instruction based on a statewide survey of middle school math teachers.

Using the 1999, 2003, and 2007 SASS datasets, this study found that large and ethnically diverse districts in urban areas with less union influence were more likely to offer PRP. However, highly qualified teachers in high demand were no more likely to receive a larger amount of PRP. The 2010 Teacher Compensation Programs survey data showed that poor rural districts were less likely than wealthy suburban districts to offer teacher incentive pay programs. Using statewide longitudinal Teachers' Opportunity to Learn survey data, this study found that most of the PRP recipients were evaluated by

their school principals, who conducted classroom observations and face-to-face meetings to assess the teachers' teaching practice and professional development activities. Only a small percentage of teachers were evaluated by peers or by using teaching portfolios, and only one out of four teachers was evaluated on student achievement data for the PRP award. After controlling for teacher and school characteristics, this study found a modest yet positive association between PRP and improvement in teacher practice of constructivist instruction.

The findings from these studies highlighted the importance of alignment between the actual program implementation and the program goal of recruiting and retaining highly qualified teachers in high demand. In addition, it is important for district leaders to reexamine the evaluation methods and data used for offering the teacher incentive pay awards and engage multiple methods and data sources for teacher evaluation in the program implementation. Furthermore, it is essential to include the teachers' teaching practice data and professional development data into teacher evaluation to improve the students' higher-order and critical thinking skills.

## Chapter 1 Introduction

This dissertation research consists of three studies. In the first study, the 1999, 2003, and 2007 Schools and Staffing Survey (SASS) survey data were used to examine the characteristics of the districts that offered performance-related pay (PRP) programs and teachers who received PRP awards in the United States. The second study used the Teacher Compensation Programs survey data collected in 2010 along with detailed administrative data from the Missouri Department of Elementary and Secondary Education (MoDESE) to examine the characteristics of the different types of teacher incentive pay programs in the state of Missouri. Using the longitudinal Teachers' Opportunity To Learn (TOTL) survey data and MoDESE administrative data on middle school mathematics teachers, the third study examined the characteristics of teacher evaluation in determining PRP awards and the relationship between PRP and improvement in the practice of constructivist instruction in Missouri. This chapter introduces the background, purposes, research questions, and significance of the studies.

### **Background of the Studies**

Teachers play a critical role in improving student achievement (Nye, Konstantopoulos, & Hedges, 2004; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004; Sanders & Horn, 1998). However, district administrators often find it challenging to recruit and retain highly qualified teachers and teachers in the subject areas of shortage (Podgursky, 2009). In addition to the predicted national shortage of qualified teachers (National Commission on Teaching and America's Future, 1997, 2003), researchers consistently found that academically talented college graduates are less likely to become

teachers and effective teachers are more likely to leave the profession (Bacolod, 2007; Corcoran, 2007; Hoxby & Leigh, 2004; Murnane & Olsen, 1990; Podgursky, Monroe, & Watson, 2004). Furthermore, mathematics, science, and special education teachers are more likely to leave the profession than are teachers of other subject specialties (Henke, Zahn, & Carroll, 2001; Ingersoll, 2001; Kirby, Berends, & Naftel, 1999). Low salaries for teachers, higher earning opportunities outside the profession, and wage compressions from unionization are important factors for the attrition of highly qualified teachers in high demand (Bacolod, 2007; Hoxby & Leigh, 2004; Ingersoll, 2001).

One proposed solution to improving teacher quality in public schools is to provide teacher incentive pay programs, especially PRP schemes of linking teacher compensation with student achievement, to attract and retain highly qualified teachers in high demand in the profession (National Commission on Excellence in Education, 1983). In his 2011 State of the Union address, President Barack Obama reiterated a strong desire to improve teacher quality through reforming teacher compensation to the state governments, saying, “If you show us the most innovative plans to improve teacher quality and student achievement, we’ll show you the money. . . . We want to reward good teachers and stop making excuses for bad ones” (The White House, 2011).

Under the American Recovery and Reinvestment Act of 2009, the federal government issued the \$4.35 billion Race to the Top Fund, a competitive grant program for states to implement widespread education reform initiatives. Among the many goals of the program, one is to reform educator compensation systems by providing additional pay to highly effective teachers and principals. In addition, the U.S. Congress appropriated \$99 million to the Teacher Incentive Fund (TIF) in 2006 to develop and

implement sustainable performance-based compensation systems for principals and teachers in high-need schools, and the appropriation soared to \$400 million for the 2010 fiscal year. School districts, charter schools, nonprofit organizations and state education agencies are all eligible to apply for funding on a competitive basis. Educational agencies in the District of Columbia and 37 states have received grants from the TIF fund (U.S. Department of Education, n.d.). Currently, 13 states (Iowa, Utah, Alaska, Connecticut, Virginia, Arizona, Arkansas, Florida, Georgia, Indiana, Minnesota, Texas, and North Carolina) are experimenting with various state level teacher PRP initiatives and 17 states have district level PRP programs (National Center on Performance Incentives, n.d.). In 2011, Ohio passed law to eliminate salary schedules for 110,000 full-time public teachers in the state and could become the first state in the U. S. with a mandatory system to pay teachers based on their performance (*Education Week*, 2011a). Table 1 presents a summary of the three studies in this dissertation research. It introduces the sources and year of the datasets, the sizes of the samples, and the purposes of the studies.

### **Purpose of the Studies**

In spite of the growing interest in teacher incentive pay programs, the knowledge base on the implementation of such programs is still limited (Loeb, Miller, & Strunk, 2009; Podgursky & Springer, 2007). Within the context of accountability and standards-based reforms, we do not know much about the characteristics of districts that offer teacher PRP programs and teachers who receive PRP awards. Neither do we know whether the highly qualified teachers and teachers in high demand are receiving a larger amount of PRP. In addition, we do not know much on the different characteristics of the teacher incentive pay programs that the districts used to recruit new teachers and to retain

Table 1: Summary of the Three Studies

	Data (Year)	Sample Size	Study Purpose
Study 1	SASS		To examine the
	1999-2000	33,917 teachers in 4,690 districts	characteristics of
	2003-04	31,341 teachers in 4,421 districts	districts that offered
	2007-08	32,657 teachers in 4,601 districts	PRP programs and teachers who received PRP awards
Study 2	2010 Teacher Compensation Programs survey data	125 districts in Missouri	To examine the characteristics of teacher incentive pay programs and districts that offered incentive pay programs
Study 3	Longitudinal Teacher's Opportunity to Learn survey data	TOTL 2008-09: 577 teachers TOTL 2009-10: 633 teachers 416 teachers participated in both surveys	To examine the characteristics of teacher evaluation used to determine PRP, and the association between PRP and improvement in the practice of constructivist instruction



existing teachers. Furthermore and more importantly, we know little on the characteristics of teacher evaluation in determining PRP awards and the relationship between PRP and teacher practice of constructivist instruction.

To address these important leadership and policy issues and fill the knowledge gap, this study used the latest and nationally representative datasets of SASS 1999-2000, 2003-04 and 2007-08 and examined the characteristics of districts that offered PRP programs and teachers who received PRP awards. It also used the 2010 Teacher Compensation Programs survey data and administrative data from the state government to study the characteristics of the different types of teacher incentive pay programs. To examine the relationship between PRP and teacher practice, this study used the longitudinal TOTL survey data on Missouri middle school mathematics teachers and examined the characteristics of teacher evaluation used to determine PRP awards and the relationship between PRP and improvement in the practice of constructivist instruction.

## **Research Questions**

### **Study 1: Research Questions**

1. How did the percentage of districts offering performance-related pay (PRP) programs and the percentage of teachers receiving PRP change from 1999 to 2007?
2. What are the characteristics of the districts that used PRP in 2007?
3. What are the characteristics of teachers who received PRP in 2007?

### **Study 2: Research Questions**

1. What percentage of school districts in Missouri offered teacher incentive pay programs to recruit and retain high quality teachers in the 2009-10 school year?

2. What are the characteristics of the teacher incentive pay programs (i.e., types of incentives, decision makers, methods for rewarding, and amount of the awards)?
3. What are the characteristics of the districts that offered teacher incentive pay programs in the 2009-10 academic year?

#### Study 3: Research Questions

1. What percentage of middle school mathematics teachers in Missouri received PRP and how much did they receive in the 2008-09 academic year?
2. What are the characteristics of teacher evaluation used to determine PRP?
3. How is mathematics teachers' PRP associated with improvement in their practice of constructivist instruction from 2009 to 2010, controlling for their background characteristics?

### **Significance of the Studies**

Understanding the level of implementation on the various teacher incentive pay programs, particularly the PRP schemes and the characteristics of districts that are more likely to implement an incentive pay program constitute important implementation data for the district-, state-, and federal-level policymakers to consider the future direction of the incentive pay programs. In addition, an examination of the characteristics of the recipients will reveal whether the incentive pay programs are benefiting highly qualified teachers and teachers in high demand. More specifically, it is important for policymakers and administrators to know whether the programs are targeting teachers with demonstrated excellence (e.g., National Board-certified teachers) and teachers in the subject areas of shortage (e.g., mathematics, science, and special education teachers) and whether those teachers are receiving a larger amount of awards than the other teachers.

In addition, the findings of this study advance the knowledge base on the different types of teacher incentive pay programs and the relationship between district characteristics and the implementation of the programs. Due to the national interest in improving teacher quality and student achievement within the context of the standards-based and accountability reforms and the high rates of teacher attrition for the districts in rural areas, it is important for the rural districts to receive more continuous and adequate funding for sustainable incentive pay programs to recruit and retain highly qualified teachers in the subject areas of shortage.

Furthermore, this study advances the knowledge base on teacher evaluation for determining PRP, and the relationship between PRP and teacher practice of constructivist instruction. This study provides district-, state-, and federal-level policymakers and administrators with important and up-to-date information on teacher evaluation practices used to determine PRP at the middle school level. In addition, an examination of the relationship between PRP and constructivist instruction is important because PRP programs may encourage teachers to teach to the test and to game the system for higher test scores instead of improving classroom teaching and promoting students' mathematical understanding. This is especially likely when teachers were evaluated mainly or solely by student scores in high-stakes tests. Due to the ultimate purpose of PRP is to motivate teachers to improve their teaching practice and enhance student understanding, it is important to examine the relationship between PRP and improvement in teacher practice of constructivist instruction. This study focused on middle school mathematics teachers, who are working under the greatest public pressure for higher

student achievement in state-mandated standardized tests. Findings on these teachers may be of particular interest and importance to the educational stakeholders.

### **Summary**

This chapter described the background, purposes, research questions and significance of the three studies in this dissertation research. Chapter two is a full length manuscript on the characteristics of districts that offered teacher PRP programs and teachers who received PRP awards using the 1999, 2003 and 2007 SASS datasets. Chapter three is also a full length manuscript on the characteristics of the different types of teacher incentive pay programs and the relationship between district characteristics and the districts' use of incentive pay programs. Chapter four, the third full length manuscript, examined the characteristics of teacher evaluation used for determining PRP awards and the association between PRP and improvement in teacher practice of constructivist instruction. After reviewing the major findings of the three manuscripts, chapter five discussed the limitations and policy and leadership implications of the study.

## Chapter 2 Performance-Related Pay: District and Teacher Characteristics

Previous empirical literature has consistently shown that teachers play a critical role in improving student achievement (Nye, et al., 2004; Rivkin, et al., 2005; Rockoff, 2004; Sanders & Horn, 1998). However, district administrators often find it challenging to recruit and retain highly qualified teachers and teachers in the subject areas of shortage (Podgursky, 2009). In addition to the predicted national shortage of qualified teachers (National Commission on Teaching and America's Future, 1997, 2003), researchers found that academically talented college graduates are less likely to become teachers and effective teachers are more likely to leave the profession (Bacolod, 2007; Corcoran, 2007; Hoxby & Leigh, 2004; Murnane & Olsen, 1990; Podgursky, et al., 2004). Furthermore, mathematics, science, and special education teachers are more likely to leave the profession than are teachers of other subject specialties (Henke, et al., 2001; Ingersoll, 2001; Kirby, et al., 1999). Low salaries for teachers, higher earning opportunities outside the profession, and wage compressions from unionization are important factors for the attrition of highly qualified teachers in high demand (Bacolod, 2007; Hoxby & Leigh, 2004; Ingersoll, 2001).

One solution to improving teacher quality in public schools is to tie teacher earnings more directly to teacher performance (Hanushek & Rivkin, 2004; National Commission on Excellence in Education, 1983). This form of teacher incentive pay embodies the American work value that people ought to be rewarded in proportion to their talent, skill, and effort (Brittan, 1995), a notion tracing back to the Protestant Reformation of the 16th and 17th centuries (Evans, 1970). In the United States, performance-related pay (PRP) proposals rekindled debates and piloting programs

nationwide. In 2006, the U.S. Congress appropriated \$99 million for the Teacher Incentive Fund to develop and implement sustainable performance-based compensation systems for principals and teachers in high-need schools. The appropriation soared to \$400 million for fiscal year 2010 (U.S. Department of Education, n.d.). State governments and local school districts are designing and experimenting with various teacher PRP programs as well (Honawar & Olson, 2008; Podgursky & Springer, 2007).

Theoretically, linking teacher compensation with teacher performance or other educational outcomes such as student achievement will elicit both motivational effects (i.e., inducing teachers to achieve higher levels of effort and performance) and sorting effects (i.e., attracting and retaining those who can produce the rewarded outcomes in the profession) (Lazear, 2003). In addition, the PRP programs provide highly qualified teachers and teachers in high demand with more earning opportunities, and the increased incomes benefit the recruitment and retention of these targeted teachers.

In spite of the revived interest in teacher PRP programs, the knowledge base on the implementation of such programs is still limited (Loeb, et al., 2009; Podgursky & Springer, 2007). Although there exists an emerging body of empirical studies both in the United States and abroad on the effects of individual PRP programs on student learning (Atkinson et al., 2009; Eberts, Hollenbeck, & Stone, 2002; Figlio & Kenny, 2007; Kingdon & Teal, 2007; Lavy, 2009; Muralidharan & Sundararaman, 2009; Winters, Ritter, Greene, & March, 2009; Woessmann, 2011), and group- or school-based PRP programs on student achievement (Clotfelter & Ladd, 1996; Glewwe, Llias, & Kremer, 2010; Ladd, 1999; Lavy, 2002; Muralidharan & Sundararaman, 2009), we do not know

much about the characteristics of districts that offer PRP programs and teachers who receive PRP awards within the context of accountability and standards-based reforms.

A few studies that analyzed nationally representative data to examine the use of PRP programs in the United States (Ballou, 2001; Belfield & Heywood, 2008; Goldhaber, DeArmond, Player, & Choi, 2008) focused on the relationship between teacher unions and PRP programs, and little is known on whether highly qualified teachers and teachers in high demand are receiving a larger amount of PRP. In addition, all of these studies used datasets predating the implementation of the No Child Left Behind Act of 2001 (NCLB). It is likely that the characteristics of districts implementing PRP have changed in this climate of teacher accountability since the NCLB. Furthermore, no previous study examined the relationship between the amount of PRP and teacher characteristics.

Understanding the level of PRP implementation among districts and the characteristics of districts that are more likely to implement a PRP program constitute important implementation data for the state- and federal-level policymakers to consider the future direction of the PRP programs. In addition, an examination of the characteristics of PRP recipients will reveal whether the PRP programs are benefiting highly qualified teachers and teachers in high demand. More specifically, it is important for policymakers and district administrators to know whether the PRP programs are targeting teachers with demonstrated excellence (e.g., National Board-certified teachers) and teachers in the subject areas of shortage (e.g., mathematics, science, and special education teachers) and whether these teachers are receiving a larger amount of PRP than the other teachers.

To fill this gap and advance our knowledge of PRP programs for teachers, this study used the Schools and Staffing Survey (SASS) datasets collected in 1999, 2003, and 2007 and explored the characteristics of districts that offered PRP programs and teachers who received PRP awards. It addressed the following research questions:

1. How did the percentage of districts offering performance-related pay (PRP) programs and the percentage of teachers receiving PRP change from 1999 to 2007?
2. What are the characteristics of the districts that used PRP in 2007?
3. What are the characteristics of teachers who received PRP in 2007?

This study found that both the percentage of districts offering PRP programs and the percentage of teachers receiving PRP awards increased significantly from 1999 to 2007. Large and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers. In the districts offering PRP programs, female and White teachers working in relatively larger rural districts with ethnically diverse student populations were more likely to receive PRP. Among the PRP recipients, teachers with a higher education degree, more teaching experience, and who worked in ethnically diverse districts with less union influence received a larger amount of PRP. Teachers with demonstrated excellence and teachers in the subject areas of shortage were not more likely to receive a larger amount of PRP, which may indicate a misalignment between the program goal of recruiting and retaining highly qualified teachers in high demand and the actual program implementation.



## **Literature Review**

### **Definition of *Performance-Related Pay* (PRP)**

There is a lack of consistent understanding or a commonly accepted definition of PRP for teachers. In practice, researchers used the term to refer to a wide variety of plans and programs, which may have hindered a constructive dialogue in teacher compensation reforms (Calhoun & Protheroe, 1983; Rowland & Potemski, 2009). Following the previous studies (e.g., Podgursky & Springer, 2007), this study defined a PRP program as “a compensation system that rewards teachers with extra financial rewards beyond the annual salary raise on the salary schedule for outstanding performance in the performance evaluation.” It provides teachers with extra financial resources including cash bonuses, salary raise, or extra steps/channels on the salary schedule based on predetermined teacher and/or student outcomes rather than inputs such as skills or knowledge. School districts or schools may use teacher data pertaining to teacher professional development, service activities, and teaching practices or student data concerning student test scores, attendance, and graduation rates for the evaluation.

A PRP program may reward individual teachers for individual performance, a group of teachers for group-level performance, or all the teachers in a school for school-level performance (e.g., average student score). Thus, the PRP recipients may be individual teachers, a group of teachers, or all the teachers in the school (Podgursky & Springer, 2007; Springer, 2009).

## **Empirical Studies on Performance-Related Pay**

In a seminal paper, Murnane and Cohen (1986) argued that PRP programs are not suitable for the teaching profession due to the multidimensional goals of education and the difficulty of isolating individual contributions from the teamwork nature of teaching. However, Ballou (2001) found that PRP was used in a large number of private schools and the amount of the awards was not trivial. The program was used as frequently in school districts where teachers did not have union representation in collective bargaining as in nonsectarian private schools. Ballou argued that it was the opposition from teacher unions that accounted for the past failures of the many teacher PRP programs.

A key argument for PRP programs is that by linking teacher compensation with student achievement or other educational goals, teachers will become motivated to achieve the rewarded outcomes and in the long run, those who can produce the desired goals will be sorted into the profession (Lazear, 2003). Previous studies suggested that PRP may serve as a salient means for districts and schools to communicate to teachers desired behaviors such as improved daily teacher attendance (Jacobson, 1989) and higher student retention rates (Eberts, et al., 2002). In addition, a growing body of empirical studies reported positive effects of individual teacher PRP programs on student achievement in the United States (Figlio & Kenny, 2007; Winters, et al., 2009), and abroad including England (Atkinson, et al., 2009), Israel (Lavy, 2009), and India (Kingdon & Teal, 2007; Muralidharan & Sundararaman, 2009). Researchers also found positive effects of school-based PRP programs on higher student score gains in the United States (Clotfelter & Ladd, 1996; Ladd, 1999) and abroad including Kenya (Glewwe, et al., 2010), Israel (Lavy, 2002), and India (Muralidharan & Sundararaman,

2009). Using country-level data from the Organisation for Economic Co-operation and Development and the student achievement data in the 2003 Programme for International Student Assessment, Woessmann (2011) found cross-country evidence that the use of PRP was significantly associated with mathematics, science, and reading achievement, and scores in countries with PRP were about one-quarter standard deviation higher than those in countries without PRP.

Compared with the relatively rich literature of the effects of PRP on student achievement, there are only a few national studies available in the United States on the characteristics of districts that offer PRP programs (Ballou, 2001; Goldhaber, et al., 2008) and teachers who have received PRP awards (Belfield & Heywood, 2008). All of the studies used data from administrations of the SASS prior to 2000, and none of them examined whether highly qualified teachers and teachers in the subject areas of shortage are more likely to receive a larger amount of PRP.

Ballou (2001) discussed the relationship between the degree of union influence and the probability of the districts' use of PRP. Using three waves of SASS (1987–88, 1990–91, and 1993–94), Ballou found a strong and inverse relationship between the extent of union influence and the use of PRP. Districts with the collective bargaining agreements with teacher unions were less likely to offer PRP programs than districts with meet-and-confer agreements. The meet-and-confer districts, in turn, were less likely to use PRP programs than were those with no bargaining agreements.

In a more recent study, Goldhaber et al. (2008) used the 1999 SASS data to examine how the political costs of union resistance affect school districts' PRP decisions. Consistent with Ballou's study, they also found that union influence was a major

deterrent to PRP programs, after controlling for a wide variety of district, community, and state characteristics. Furthermore, their study showed that districts were more likely to offer PRP programs in states with stronger accountability and information systems. The enrollments of minority and low-income students were not significantly associated with the probability for districts to offer PRP programs. Large and suburban school districts were more likely than small and rural districts to implement PRP programs.

Both of these studies used the 1999 or older SASS datasets, which predated an important development in the accountability reforms, specifically the enactment of the No Child Left Behind Act in 2001. With the development of standards and accountability reforms, the characteristics of districts implementing a PRP program may have changed since 1999. Thus, it is important to examine the PRP implementation status using the most recent 2007 SASS dataset.

There is only one empirical study that examined the characteristics of teachers who received PRP. Using the restricted-use 1999 SASS dataset, Belfield and Heywood (Belfield & Heywood, 2008) found that 12.3% of public school teachers obtained some form of PRP in 1999 and the average amount of the awards was \$1,612, which constituted only a small portion of the teachers' supplementary earnings. The probit estimation showed that the probability of receiving PRP was negatively associated with union member status, and female teachers were significantly more likely than male teachers to receive PRP. Their study did not control for the teacher's teaching subjects, and it was therefore unclear whether the probability of receiving PRP was higher for teachers in high demand. In addition, their study did not examine the association between teacher characteristics and the amount of PRP.

In conclusion, only a few studies examined the characteristics of districts that offered PRP programs and teachers who received PRP awards. All of them used earlier administrations of the SASS datasets that predated the developments in the current accountability and standards-based reforms. In addition, none of them explored the association between teacher characteristics and the amount of PRP. Because the effect of PRP programs would differ by the amount of PRP, it is important to examine whether the teachers targeted by the program are receiving more PRP. To fill the knowledge gap, this study used the 2007 SASS dataset to examine the characteristics of the districts offering the PRP programs and the teachers receiving the PRP awards.

### **Characteristics of Teachers Targeted in PRP Programs**

When the program goal and the actual program implementation are well aligned, teacher PRP programs may serve as a great tool for recruiting and retaining highly qualified teachers in high demand. By linking teacher compensation with teacher performance, the PRP programs offer more benefit to those highly qualified teachers. In addition, the PRP programs provide the teachers in the subject areas of shortage with more earning opportunities and serve as an important incentive for these teachers to stay in the profession.

There is a growing body of empirical studies showing that the National Board certification may serve as a reliable measure of teacher qualification (Cavalluzzo, 2004; Clotfelter, Ladd, & Vigdor, 2007; Goldhaber & Anthony, 2007; Vandervoort, Amrein-Beardsley, & Berliner, 2004). Using rich administrative data from the Department of Public Instruction of North Carolina for school years 1996–97 through 1998–99, Goldhaber and Anthony (2007) found strong evidence that the National Board

certification efficiently signals the more effective teachers and that the National Board-certified teachers were more effective in improving student achievement. Student gains produced by the National Board-certified teachers exceeded those of noncertified applicants by about 4% of a standard deviation in reading and 5% in mathematics. The empirical studies reached the same conclusion in Florida (Cavalluzzo, 2004), Arizona (Vandervoort, et al., 2004), and North Carolina (Clotfelter, et al., 2007).

Several syntheses of the empirical studies suggested that some other observable teacher qualification measures such as state certification, degree, and teaching experience contained useful information in predicting student achievement (Darling-Hammond & Youngs, 2002; Rice, 2003; Wayne & Youngs, 2003), although their associations with student achievement were not consistently strong (Hanushek, 1986, 1997). For example, in a review of 21 empirical studies in the United States that all accounted for the students' prior achievement and socioeconomic status, Wayne and Young (Wayne & Youngs, 2003) concluded that the positive effects of teacher degree and certification appear when the teachers have degrees or certification for the subject they taught (these findings have been for mathematics only).

Researchers have consistently found that the academically talented college graduates were less likely to become teachers and the effective teachers were more likely to leave the profession (Bacolod, 2007; Corcoran, 2007; Hoxby & Leigh, 2004; Murnane & Olsen, 1990; Podgursky, et al., 2004). Using the survey datasets from the Recent College Graduates, Hoxby and Leigh (2004) found that from 1963 to 2000, the share of teachers in the highest aptitude category as measured by the mean combined SAT scores of the college fell from 5% to 1%. Pay compression from unionization explained about

80% of this decline. Bacolod (2007) and Corcoran (2007) also reported the marked decline in the quality of new teachers. Podgursky et al. (2004) studied public school teacher cohorts in Missouri from 1990 to 2001 and found that the academically talented college graduates as measured by the ACT scores tended not to select into teaching and those who did become teachers were more likely to leave the profession, consistent with the findings of Murnane and Olsen (1990).

In addition, mathematics, science, and special education teachers were more likely to leave the profession than were teachers of other subject specialties (Henke, et al., 2001; Ingersoll, 2001; Kirby, et al., 1999; Podgursky, et al., 2004). By linking the 1991–92 Teacher Follow-up Survey dataset with the teacher and administrator questionnaires in the 1990–91 SASS dataset, Ingersoll (2001) identified a “revolving door” effect where large numbers of highly qualified teachers leave the profession. In addition, Ingersoll found that mathematics, science, and special education teachers were more likely to migrate to another district than were teachers of other subjects. The most important reason for teacher attrition was job dissatisfaction, and a most frequently reported cause for job dissatisfaction was low salary of teachers. Henke et al. (2001), Kirby et al. (1999), and Podgursky et al. (2004) also reported higher attrition rates for mathematics, science, and special education teachers.

In summary, literature has consistently shown that highly qualified teachers and teachers in high demand are more likely to leave the profession. Low salaries for teachers, higher earning opportunities outside the profession, and wage compressions from unionization are some of the most important reasons. Therefore, it is important for the PRP programs to focus on rewarding highly qualified teachers in high demand. By

creating additional earning opportunities, the PRP programs provide an important incentive for these teachers to stay in the teaching profession.

### **Applying the Principal-Agent Model to Teacher Performance-Related Pay**

The principal-agent theory provided a useful framework in analyzing the districts' implementation of PRP programs. According to the theory, a principal-agent relationship exists when the principal (e.g., the school district) contracts the agent (e.g., the teachers) to perform services and provide goods (e.g., teaching). The objective of the principal is always to maximize the principal's own payoff. A key assumption of this theory is that there exist various information asymmetries between the agent and the principal. In the public education system, the school district employs the teachers to teach and pays the teachers for their teaching efforts. However, the teachers have more information than the district has about their teaching efforts and effectiveness in improving student achievement. The key task for the district is, therefore, to design an incentive pay scheme that will induce the teachers to perform according to the district's goals and produce the desired outputs at the least cost to the district (Dixit, 2002; Levacic, 2009).

In applying the principal-agent model to teacher PRP, this study developed three hypotheses on the characteristics of districts offering PRP and teachers receiving PRP:

1. Large and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers than are other districts.
2. In the districts that offer PRP programs, highly qualified teachers and teachers in high demand are more likely to receive PRP.
3. Among those who receive PRP, highly qualified teachers and teachers in high demand are more likely to receive a larger amount of PRP.



In the first place, the principal-agent theory predicts that to maximize the district's own welfare, the district will only choose to offer the PRP program when the benefits of the program exceed the administrative and political costs. This study measured the political cost in terms of union influence (Ballou, 2001; Goldhaber, et al., 2008). The greater the influence of the teacher unions in the district, the higher the political costs for the program implementation and the less likely the districts are to offer the programs. In addition, teacher attrition rates are higher when the districts have larger student enrollment (Mont & Rees, 1996; Murnane & Olsen, 1990), higher percentage of ethnically diverse students (Hanushek, Kain, & Rivkin, 2004; Mont & Rees, 1996), and are in urban areas (Hanushek, et al., 2004; Kirby, et al., 1999). In order to recruit and retain highly qualified teachers in high demand and to improve student achievement, it is predicted that the large and ethnically diverse districts in urban areas should be more likely to offer PRP programs.

Furthermore, for PRP programs to take effect in motivating teachers and sorting the highly qualified teachers into the profession, the targeted teachers need to actually receive the awards. The amount of the PRP awards needs also to be substantial and attractive so that the programs can be more effective. Therefore, teachers with demonstrated excellence in improving student achievement (e.g., National Board-certified teachers) and in high demand (mathematics, science, and special education teachers) should be more likely to receive a larger amount of PRP.

## **Method**

### **Data**

To examine the characteristics of PRP program implementation in the United States, this study used the district and teacher data from the SASS, which are the largest nationally representative datasets on America's elementary and secondary schools, districts, and teachers. To address the first research question on the implementation trend, the study used the restricted-use datasets of the SASS 1999, 2003 and 2007 to examine how the percentage of districts using PRP programs and the percentage of teachers receiving PRP awards have changed from 1999 to 2007. To answer the second and third research questions on the district and teacher characteristics and test the corresponding three research hypotheses, the study used the most recent SASS 2007 dataset.

The district survey in the SASS asked for background information including student enrollment, staffing patterns, teacher recruitment, hiring practices, and salary schedules. The teacher survey asked questions on teacher education and training, teaching assignment, and certification. There were also questions on the base pay, additional sources of income from teaching and nonteaching jobs, and PRP.

The SASS used a complex and stratified probability sample design to achieve sufficient data for estimates. For the 2007 SASS dataset, the sample was a school-based stratified probability-proportionate-to-size sample. All schools except those funded by the Bureau of Indian Education were sampled using multiple stratification factors including grade range and school type. The districts associated with the sampled public schools were selected as the district sample. The teachers in the sampled schools were stratified into five groups and the probability of selection varied between the groups. Some groups

of teachers such as new teachers who were likely to leave the profession in the following school year were oversampled.

The U.S. Census Bureau collected the data for the three administrations of SASS with similar methodology and procedures in 1999, 2003 and 2007. For the 2007 SASS, the data were collected by mail surveys with subsequent telephone and field follow-ups. The Census Bureau used a computer-assisted telephone-interviewing instrument to verify school information and identify school coordinators. The teachers were sampled on an ongoing basis from the Teacher Listing Form and the sampled teachers received the questionnaires. The non-respondents received telephone calls and field follow-ups.

The response rates for the SASS were generally high. For SASS 1999, the initial sample size for the public school sector included 56,354 teachers across 9,893 schools in 5,465 districts. The weighted response rates were 83.1%, 88.5%, and 88.6%, respectively. The 2003 SASS sampled 52,478 public school teachers across 10,202 schools in 5,437 school districts and the weighted response rates were 84.8%, 80.8%, and 82.9%, respectively. For SASS 2007, the sample sizes were 47,600 teachers across 9,800 schools in 5,250 districts and the response rates were 84.0%, 80.4%, and 87.8%, respectively.

## **Variables**

**Districts offering PRP programs.** In the district questionnaires of the 1999, 2003, and 2007 SASS datasets, the district officers were asked, “Does this district currently use any pay incentives such as cash bonuses, salary increases, or different steps on the salary schedule to – b. Reward excellence in teaching?” The previous studies have commonly used this item to identify the districts that offered PRP programs (Ballou, 2001; Figlio & Kenny, 2007; Goldhaber, et al., 2008). This item corresponds with the definition of PRP

in this study on the focus of the teachers' teaching performance. In addition, the other items in the same question asked whether the district provided the teachers with financial incentives to earn the National Board certification, to teach in a less desirable location, and to teach in fields of shortage. These items covered the other major forms of teacher incentive pay, and therefore the respondents may likely equate excellence in teaching with outstanding teacher performance in the performance evaluation. Therefore, this study used this question item to determine whether a school district offered a PRP program. If the district officer answered yes to the above question, the district was assigned a value of 1 and otherwise a value of 0.

**Teachers receiving PRP awards.** In the teacher questionnaire, the teachers were asked, "DURING THE CURRENT SCHOOL YEAR, have you earned income from any OTHER sources from this school system, such as a merit pay bonus, state supplement, etc.?" Researchers have used this question to determine whether a teacher received PRP (e.g., Belfield & Heywood, 2008). Given that the scope of this question is broader than the aforementioned definition of PRP, this study refined the measure and defined a teacher who received PRP as one who answered yes to the above question and simultaneously worked in the district that acknowledged offering incentive pay to reward excellence in teaching in the district questionnaire. Previous studies have also used this method (Ballou, 2001; Figlio & Kenny, 2007). In addition, the teacher survey asked for the dollar amount of the PRP award.

**Independent variables.** The Appendix A provides the list of the independent variables and the coding schemes. The independent variables at the district level are the location of the district, the negotiation agreements with the teacher unions, the percentage

of minority students, the percentage of students receiving free or reduced price lunch, and the total number of the K–12 students enrolled in the district. At the teacher level, the control variables are the teacher's gender, ethnicity, state certification status, National Board-certification status, teaching experience, degree, subject, and union membership.

## **Analysis**

The SASS utilized a complex sampling methodology including stratifying the school sample, oversampling new teachers, and sampling with unequal probabilities. Therefore, weights should be used to adjust for differential sampling probabilities and for differential non-responses. Direct estimations of sampling errors that assume a simple random sample will underestimate the variability in the estimates. The preferred method of calculating the standard errors to reflect these sampling design characteristics of the SASS is to use replication with the balanced repeated replicate weights (BRR). This method constructs replicates from the full sample and computes the statistics of interest for each replicate. The mean square error of the replicate estimates provides an estimate of the variance of the statistic for the full sample (Strizek et al., 2006).

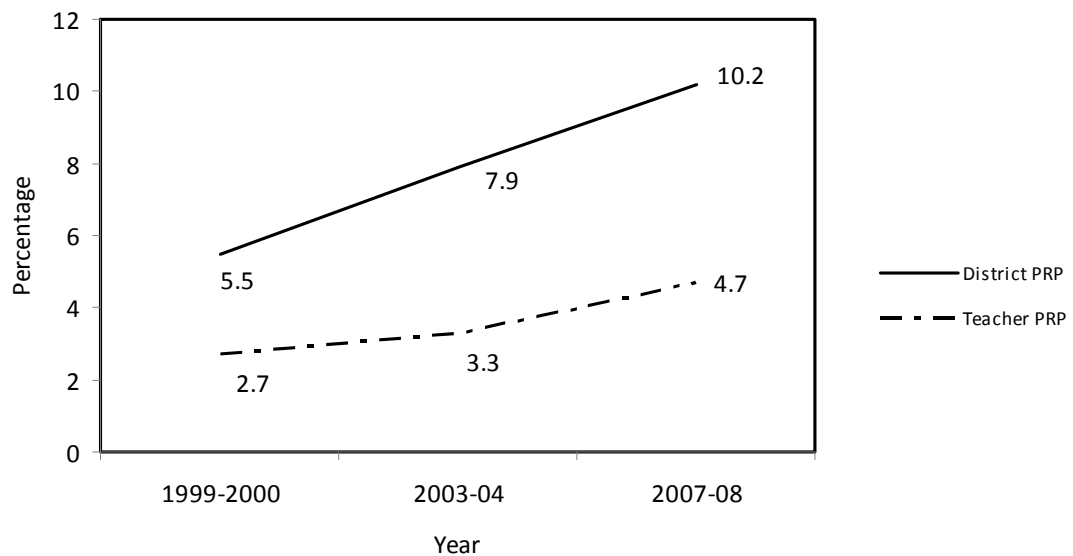
Due to the complex sampling methods and variance estimation procedures in SASS, this study used the WesVar statistical software (version 5.1.17) developed by Westat, Inc., and applied the balanced repeated replication methods with the 88 replicate weights in each SASS data file for the replication procedures. The appropriate final weighting variables were linearly transformed to reflect the actual sample sizes. Missing and extreme values were replaced with the series means.

## Results

### Trends of Teacher Performance-Related Pay From 1999 to 2007

The 1999, 2003, and 2007 SASS datasets were used to examine how the percentage of districts offering PRP programs and the percentage of teachers receiving PRP awards have changed from 1999 to 2007. The district data included all the districts in the SASS surveys, and the teacher samples were limited to regular full-time public school teachers. The upper line in Figure 1 presents the percentage of districts that offered PRP programs and the lower line shows the percentage of teachers who received the PRP awards.

Figure 1. Percentages of School Districts That Used PRP and Teachers Who Received PRP in 1999-2000, 2003-04, and 2007-08



*Note.* Schools and Staffing Survey (SASS) 1999-2000, 2003-04, and 2007-08.

As shown in Figure 1, the percentage of districts offering PRP and the percentage of teachers receiving PRP increased greatly from 1999 to 2007. In the 1999–2000 academic year, only 5.5% of public school districts in the United States offered PRP programs and 4 years later, this figure grew to 7.9%. By 2007, the number jumped to 10.2%, with almost twice as many districts offering PRP programs than in 1999.

The same pattern applies to the percentage of teachers who received PRP. In 1999, only 2.7% of public school teachers received PRP. Four years later, this figure reached 3.3% nationally. In 2007, of all full-time public school teachers in the United States, 4.7% received some form of PRP for their excellence in teaching. The amount of the PRP awards remained fairly stable from 1999 to 2007. In 1999, the average amount of the PRP award was \$1,528 (SD = \$1,586), or \$1,902 when converted to 2007 constant dollars after adjusting for the changes in the cost of living. In 2003, that figure reached \$1,658 (SD = \$1,856), or \$1,868 in 2007 constant dollars. In 2007, the average amount was \$1,967 (SD = \$2,094).

### **Characteristics of Districts Offering Performance-Related Pay Programs**

The 2007 SASS district dataset was used to examine the district characteristics associated with the use of teacher PRP programs. The Appendix B provides the descriptive statistics of the variables in the analysis. Table 2 presents the multiple logistic regression results on the association between district characteristics and the probability for the district to offer PRP plans (1 = Yes, 0 = No).

As shown in the table, all the district factors are significantly associated with the district's PRP decisions except for its share of free or reduced-price lunch students. Large

and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers.

Controlling for the other characteristics, the probability of using a PRP program for urban districts is 28.4% higher than suburban districts. Such probability is 11.8% lower for rural districts than suburban districts. In addition, a 1% increase in the percentage of ethnic minority students is associated with a 0.2% increase in the probability of district PRP decisions. When a district's enrollment increases by 1,000 students, the probability of using a PRP program increases by 0.1 percentage point.

Table 2. Characteristics of School Districts That Offered PRP in 2007-08

	B	SE	Prob. <sup>a</sup>
Intercept	-3.367	0.168	-0.467
Rural district	-0.481**	0.150	-0.118
Urban district <sup>b</sup>	1.288***	0.191	0.284
Meet-and-confer	0.840***	0.154	0.198
No bargaining agreement <sup>c</sup>	1.763***	0.156	0.354
Minority students	0.010***	0.003	0.002
Free/reduced-price lunch students	-0.007	0.004	-0.002
Enrollment (in 1,000s)	0.005*	0.002	0.001

<sup>a</sup> The probability change in the districts' use of PRP programs with a one-unit increase in each independent variable controlling for the other independent variables was computed based on the equation  $\exp(B) / [1 + \exp(B)] - .50$ . <sup>b</sup> The reference group is the suburban districts. <sup>c</sup> The reference group is the districts with collective bargaining agreements with the teacher unions.

\*p < .05, \*\* p< .01, \*\*\*p < .001



Consistent with the previous studies (Ballou, 2001; Goldhaber, et al., 2008), this study found that the districts with stronger teacher union influence are less likely to offer PRP programs. Controlling for the other characteristics, the probability of offering PRP programs is 19.8% higher for districts with meet-and-confer plans than for districts having collective bargaining agreements. Such probability is 35.4% higher for districts having no bargaining agreements than for districts having collective bargaining.

### **Characteristics of Teachers Receiving Performance-Related Pay**

To explore the association between teacher characteristics and the probability of receiving PRP and the amount of PRP, this study merged the teacher data with the district data from the 2007 SASS. This study used the data from the 5,111 regular full-time teachers who worked in districts that offered PRP programs and conducted a multiple logistic regression analysis to examine the relationship between the probability of receiving PRP (1 or 0) and teacher characteristics, controlling for district background characteristics. The left column of Table 3 presents the result.

The analysis shows that female and White teachers are more likely to receive PRP, controlling for district background characteristics. The probability for female teachers to receive PRP is 10.1% higher than for male teachers, and the probability for White teachers to receive PRP is 10.3% higher than for non-White teachers. However, none of the teacher qualification measures is significantly associated with the probability of receiving PRP. The teachers with a National Board certification, full certification, master's degree or higher, and more teaching experience are no more likely than the other teachers without these qualifications to received PRP. In addition, teachers in the subject areas of shortage (i.e., mathematics, science, and special education teachers) are no more

Table 3. Characteristics of the Teachers Who Received PRP in 2007-08

	Teacher Characteristics and PRP (N = 5,111)			Teacher Characteristics and PRP Amount (N = 1,533)	
	B	SE	Prob. <sup>a</sup>	B	SE
Female	0.41 *	0.20	0.101	-660.39	395.34
White	0.42*	0.21	0.103	150.62	381.00
Full certification	0.06	0.24	0.015	-342.69	253.75
National Board Certification	-0.31	0.21	-0.077	544.77	317.02
Teaching experience	0.02	0.01	0.005	36.05**	13.30
Master's degree or above	-0.11	0.17	-0.027	736.22**	232.55
Mathematics teacher	0.21	0.28	0.052	43.42	350.03
Science teacher	-0.06	0.24	-0.015	-314.24	350.55
Special education teacher	0.27	0.23	0.067	-241.46	361.26
Teacher union member	-0.23	0.17	-0.057	138.81	186.15
Rural district	0.77**	0.29	0.184	-0.5	277.14
Urban district	-0.49*	0.20	-0.120	-62.13	280.84
Meet-and-confer	0.47**	0.18	0.115	791.89*	347.47
No bargaining agreement	0.23	0.23	0.057	494.41	368.96
Minority students	0.01**	0.00	0.002	13.92*	5.95
Free/reduced lunch students	-0.01	0.01	-0.002	-25.64**	8.76
Enrollment (in 1,000s)	0.01***	0.00	0.002	-1.78	2.12

<sup>a</sup> The probability change in the districts' use of PRP programs with a one-unit increase in each independent variable controlling for other independent variables was computed based on the equation  $\exp(B) / [1 + \exp(B)] - .50$ .

\*p < .05, \*\*p < .01, \*\*\*p < .001

likely than the other teachers to receive PRP. Whether a teacher is a union member is also not significantly associated with his or her probability of receiving PRP.

Among the teachers who received PRP during the 2007–08 academic year, which teachers are more likely to receive a larger amount of PRP? In contrast to the teacher characteristics that differentiate PRP recipients and non-recipients, demographic characteristics of gender and ethnicity are not significantly associated with the amount of PRP. In other words, although female teachers have a higher chance to receive PRP, they are not more likely to receive a larger amount of PRP than the other teachers who also received PRP. Two teacher qualification measures—teaching experience and master’s degree or above—are significantly associated with the PRP amount. Experienced teachers with a master’s degree or above are more likely than less experienced teachers without a master’s degree to receive more PRP. Holding the other factors constant, a 1-year increase in the teacher’s teaching experience is associated with an average increase of \$36 in the PRP. Teachers having a master’s degree or above earn \$736 more, on average, than those who have a bachelor’s degree. However, other important measures of teacher qualification, National Board certification and regular certification, are not significantly associated with the amount of PRP. Among those who received PRP, the Board-certified teachers did not receive a larger amount of PRP than the other teachers. Likewise, teachers with a regular certification did not receive more PRP than the teachers without a regular certification.

In addition, considering the availability of merit-based private sector positions and/or high attrition rates for mathematics, science, and special education teachers, PRP programs could serve as an important incentive for these teachers to stay in the teaching

profession. However, our analysis showed that these teachers are no more likely than the teachers of other subjects to receive a larger amount of PRP.

Among those who received PRP awards, the teachers working in the districts with a higher percentage of ethnically diverse students tended to receive more PRP. In addition, the teachers in meet-and-confer districts earn a larger amount of PRP on average than their peers in districts having collective bargaining agreements with the teacher unions.

## **Discussion**

Teacher PRP programs are regaining popularity across the nation (Honawar & Olson, 2008; Podgursky & Springer, 2007). However, there are only a few national studies available on the characteristics of districts that offer the programs and the characteristics of teachers who receive the awards (Ballou, 2001; Belfield & Heywood, 2008; Goldhaber, et al., 2008). The few available studies used earlier datasets of the SASS, which predated important developments in the standards and accountability reforms and focused on the examination of the relationship between the presence of teacher unions and PRP programs. Thus, we did not know whether highly qualified teachers (e.g., National Board-certified teachers) or teachers in high demand (e.g., math, science, and special education teachers) are more likely to receive PRP. In addition, no study examined the association between teacher characteristics and the amount of PRP.

Our study showed that from 1999 to 2007, both the percentage of districts offering PRP programs and the percentage of teachers receiving PRP awards increased significantly from 5.5% to 10.2% and from 2.7% to 4.7%, respectively. These percentages show that PRP programs have become more common since the NCLB Act of

2001. Although only about 10% of districts were implementing PRP programs as of 2007, it is likely that more and more districts will implement the programs with the support of the Teacher Incentive Fund (TIF) from the U.S. Department of Education and other state funding. It is, therefore, important to examine whether these PRP programs are actually encouraging highly qualified teachers and teachers in high demand to stay in teaching.

This study found that the large and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers than are small suburban or rural districts with a more homogeneous student population and more union influence. This finding supports our first hypothesis. Because these high-need districts have higher rates of teacher attrition and are in great need of highly qualified teachers in high demand, they are more likely to offer PRP programs to motivate teachers for higher productivity and recruit and retain excellent teachers in the subject areas of shortage.

Consistent with the previous studies (Ballou, 2001; Goldhaber, et al., 2008), this study found that the districts with stronger influence from teacher unions are less likely to offer PRP programs. This finding indicates that although 6 years has passed since the enactment of NCLB, teacher union opposition remains a strong force against the spread of PRP programs. In recent years, although not a national-level policy, teacher unions such as the National Education Association are becoming more supportive of allowing local affiliates to negotiate PRP programs with the districts (Sawchuk, 2010).

At the teacher level, the most striking finding is that highly qualified teachers and teachers in the subject areas of shortage are not more likely to receive a larger amount of PRP. Previous studies have consistently shown that the National Board-certified teachers are more effective in improving student achievement (Cavalluzzo, 2004; Clotfelter, et al.,

2007; Goldhaber & Anthony, 2007; Vandervoort, et al., 2004). In addition, highly qualified teachers in high demand are more likely to leave the profession (e.g., Murnane & Olsen, 1990; Podgursky, et al., 2004). For PRP programs to effectively recruit and retain those targeted teachers, it is important for those teachers to benefit more from the program and receive a large amount of the awards.

The SASS data do not have measures of teacher quality that are commonly used in the teacher evaluation for determining PRP such as teaching practice, teaching portfolio, and other dispositions of teachers observed by the principals. However, it is likely that these characteristics are highly associated with observable teacher qualifications such as National Board certification, full certification, teaching experience, and education level. The finding that none of these measures were significantly associated with teachers' chance to receive PRP is a concern.

Among the teachers who have received PRP, teachers with more teaching experience and a master's degree or above are more likely to receive a larger amount of PRP. However, the more reliable measure of teacher qualification, the possession of the National Board certification, is not significantly associated with the amount of PRP. Board-certified teachers are no more likely to receive PRP than are other teachers, and even when they receive it, the amount is no more than that for the other teachers.

Our recent statewide survey of middle school mathematics teachers (Liang & Akiba, 2011b) showed that more than 90% of teachers who received PRP were evaluated through a classroom observation by the principals and a face-to-face meeting with them, and less than 20% of teachers reported the use of teaching portfolios. It may be that the principals' one-time visits to the classrooms and meetings with teachers are not sufficient

to identify excellent teachers who can teach students higher-order and critical thinking skills. It is important for district leaders to revisit the evaluation methods for offering PRP in order to attract and retain excellent teachers.

In addition, among the teachers who received PRP, the mathematics, science, and special education teachers were not more likely to receive PRP than the other teachers. When they received the award, the amount was not larger than that of the other teachers. In fact, our analysis suggests that science and special education teachers are receiving a smaller amount of PRP, although the difference is not statistically significant.

The SASS data do not contain information on teacher evaluation and the determination of the PRP awards. However, this finding may indicate a misalignment between the program goal of recruiting and retaining the teachers in high demand and the actual program implementation. Because these teachers have more nonteaching earning opportunities and are in greater shortage than the other teachers, the PRP programs should serve as an important incentive for these teachers to stay in the profession.

Before discussing the policy implications, it is important to identify the limitations of this study. In the first place, the measures of PRP based on district reports and teacher reports are limited. Starting from the 1993–94 administration, the SASS replaced the term *merit pay* with *pay incentives to reward excellence in teaching* in the district survey. Because the survey instrument does not provide a definition of the term, the district respondents may interpret it in a various ways, and it is not clear which term teacher or student outcomes districts used to determine who receives PRP and in what amount. In addition, the teacher survey asks the teachers about their income from other school-related sources such as merit pay or state supplement. Respondents may refer to some

other sources of income rather than PRP. It is important that future studies on PRP use more refined measures of PRP programs with a clear definition.

In addition, these district and teacher surveys do not distinguish individual-based PRP from group- or school-based PRP programs. These programs have different effects on teacher satisfaction, instructional improvement, and student achievement. Some scholars have advocated for group- or school-based PRP programs over individual PRP programs due to the team nature of teaching (e.g., Kelley, 1997; Monk & Jacobson, 1985; Odden, 2000; Odden & Kelley, 2002). The teacher data on PRP analyzed in this study include both individual and group- or school-based PRP. It is, therefore, important to know that the lack of a statistically significant association between PRP and teacher qualification or subject areas of shortage may be influenced in part by the unknown number of teachers who have received group- or school-based PRP. Future studies should differentiate individual PRP programs from collective PRP programs and examine the implementation status and effects separately for these types of PRP programs.

Finally, this study focused on the identification of district and teacher characteristics involved in the PRP programs. Because the SASS datasets do not contain information on student achievement, this study cannot answer whether the use of PRP programs will improve student learning. Although the effectiveness of PRP programs is the major concern for the district leaders who are considering the implementation of PRP programs, it is also important for them to know whether the districts already implementing PRP programs are benefiting the teachers they want to retain. Thus, the future studies on the relationship between PRP programs and teacher or student outcomes should also consider the processes including how teachers are evaluated for PRP, who are



receiving PRP and how much, and how such pay influences teachers' motivation to improve their teaching and student learning. This study examined one such process—who are receiving PRP and the findings have important policy and leadership implications.

### **Policy and Leadership Implications**

This study examined the characteristics of PRP for teachers in the United States. Using the latest three nationally representative SASS datasets, this study found that both the percentage of districts offering PRP programs and the percentage of teachers receiving PRP awards increased significantly from 1999 to 2007. Large and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers than the other districts. Among the PRP recipients, teachers with a higher education degree and more teaching experience and who work in districts with less union influence and a higher percentage of ethnically diverse students, tend to receive more PRP. However, teachers with demonstrated excellence (e.g., National Board-certified teachers) and teachers in high demand (e.g., mathematics, science, and special education teachers) are no more likely than the other teachers to receive a larger amount of PRP.

The findings of this study provide important implementation data for the state- and federal-level policymakers to consider the future direction of the PRP programs. Although the large and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers than small suburban or rural districts with a more homogeneous student population and more union influence, teachers in these districts are not consistently more likely to receive a larger amount of PRP. Given the national interest in improving student achievement under the standards-based and accountability reforms and the high rates of teacher attrition in the high-need districts, it

is important for these districts to receive more continuous and adequate funding for sustainable PRP programs to recruit and retain excellent teachers in shortage.

Of particular interest, this study found that highly qualified teachers and teachers in high demand are not more likely to receive a larger amount of PRP awards than the other teachers. This finding indicates that the PRP programs are not benefiting the teachers the districts want to recruit and retain. Given that these teachers are most effective in improving student achievement and often in greater shortage, it is important for district leaders to revisit the PRP programs and better align the actual program implementation and the program goal of recruiting and retaining highly qualified teachers in high demand.

In the first place, it is important for district leaders to reexamine the evaluation methods and data used for offering the PRP awards. The traditional subjective evaluations by principals or other school administrators with a few classroom observations may not efficiently identify the highly qualified teachers. As a result, those excellent teachers may not actually benefit from the PRP programs in receiving a large amount of PRP awards. Therefore, it is important to engage multiple methods and data sources for teacher evaluation in the implementation of PRP programs.

In addition, PRP programs require continuous and substantial financial input. To make better use of the constrained financial resources, it is important for the district leaders to prioritize providing or extending the PRP programs to those teachers in the subject areas of shortage such as mathematics, science, and special education. When the program goal and the actual program implementation are well aligned, the PRP programs provide highly qualified teachers in high demand with more earning opportunities in increasing their compensation, which in turn helps recruit and retain these teachers.

### Chapter 3 Teacher Incentive Pay Programs and District Characteristics

There is an increasing interest in teacher incentive pay programs in the United States for the recruitment and retention of highly qualified teachers (Podgursky & Springer, 2007). During the 2009-10 academic year, 10 states had performance-related pay (PRP) programs that rewarded teachers for raising student achievement, 16 states offered pay incentives for teachers to take on differentiated roles, and 31 states rewarded teachers for earning National Board certification. In addition, states used pay incentives to attract teachers to hard-to-staff school assignments including high-poverty schools (13 states), low-performing schools (13 states), and geographically isolated schools (three states), as well as teaching assignments for math (15 states), science (15 states), and special education (14 states) (*Education Week*, 2011b).

At the district level, the percentages increased significantly for public school districts across the nation to offer multiple types of teacher incentive pay programs. From 2003-04 to 2007-08, the percentage of school districts that used pay incentives to recruit, retain, and reward teachers increased from 11.9% to 15.4% (a 29.4% increase) for teachers in fields of shortage, from 4.6% to 5.7% (a 23.9% increase) for teachers teaching in a less desirable location, from 18.4% to 24.5% (a 33.2% increase) for attaining the National Board certification, and 7.9% to 10.2% (a 29.1% increase) for excellence in teaching, respectively (National Center for Education Statistics, n.d.).

Despite the growing popularity of the teacher incentive pay programs, literature reviews showed that the knowledge base of the incentive pay programs is still weak as it relates to successful program development and implementation (Loeb, et al., 2009; Podgursky & Springer, 2007). The nationally representative SASS datasets do not

distinguish between the incentive pay programs for recruiting new teachers from those for retaining existing teachers. The districts in the SASS dataset were simply asked whether they used pay incentives to reward “excellence in teaching.” This vague terminology may encompass a wide variety of incentive pay programs. In addition, the SASS datasets do not contain information on the amount and the method of rewarding in the incentive pay programs. The effectiveness of the incentive pay programs will differ greatly if a teacher received a \$3,000 bonus versus a \$300 bonus, and the difference will be substantial for a teacher who received a one-time \$3,000 bonus versus a recursive annual stipend of \$3,000. Furthermore, there is only one empirical study that examined the relationship between teacher union influence and the adoption of the different types of teacher incentive pay programs (West & Mykerezi, 2011). However, West and Mykerezi used three broad categories based on whether the teacher performance measure included student test scores, was entirely student test scores, or was entirely other measures, and their study did not distinguish among the various teacher incentive pay programs. It is, therefore, unclear what district characteristics are related to a district’s use of different types of teacher incentive pay plans.

To fill this knowledge gap, this study used statewide survey data collected in 2010 from 125 standard school districts with at least two buildings and a minimum enrollment of 1,000 students in Missouri and administrative data from the Missouri Department of Elementary and Secondary Education (MoDESE). This study focused on these districts because Missouri has a highly skewed distribution of students among its districts. Of the 521 standard districts in 2009-10, there were 290 districts (55.7%) with an enrollment of fewer than 1,000 students and they together enrolled only 15.8% of all students in

Missouri. Therefore, this study focused on the midsize to large districts that serve more than 80% of Missouri students. This study examined the characteristics of the teacher incentive pay programs and the association between district characteristics and the use of the programs. Specifically, this study addressed the following research questions:

1. What percentage of school districts in Missouri offered teacher incentive pay programs to recruit and retain high quality teachers in the 2009-10 school year?
2. What are the characteristics of the teacher incentive pay programs (i.e., types of incentives, decision makers, methods for rewarding, and amount of the awards)?
3. What are the characteristics of the districts that offered teacher incentive pay programs in the 2009-10 academic year?

This study examined five characteristics of the teacher incentive pay programs: (a) whether the incentive pay program was for new teachers or existing teachers; (b) the types of the pay incentives (e.g., teaching in hard-to-staff schools, assuming extra duties); (c) person(s) in charge of making the decision to offer the awards (e.g., superintendent, school board); (d) methods for rewarding teachers (e.g., salary raise, extra steps/channels on the salary schedule); and (e) amount of the awards. This study also examined the district characteristics associated with a district's use of teacher incentive pay programs.

This study found that although all the districts reported having primarily used a salary schedule to compensate teachers in the 2009-10 academic year, 32% of the school districts in Missouri offered some teacher incentive pay programs to recruit and retain highly qualified teachers. Compared with the percentage of districts offering pay incentives to recruit new teachers, a much higher percentage of districts implemented incentive pay programs to retain and reward existing teachers. The school board, the

superintendent, and personnel in the human resources office are the most important decision makers to offer the awards.

In addition, among those that offered incentive pay programs for new teachers, 70% targeted the rewards to the teachers who are certified by the National Board. Only a small percentage of districts had incentive pay programs for teachers in the subject areas of shortage or in hard-to-staff schools. For existing teachers, about two thirds of the districts provided pay incentives for teachers to assume extra duties or to get certified by the National Board. No districts in the study reported that they had formal individual- or school-based PRP programs. In offering the awards, the districts tended to be less likely to use one-time bonuses than to offer salary raises, extra steps/channels, or annual stipends that often become permanent increases to the base pay. The average amounts of the awards are generally smaller than the scale recommended by previous studies.

Furthermore, this study found that rural districts were consistently less likely than suburban districts to offer teacher incentive pay programs. Controlling for the other district characteristics, the probability of offering an incentive pay program is 21% lower for rural districts than for suburban districts. There is also some evidence that the probability decreases by 1%, with one percentage point increase in the district's share of poor students. Teacher unions' influence tended not to be associated with the districts' use of teacher incentive pay programs.

Findings of this study advance the knowledge base of the various types of teacher incentive pay programs and the relationship between district characteristics and program implementation. Because teacher incentive pay programs may play important roles in the districts' ability to attract and retain quality teachers, this study provides district-, state-,

and federal-level policymakers with important implementation data and up-to-date information on the characteristics of the teacher incentive pay programs to guide the future direction of those programs. In addition, due to the high rates of teacher turnover and low student achievement in rural districts, it is important for those districts to receive continuous and adequate funding for sustainable incentive pay programs to recruit and retain highly qualified teachers in the subject areas of shortage.

## **Literature Review**

### **Theoretical Framework**

This study used the principal-agent theory as the theoretical framework in analyzing the districts' implementation of teacher incentive pay programs. According to the theory, there exists a principal-agent relationship when the principal (e.g., the school district) contracts the agent (e.g., the teachers) to perform services and provide goods (e.g., teaching). The objective of the principal is always to maximize the principal's own payoff. A key assumption in the theory is that there exist various information asymmetries between the agent and the principal.

In the public education system, the school district employs the teachers to teach and pays them for their teaching efforts. However, the teachers have more information on their teaching efforts and effectiveness in improving student achievement than the district does. The key task for the district is, therefore, to design an incentive pay scheme that will induce the teachers to perform according to the district's goals and produce the desired outputs at the least cost to the district (Dixit, 2002; Levacic, 2009).

To maximize the district's own welfare, it will only choose to offer the incentive pay program when the benefits exceed the administrative and political costs of the program. The greater the influence and opposition of the teacher union in the district, the higher the political costs for the program implementation and the less likely the district is to offer the incentive pay programs. Conversely, the greater the influence and support of the teacher unions, the lower the political costs and the more likely the district is to offer the teacher incentive pay programs.

### **Characteristics of Teacher Incentive Pay Programs**

Based on the district's educational goals and needs, school districts may choose and implement a wide variety of incentive pay programs to attract and retain quality teachers in high demand. Some of the commonly offered programs are (a) pay incentives targeted to teachers in the subject areas of shortage (e.g., math, science, and special education); (b) pay incentives offered for teaching in hard-to-staff schools (e.g., high-poverty, low-performing, or geographically remote schools); (c) knowledge- and skills-based pay (e.g., National Board certification); (d) extra pay for extra duties (e.g., career ladders); and (e) performance-related pay (Springer, 2009). The methods for rewarding and the magnitude of the awards may also vary from program to program and from district to district. A review of the literature showed that no state-level studies are available that examined the detailed characteristics and the implementation of different types of incentive pay programs for teachers.

Many high-poverty school districts found it hard to recruit and retain teachers in the subject areas of shortage (Podgursky, 2009). Research on teacher mobility also consistently found that mathematics, science, and special education teachers are more



likely to leave the profession than are teachers of other subject specialties (Henke, et al., 2001; Ingersoll, 2001; Kirby, et al., 1999; Podgursky, et al., 2004). In addition, teachers in high-poverty schools serving ethnically diverse and low-achieving students in urban and rural areas are more likely than teachers in other schools to quit teaching (Hanushek, et al., 2004; Smith & Ingersoll, 2004). One way to deal with the problem of teacher shortage in those subject areas and to address the inequitable distribution of highly qualified teachers among school districts is to provide market-based recruitment and retention pay incentives and additional earning opportunities that specifically target the teachers in high demand to teach in hard-to-staff schools.

Unlike the market-based incentive pay programs, knowledge- and skill-based pay programs reward teachers for the completion of activities for the development of knowledge and skills linked to improved student outcomes (Springer, 2009). A good example is the incentive pay for National Board-certified teachers. Empirically, a growing body of studies suggested that the National Board certification may serve as a reliable measure of teacher qualification and that National Board-certified teachers are more effective in improving student achievement (Cavalluzzo, 2004; Clotfelter, et al., 2007; Goldhaber & Anthony, 2007; Vandervoort, et al., 2004).

Another type of pay incentives is offering additional pay for teachers to assume extra duties and responsibilities (Springer, 2009). One example is the career ladder programs. The states of Missouri and Arizona have the longest-running career ladder programs, which have lasted since the 1980s. In Missouri, the career ladder consists of three stages and teachers are assessed at each stage through periodic observations and evaluations of documentation. Those who meet statewide and district-level performance criteria are eligible to receive supplementary pay of up to \$1,500 for Stage I, \$3,000 for Stage II, and

\$5,000 for Stage III for the career ladder responsibilities, which can be extra teaching work or participation in professional development programs. To qualify for the program, a teacher must have a minimum teaching experience of five years for Stage I, seven years for Stage II, and 10 years for Stage III (Booker & Glazerman, 2009). Using teacher-level data on all Missouri public school teachers for the 18 years from 1989-90 through 2006-07, Booker and Glazerman found that a school district's participation in the career ladder program tended to increase retention in the district and the profession, especially for midcareer teachers.

Compared with the sparse studies on the other types of incentive pay programs, there is a growing body of empirical studies both in the United States and abroad on both individual PRP programs and student learning (Atkinson, et al., 2009; Eberts, et al., 2002; Figlio & Kenny, 2007; Kingdon & Teal, 2007; Lavy, 2009; Muralidharan & Sundararaman, 2009; Winters, et al., 2009; Woessmann, 2011) and group- or school-based PRP programs and student achievement (Clotfelter & Ladd, 1996; Glewwe, et al., 2010; Ladd, 1999; Lavy, 2002; Muralidharan & Sundararaman, 2009).

The amount of the incentive pay and the method of rewarding are both important factors affecting the effectiveness of the incentive pay programs. As a general rule, the financial incentives should be large enough to affect behavior on the margin and attract those teachers who might not otherwise have chosen to work in the profession (Prince, 2003). Using panel data of public school teachers in Texas from 1993 to 1996, Hanushek et al. (2004) estimated that the incentive pay needs to be about 8.8% to 12.3% of teacher salary for men and 25.2% to 42.6% for women in order to neutralize the effects of turnover in hard-to-staff large urban districts relative to suburban districts. These estimates were comparable to the findings in previous research that suggested that increases of 10% to 20% of the salary are generally necessary to motivate employees to

change their behaviors in response to the pay incentive (Lawler, 1990). In addition, compared with one-time bonuses, incentive awards in the form of a salary raise, extra steps or channels on the salary schedule and annual stipends often become permanent increases in the teacher's base pay. The increased salary may play an important role in recruiting and retaining the highly qualified teachers.

In summary, school districts in need of quality teachers may engage a variety of incentive pay programs including pay incentives for teachers in the subject areas of shortage, awards for teaching in hard-to-staff schools, knowledge- and skill-based pay, extra pay for extra duties, and PRP to recruit and retain highly qualified teachers in high demand. By focusing on rewarding the targeted teachers and creating supplementary earning opportunities, the incentive pay programs provide important incentives for those teachers to stay in the district and the teaching profession. However, although a growing number of states and districts are piloting and implementing various teacher incentive pay programs, there are no studies that examined the detailed characteristics and implementation of the different types of incentive pay programs across a state, which constitutes important information for policymakers to guide the future direction of the teacher incentive pay programs.

### **Characteristics of Districts Offering Teacher Incentive Pay Programs**

There are a variety of factors such as the educational goals, financial resources, needs of the districts, and the teacher unions' positions for the district leaders to consider before making the decision to pilot or implement a particular type of teacher incentive pay program. Given the national interest in improving teacher quality and increasing student achievement within the accountability and standards-based reforms, districts with

higher rates of teacher attrition and more difficulty in filling the teaching vacancies may be more willing to implement the incentive pay programs. In addition, as is the case for any discussion in educational policies, teacher unions play a crucial role in program implementation. The more support the unions provide, the less the political costs are involved in the programs and the more likely the districts are to offer the programs.

Research suggests that several district characteristics are associated with teacher mobility. Teacher attrition rates are higher in the districts with larger student enrollment (Mont & Rees, 1996; Murnane & Olsen, 1990) and a higher percentage of ethnically diverse students (Carroll, Reichardt, Guarino, & Mejia, 2000; Hanushek, et al., 2004; Mont & Rees, 1996). Compared with suburban districts, the attrition rates are higher in urban and rural districts and it is often more challenging for those districts to fill the vacancies (Kirby, et al., 1999; Monk, 2007). Therefore, large and ethnically diverse districts in urban and rural areas are in greater need of quality teachers, and teacher incentive pay programs may serve as important tools for the district leaders to combat the uneven distribution of quality teachers.

In addition, teacher unions are an important stakeholder in education and their positions are often a deciding factor for the implementation of many educational policies. The National Education Association (NEA) supports providing extra compensation for teachers to teach in hard-to-staff schools, to earn National Board certification, and to assume extra duties such as mentoring newer colleagues. The NEA opposes tying pay to student achievement or test scores and paying more for shortage area subjects such as mathematics and science. The American Federation of Teachers (AFT), the other large national teachers' organization, supports giving additional compensation to teachers

earning National Board certification, working in challenging schools, and assuming extra duties. Unlike the NEA, the AFT is in favor of providing extra compensation for teachers in the subject areas of shortage. The AFT opposes evaluating teachers solely on student test scores but advocates for a combination of academic indicators in teacher evaluation, including standardized test scores, students' classroom work, dropout rates, and disciplinary incidents (Koppich, 2010).

Historically, teacher unions' opposition to linking teacher compensation with student achievement led to the failure of many PRP programs (Darling-Hammond & Berry, 1988; Hatry, Greiner, & Ashford, 1994; Murnane & Cohen, 1986). Empirical studies have also consistently identified an inverse relationship between union influence and the probability of the district to offer PRP programs (Ballou, 2001; Goldhaber, et al., 2008; Liang & Akiba, 2011a). Using the latest three waves of the SASS, Liang and Akiba (2011a) found that controlling for the other characteristics, the probability of offering PRP is 19.8% higher for districts with meet-and-confer plans than for districts having collective bargaining agreements. This probability is 35.4% higher for districts having no bargaining agreements than for districts having collective bargaining agreements.

Compared with the relatively rich studies on PRP programs, there is only one study to date that examined the relationship between teacher union influence and the districts' use of various types of teacher incentive pay programs. West and Mykerezzi (2011) used the 1999-2000 SASS data by the National Center for Education Statistics and the 2006-07 Teacher Rules, Roles, and Rights survey data compiled by the National Council for Teacher Quality and examined the impact of collective bargaining on multiple dimensions of teacher compensation including the use of different incentive pay schemes.

They found that teacher unions tend to support teacher incentive pay programs that are based on additional qualifications or duties, but discourage rewards that directly reward improved student test scores. Controlling for other factors, unionized districts are 3.2 percentage points more likely to have an incentive pay with rewards that do not include student test scores, but 20.1 percentage points less likely to have an incentive pay program that includes rewards for student test scores.

In summary, teacher incentive pay programs provide highly qualified teachers in high demand with more earning opportunities to increase their compensation and can be used by the districts with high rates of teacher attrition to attract and retain quality teachers. Teacher unions support incentive pay programs that reward teachers for teaching in hard-to-staff schools, getting certified by the National Board, and assuming extra duties. They oppose linking teacher compensation with test scores. Few empirical studies examined the relationship between district characteristics (e.g., district locale and teacher union influence) and the use of different types of teacher incentive pay programs.

### **The Current Study**

Despite the national interest in teacher incentive pay plans, the knowledge base is still very limited on the implementation of those programs. In addition to the lack of empirical studies on the effectiveness of the various incentive pay programs in recruiting and retaining quality teachers, we do not know what characteristics are associated with a district's use of the programs, whether districts are more likely to offer pay incentives to recruit new teachers or to reward existing teachers, and what types of incentive pay programs districts are more likely to use and how much the awards are. The Schools and Staffing Survey (SASS), the only nationally representative datasets that contain data on

teacher incentive pay programs, do not distinguish between incentive pay programs for new teachers from the programs for existing teachers. In addition, it does not contain the information on the methods for rewarding teachers and the amount of the awards reported by districts, which are both important characteristics of the programs.

Understanding the characteristics of the implementation of the incentive pay programs and the characteristics of districts that are more likely to offer teacher pay incentives constitute important implementation data for the state- and federal-level policymakers to consider the future direction of the incentive pay programs. Findings of the study will reveal whether the incentive pay programs are targeting teachers with demonstrated excellence (e.g., National Board-certified teachers) and teachers in the subject areas of shortage (e.g., mathematics, science, and special education).

To fill the knowledge gap, this study used the Teacher Compensation Programs survey data collected in 2010 on the districts' use of incentive pay programs during the 2009-10 academic year in Missouri and examined the characteristics of the incentive pay programs. The survey asked rich information, including whether the incentive pay programs were for new teachers or existing teachers, who were responsible for making the decision to offer the awards, the types of pay incentives, the methods for rewarding teachers, and the amount of the awards. In addition, this study examined the relationship between district characteristics and the use of teacher incentive pay programs.

This study selected the state of Missouri because on the one hand, it is similar to many other states without a statewide teacher incentive pay programs. During the 2009-10 academic year, Missouri did not have a state-level PRP policy to reward teachers for raising student achievement. Nor did the state have policies regarding pay incentives for

teachers to take on differentiated roles, to earn National Board certification, to work in targeted schools, or to work in hard-to-staff teaching-assignment areas (*Education Week*, 2011b). On the other hand, Missouri has one of the longest-running career ladder programs, dating back to the 1980s. In addition, contrary to the national trend of a higher percentage of districts offering teacher pay incentives, the percentages of school districts in Missouri that offered teacher incentive pay programs decreased significantly. From 2003-04 to 2007-08, the percentages of school districts that used pay incentives to recruit and retain teachers decreased from 4.8% to 3.5% (a 27.1% decrease) for teachers in fields of shortage, from 7.0% to 0.4% (a 94.3% decrease) for teacher teaching in a less desirable location, from 10.4% to 9.8% (a 5.8% decrease) for National Board-certified teachers, and from 9.7% to 4.1% (a 57.7% decrease) for rewarding excellence in teaching, respectively (National Center for Education Statistics, n.d.). This is probably due to the dwindling budgets: The financial constraint forced the districts to prioritize the traditional career ladder program and the pay incentives for the National Board-certified teachers.

In summary, no studies have examined the characteristics of the different types of teacher incentive pay programs across a state. The nationally representative SASS datasets do not have detailed information on the implementation of the programs. Using the Teacher Compensation Programs survey data collected in 2010, this study will provide state- and federal-level policymakers with important implementation data for the future direction of the different types of teacher incentive pay programs. Given the similarities between Missouri and states with few statewide teacher incentive pay programs, findings of the study may provide important information for those states.



## **Method**

### **Data**

This study used two sets of data: (a) the 2009-10 Teacher Compensation Programs survey data collected on teacher compensation and incentive pay programs in school districts in Missouri; and (b) administrative data from the Missouri Department of Elementary and Secondary Education (MoDESE).

The Teacher Compensation Programs survey was developed to understand the nature and characteristics of teacher incentive pay programs the districts used during the 2009-10 school year in Missouri (Appendices C and D present the cover letter and the complete survey). It asked the district officials whether the district offered financial incentives to recruit and reward highly qualified new and existing teachers. For those who reported having had incentive pay programs, they were further asked questions on (a) who was in charge of making the decision to offer the reward; (b) what types of incentive pay programs were used (e.g., incentives for teaching in hard-to-staff schools); and (c) how was the award offered (i.e., salary raise, extra steps or channels on the salary schedule, one-time bonus, or annual stipend); and (d) how much the average award was. The survey also asked whether the district primarily used a formal salary schedule to pay teachers in 2009-10 and whether the district had agreements with a teachers' association or union for the purpose of collective bargaining or meet-and-confer discussions.

The MoDESE data contain rich information on all school districts in the state of Missouri, including the enrollment, the percentage of students receiving free or reduced-price lunch, the ethnic composition of the student population, and the locale of the district. It also has information on the district-level average scores in mathematics and

communication arts in the state-mandated tests of the Missouri Assessment Program (MAP) and whether the district met Adequate Yearly Progress (AYP) status in mathematics and communication arts.

The distribution of student enrollment is highly skewed among school districts in Missouri. Among the 521 standard districts, the 290 smallest districts (55.7%), whose enrollments are all fewer than 1,000 students, together enrolled just 15.8% of all students in Missouri during 2009-10. Therefore, this study focused on the midsize to large districts based on the following criteria: the district (a) is a standard district; (b) has at least two buildings; and (c) has a minimum enrollment of 1,000 students. From the administrative data of MoDESE, 172 districts were identified and sent the survey instrument. These districts enrolled 84.2% of all students in standard school districts in Missouri. The data were collected through two waves of mailings in October and November 2011. Each participant who completed the survey received a \$15 online gift card for a major online retailer as a financial incentive. Finally, 125 school districts returned the complete surveys, with a response rate of 72.7%. The respondents consisted of superintendents (20.8%), assistant superintendents (23.2%), payroll/human resources officers (26.4%), and some others, including secretaries, administrative assistants, and bookkeepers (29.6%). T-tests and chi-square tests showed no significant differences between the 125 districts in the sample and the 172 districts in the total population in the observable characteristics on district enrollment, the percentage of students receiving free or reduced-price lunch, percentage of minority students, district location, average scores of mathematics and communication arts on the MAP, and the AYP status. Therefore, the findings from these 125 districts can be generalized to the population of 172 districts.

## Measures

**Teacher incentive pay programs.** The 2010 Teacher Compensation Programs survey asked district officials whether their district provided financial incentives to recruit new teachers and retain existing teachers and by what means the teachers were rewarded (e.g., salary raise or one-time bonus). For clarification purposes, the survey provided definitions on salary raise, extra steps/channels, one-time bonus, and annual stipend and gave examples where appropriate (see Appendix D). If the district official indicated that the district had teacher incentive pay programs, the survey asked a series of yes/no questions on who were in charge of making the decision to offer the reward, what the selection criteria were, and how much the average reward was. If the officials marked *other* in the questions, they were asked to specify and provide more information. A dummy variable was created, with 1 indicating the district offered any of the incentive pay programs beyond the regular salary schedule to recruit new teachers and reward existing teachers. See Appendices C and D for the cover letter and the survey questions.

**Decision makers.** District officials were asked whether the following individuals and office were in charge of making the decision to offer the reward to new and existing teachers: (a) superintendent; (b) school board; (c) principal; (d) human resources office; and (e) other. Their responses were coded as 1 = yes, 0 = no.

**Types of pay incentives.** District officials were asked whether the following factors were considered for new teachers beyond a formal step based on experience and degree: (a) subject areas of shortage (e.g., math, science, special education); (b) teaching in hard-to-staff schools; (c) certification by the National Board; and (d) other. For existing teachers, the incentive pay programs might include (a) assuming extra duties

(e.g., lead teacher, department head); (b) National Board certification; (c) individual-based PRP, defined as a compensation system that rewards teachers for above-average or outstanding individual performance in student achievement or performance evaluations; (d) school-based performance pay, and (e) other. Their responses were coded as 1 = yes, 0 = no. If the districts reported having offered PRP, they were further asked what percentage of teachers received PRP during 2009-10 and what data were used in the assessment (e.g., student achievement data, student/parent survey or feedback).

**Amount of the awards.** If the district officials reported that the district offered any of the aforementioned teacher incentive pay programs, they were asked to indicate by what means the district rewards the teachers: (a) salary raise, defined as a percentage increase in the teacher's salary; (b) extra steps/channels, defined as advancement of one or more extra steps/channels on salary schedule; (c) a one-time cash bonus; and (d) annual stipend, defined as a recursive annual cash bonus. The respondents were also asked to report the average amount where appropriate for each type of awards.

**District-level variables.** The district-level variables include the measure of teacher union influence and the observable district characteristics. The Teacher Compensation Survey asked whether the district had an agreement with a teachers' association or union for the purpose of collective bargaining or meet-and-confer discussions: (a) yes, collective bargaining; (b) yes, meet-and-confer; and (c) no. Two dummy variables were created for collective bargaining and meet-and-confer agreements. The following district-level background data were obtained from the MoDESE: (a) enrollment; (b) poverty level, as measured by the percentage of students receiving free or reduced-price lunch; (c) ethnic diversity level, as measured by the percentage of ethnic minority students; (d)

location (urban, suburban, and rural); (e) average scores of the district for mathematics and communication arts on the MAP during the 2009-10 school year; and (f) whether the district met the AYP status for mathematics and communication arts. Two dummy variables were created for school location of urban and rural schools. The district-level MAP scores in mathematics and communication arts were averaged as an indicator of student performance in the district. The district AYP status was recoded as 1 = the district met the AYP requirement in mathematics, communication arts, or both and 0 = the district did not meet the AYP requirement in either of the two subjects.

## **Analysis**

To answer the first question, “What percentage of school districts in Missouri offered teacher incentive pay programs to recruit and retain high quality teachers in the 2009-10 school year?” and the second question, “What are the characteristics of the teacher incentive pay programs (i.e., types of incentives, decision makers, methods for rewarding, and amount of the awards)?” this study computed and reported separately the percentages of districts that offered incentive pay programs for new and existing teachers, the percentages of the various stakeholders who are involved in making the decision to offer the awards, and the percentages of districts that adopted the various types of incentive pay programs. This study also computed and reported the means of the amount of the awards. To answer the third question, “What are the characteristics of the districts that offered teacher incentive pay programs in the 2009-10 academic year?” this study used binary logistic regression to estimate the relationship between district characteristics and probability of the district offering incentive pay programs.

## Results

### Percentage of Districts Offering Teacher Incentive Pay Programs

Table 4 shows that during the 2009-10 academic year, all 125 school districts in Missouri (100%) primarily used a formal salary schedule to pay teachers. This is consistent with the finding in numerous previous studies (e.g., Podgursky, 2009) that school districts across the nation primarily pay teachers based on their educational credentials and teaching experience. In addition, more than two thirds of the districts in Missouri (68%) did not offer any formal teacher incentive pay programs. Only 40 school districts (32%) offered one or more incentive pay programs to recruit or reward teachers.

Table 4. Incentive Pay Programs in School Districts in Missouri in 2009-10

	<i>N</i>	%
Districts primarily used a formal salary schedule to pay teachers	125	100
Districts offered one or more teacher incentive pay programs		
Yes	40	32
No	85	68
Among the 125 school districts, the number of districts that offered		
Incentive pay programs for new teachers	10	8
Incentive pay programs for existing teachers	38	30
Among the 40 districts offering at least one incentive pay program		
The program(s) is for new teachers only	2	5
The program(s) is for existing teachers only	30	75
The program(s) is for both new and existing teachers	8	20

The table also shows that a much higher percentage of districts offered teacher incentive pay programs for existing teacher than for new teachers. Among the 125 school districts, only 10 (8%) offered incentive pay programs to recruit new teachers, and 38 districts (30%) had programs to retain existing teachers. Among the 40 districts that had at least one incentive pay program for teachers, only two districts (5%) had programs only for new teachers. In contrast, 30 districts (75%) offered such programs only for existing teachers. Eight school districts (20%) implemented incentive pay programs for both new and existing teachers.

### **Characteristics of the Teacher Incentive Pay Programs**

Tables 5, 6, and 7 present the findings on the characteristics of teacher incentive pay programs for new and existing teachers in Missouri. They address who are in charge of making the decision to offer the awards, what types of incentive pay programs are provided, what methods are used for rewarding the teachers, and how much the awards are. Because school districts may offer multiple types of incentive pay programs for teachers, the right column of Table 5 shows the frequency of combinations of multiple programs. In addition, because most districts have multiple decision makers, the right column of Table 6 shows the frequency of combinations of multiple decision makers. These percentages sum to 100%.

**Types of pay incentives.** The first panel of Table 5 shows that providing financial incentives for teachers who are certified by the National Board is the primary tool for school districts to recruit highly qualified teachers. Of the 10 districts that offered incentive pay programs for new teachers, seven (70%) had programs for teachers certified by the National Board, two (20%) offered programs for teachers in subject areas

Table 5. Types of Teacher Incentive Pay Programs Used by School Districts in Missouri in 2009-10

Types of Incentive Pay Programs	N (%)	Program Types in Combination	N (%)
<i>Programs for New Teachers (n = 10)</i>			
Subject areas of shortage	2 (20)	National Board certification (NBC)	5 (50)
Teaching in hard-to-staff schools	2 (20)	NBC & Other	1 (10)
NBC	7 (70)	Subject areas of shortage and teaching in hard-to-staff schools	1 (10)
Other (e.g., doctoral stipend)	3 (30)	Other combinations	3 (30)
<i>Programs for Existing Teachers (n = 38)</i>			
Assuming extra duties	25 (65.8)	Assuming extra duties & NBC	14 (36.8)
NBC	25 (65.8)	Assuming extra duties	11 (28.9)
Individual PRP	0 (0)	NBC	10 (26.3)
School PRP	0 (0)	Other combinations	3 (7.9)
Other (e.g., doctoral degree)	2 (5.3)		

of shortage, another two (20%) provided pay incentives for teachers to teach in hard-to-staff schools, and three districts (30%) used other incentive pay programs such as stipends for doctoral degree holders. In the frequency of combinations of multiple incentive pay programs, 14 districts (36.8%) only offer incentive pay programs for the



recruitment of National Board-certified teachers. In one district (10%), the programs were to recruit National Board-certified teachers and other highly qualified teachers. In another district (10%), the programs were for the teachers in subject areas of shortage and those who taught in hard-to-staff schools. In three other districts (30%), other combinations of multiple incentive pay programs were provided for the recruitment of highly qualified new teachers.

The second panel of the table shows that providing financial incentives for teachers who are certified by the National Board and those who assume extra duties are the two primary tools for school districts to reward existing highly qualified teachers. Of the 38 districts that offered incentive pay programs for existing teachers, 25 (65.8%) provided extra financial awards for teachers to assume extra duties such as mentoring colleagues, 25 (65.8%) offered pay incentives for teachers to be certified by the National Board, and two (5.3%) used other incentive pay programs such as stipends for doctoral degree holders. In the frequency of combinations of multiple incentive pay programs, 14 districts (36.8%) offered incentive pay programs for teachers to assume extra duties and to get certified by the National Board, 11 (28.9%) rewarded teachers exclusively for assuming extra duties, and 10 (26.3%) provided pay incentives for National Board certification. In three other districts (7.9%), other combinations of multiple incentive pay programs were provided for the retention of highly qualified existing teachers.

**Decision makers.** The first panel of Table 6 shows that in offering incentive pay awards to new teachers, the school board, superintendent, and the personnel in the human resources office are the most important decision makers. Of the 10 districts that offered teacher incentive pay programs for new teachers, six (60%) engaged the school board as

Table 6. Decision Makers in the Teacher Incentive Pay Programs

Decision Makers	%	Decision Makers in Combination	%
<i>Programs for New Teachers (n = 10)</i>			
School Board	60	School Board	30
Superintendent	50	Superintendent, School Board, HR	20
Human Resources Office	50	Human Resources Office	10
Principal	0	Superintendent, HR, Other	10
Other (e.g., Financial Office)	30	Other combinations	30
<i>Programs for Existing Teachers (n = 38)</i>			
School Board	65.8	School Board	23.7
Superintendent	44.7	Superintendent and School Board	18.4
Human Resources Office	26.3	Human Resources Office	5.3
Principal	15.8	Superintendent, School Board, Other	5.3
Other (e.g., Athletic director)	28.9	Other Combinations	47.3

a decision maker, five (50%) involved the superintendent, five (50%) included the personnel in the human resources office, none (0%) involved the school principals, and three (30%) engaged other stakeholders such as the financial office. In the frequency of combinations of multiple decision-makers, the school boards are solely responsible for making the decisions to offer the reward in three districts (30%). In two districts (20%), the decisions are made jointly by the school board, the superintendent, and the HR office. One district (10%) delegates the responsibility to the human resources office and another

district (10%) to the superintendent, HR, and some other stakeholders. In three other districts (30%), other combinations of multiple stakeholders make the decisions.

The second panel of the table also shows that in offering pay incentives to existing teachers, the school board, the superintendent, and the HR office are also the most important decision makers. Of the 38 districts that offered incentive pay programs for existing teachers, 25 (65.8%) engaged the school board as a decision maker, 17 (44.7%) involved the superintendent, 10 (26.3%) included the HR office, six (15.8%) involved the school principals, and 11 (28.9%) engaged other stakeholders such as the athletic director. In the frequency of combinations of multiple decision makers, the school boards are solely responsible for making the decisions to offer the reward in nine districts (23.7%). In seven districts (18.4%), the decisions are made jointly by the school board and the superintendent. Two districts (5.3%) delegate the responsibility to the human resources office and two other districts (5.3%) to the school board, the superintendent, and some other stakeholders. In about half of the districts (47.3%), other combinations of multiple stakeholders made the decisions.

**Amount of the awards.** The district officials were asked whether a list of factors such as teaching in hard-to-staff schools or assuming extra duties were considered for rewarding a salary raise, extra steps or channels, a one-time cash bonus, or an annual stipend for new and existing teachers. They were also asked to report the average amount of the awards where appropriate. If the district granted an extra step(s) or channel(s) on the salary schedule, the respondents were asked to indicate whether the award was an extra step(s) or an extra channel(s) and the number of steps or channels. Table 7 reports the types of incentive pay programs for new and existing teachers and the average

amount of the awards. The first number in each cell represents the number of districts that rewarded teachers with the corresponding type of incentive pay program and the method of awarding. The second number in parentheses shows the average amount of the awards.

The first panel presents the results for the recruitment of new teachers. To attract teachers in the subject areas of shortage, one district offered an extra 1.8% increase in the teacher's base salary, two districts awarded the teachers in high demand an extra step on the salary schedule, and none of the districts reported having offered one-time cash bonuses. The findings were exactly the same for the recruitment of teachers for hard-to-staff schools. To attract the National Board-certified teachers, one district provided those highly qualified teachers with an extra 10% increase in the teacher's base salary, six districts offered one-time cash bonuses for an average amount of \$2,217, and none of the districts reported having offered extra steps or channels on the salary schedule.

The second panel of the table shows the findings for the retention of existing teachers. To encourage highly qualified teachers to assume extra duties such as mentoring their colleagues, seven districts offered increases in the teacher's base salary. The amount of the increases in three districts varies based on the nature of the duties, and the average of the reported increases in the other four districts was 2.5% of the teacher's base salary. In addition, two districts awarded the highly qualified teachers an extra step on the salary schedule for their extra work. Furthermore, 18 districts provided the teachers with recursive annual cash bonuses. The amount of the annual bonuses in 11 districts varied based on the duties, and the average amount of the bonuses was \$2,014 in the other seven districts. To reward the existing teachers who were certified by the National Board, two districts offered average increases of 10% in the teacher's base salary; one district

Table 7. Number of School Districts in Missouri That Offered Teacher Incentive Pay Programs and the Average Amount of the Awards in 2009-10

Selection Criteria	Salary Raise <sup>a</sup>	Extra Steps or Channels	One-Time Bonus	Annual Stipend
<i>Programs for New Teachers (n = 10)</i>				
Subject areas of shortage (2 districts)	1 (1.8%) <sup>b</sup>	2 (one extra step)	N/A	N/A
Teaching in hard-to-staff schools (2 districts)	1 (1.8%)	2 (one extra step)	N/A	N/A
National Board certification (7 districts)	1 (10.0%)	N/A	6 (mean: \$2,217; min: \$1,500; max: \$3,500)	N/A
<i>Programs for Existing Teachers (n = 38)</i>				
Assuming extra duties (25 districts)	3 (amounts vary)	2 (one extra step)	None	11 (amounts vary)
	4 (mean: 2.5%) <sup>c</sup>			7 (mean: \$2,014)
National Board certification (25 districts)	2 (10.0%)	1 (one extra step)	None	22 (mean: \$2,445)
		1 (one extra channel)		
Individual PRP	N/A	N/A	N/A	N/A
School PRP	N/A	N/A	N/A	N/A

<sup>a</sup>A salary raise was defined as a percentage increase in the teacher's salary. Extra steps/channels were defined as advancement of one or more extra steps/channels on the salary schedule. A one-time bonus was defined as a one-time cash bonus. An annual stipend was defined as a recursive annual cash bonus.

<sup>b</sup>The total numbers of districts in some rows are different from the numbers reported in Table 5 because some districts used multiple methods for rewarding teachers.

<sup>c</sup>This cell has two numbers because three districts indicated that the amounts of the salary raises for teachers assuming extra duties varied based on the duties while four districts reported the average percentage of the salary raises. It is the same reason for the other cells with two numbers.

provided those highly qualified teachers with one extra step, and one district provided one extra channel on the salary schedule; 22 districts rewarded those teachers with annual stipends for an average amount of \$2,445; and none of the districts offered one-time cash bonuses. None of the districts reported having offered individual- or school-based PRP programs for existing teachers.

The table shows that although the districts engaged a wide variety of programs to recruit new teachers and retain existing teachers, they were more likely to reward teachers by increasing their base salary, advancing them on the salary schedule, or providing them with recursive annual stipends than by using one-time cash bonuses. Those types of awards often build the increase into the teacher's base salary and become a permanent part of the teacher's compensation. The increased compensation may play an important role in attracting academically talented college graduates into the candidate

pool of the teaching profession and enhancing the retention of the highly qualified teachers in the workforce.

During the 2009-10 school year, the average teacher salary in Missouri was about \$45,000 (Missouri Department of Elementary and Secondary Education, n.d.). Therefore, the amounts of the incentive pay were generally between 2-10% of the teacher's base salary, smaller than the recommended scale of more than 10% of the teacher's salary (Hanushek, et al., 2004; Lawler, 1990). How effective the incentive pay programs are in motivating teachers to change their behaviors is beyond the scope of this study. However, this finding may indicate that the awards are not substantial enough to recruit and retain high-quality teachers.

### **Characteristics of the Districts Offering Teacher Incentive Pay Programs**

The Appendix E provides the descriptive statistics of the variables in the analysis. Table 8 presents the results of a series of binary logistic regressions on the association between district characteristics and the probability for the district to offer at least one teacher incentive pay program (1 = yes, 0 = no). As shown in the table, all the district characteristics are not significantly associated with the districts' use of teacher incentive pay programs except that rural districts are statistically significantly (at the 10% level) less likely than suburban districts to offer teacher incentive pay programs. Controlling for the other characteristics, the probability of rural districts using a teacher incentive pay program is 21% lower than that of suburban districts. This result is consistent with the finding in previous studies (e.g., Liang & Akiba, 2011a) that rural districts are less likely to offer PRP programs than suburban districts.

Table 8. Characteristics of the School Districts in Missouri that Used Teacher Incentive Pay Programs in 2009-10

	Model 1			Model 2			Model 3			Model 4		
	B	S.E.	Prob. <sup>a</sup>	B	S.E.	Prob.	B	S.E.	Prob.	B	S.E.	Prob.
Enrollment	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
% Free/reduced price lunch	-0.027	0.016	-0.007*	-0.024	0.017	-0.006	-0.027	0.016	-0.007*	-0.024	0.017	-0.006
% Minority	0.017	0.012	0.004	0.017	0.012	0.004	0.017	0.012	0.004	0.017	0.012	0.004
Urban	-0.091	0.852	-0.023	-0.130	0.856	-0.032	-0.089	0.852	-0.022	-0.128	0.856	-0.032
Rural	-0.925	0.531	-0.216*	-0.902	0.533	-0.211*	-0.917	0.536	-0.214*	-0.896	0.537	-0.210*
Collective bargaining	-0.448	0.912	-0.110	-0.444	0.913	-0.109	-0.462	0.924	-0.113	-0.455	0.925	-0.112
Meet-and-confer	0.120	0.447	0.030	0.159	0.455	0.040	0.113	0.453	0.028	0.152	0.461	0.038
MAP Score				0.004	0.008	0.001				0.004	0.008	0.001
AYP Status							0.069	0.644	0.017	0.054	0.644	0.013

*Note.* The table reported the probability change in the districts' use of teacher incentive pay programs with a one-unit increase in each independent variable, controlling for the other variables. They were computed based on the equation  $\text{Exp(B)} / [1 + \text{Exp(B)}]$  - .50. \*p < .10.



In addition, the table suggests that poor districts as measured by the percentage of students receiving free or reduced-price lunch are somewhat less likely to offer teacher incentive pay programs. Holding other factors constant, the probability of offering a teacher incentive pay program decreases by 1% with a one percentage point increase in the district's share of poor students. Furthermore, union influence tended not to be associated with the probability of the district offering teacher incentive pay programs. This is somewhat different from the finding in a previous study that teacher unions tend to encourage teacher pay incentives based on additional qualifications or duties (West & Mykerezzi, 2011).

## **Discussion**

Although there is a revived interest in teacher incentive pay programs across the nation and around the world (Loeb, et al., 2009; Podgursky & Springer, 2007), the knowledge base is still limited regarding the implementation of the different types of teacher incentive pay programs. There is only one study that examined the relationship between union influence and a district's adoption of the programs (West & Mykerezzi, 2011). However, West and Mykerezzi divided the programs into three broad categories based on whether teacher performance measure included student test scores, was entirely student test scores, or was entirely other measures. It is, therefore, unclear as to what district characteristics are related to the district's use of teacher incentive pay plans. In addition, no previous studies examined the characteristics of the different types of incentive pay programs. Thus, we know little about the methods the districts used to reward teachers or whether the awards were substantial enough to motivate teachers.

To fill the knowledge gap, this study used the 2010 Missouri Teacher Compensation Programs survey data and examined the characteristics of the different types of teacher incentive pay programs adopted by the school districts in Missouri. This study found that although Missouri has few state-level policies for teacher incentive pay programs (*Education Week*, 2011b), 32% of Missouri's school districts implemented some incentive pay programs to recruit and retain highly qualified teachers. Compared with districts offering pay incentives to recruit new teachers, a much higher percentage of districts implemented incentive pay programs to retain existing teachers. The school board, the superintendent, and the personnel in the human resources office all played important roles in making the decision to offer the awards.

Among the districts that offered incentive pay for new teachers, the majority targeted the programs to the teachers who are certified by the National Board. Only a small percentage of districts had incentive pay programs for teachers in the subject areas of shortage or teaching in hard-to-staff schools. To retain and reward existing teachers, about two thirds of the districts provided pay incentives for teachers to assume extra duties or to get certified by the National Board. This finding reflects the long use of the career ladder program in Missouri, one goal of which is to help districts with difficulty in retaining teachers by offering those teachers opportunities to earn extra pay for extra work (Booker & Glazerman, 2009).

The common adoption of pay incentives for teachers with National Board certification is consistent with the principal-agent theory. Research suggests that the National Board-certified teachers are more effective in improving student achievement (e.g., Goldhaber & Anthony, 2007). In addition, teacher unions support providing

teachers with extra pay to get certified by the National Board (Koppich, 2010). Thus, the political costs are low for the implementation of this type of incentive pay program.

However, this study found that only two out of 125 districts offered incentive pay programs to recruit teachers in the subject areas of shortage (e.g., mathematics, science, and special education), and teachers teaching in hard-to-staff schools. Because these teachers have more earning opportunities outside the teaching profession and these schools are often in greatest need of quality teachers, the finding that few districts offered market-based incentive pay programs is a concern.

In addition, although no districts in the study reported using formal individual- or school-based PRP programs, a previous study (Liang & Akiba, 2011b) found that about 10.9% of middle school mathematics teachers in Missouri reported receiving some form of PRP awards during the 2009-10 academic year. This may indicate that because teacher unions oppose formal PPR programs, some districts used informal incentive practices such as crediting the teachers with additional experience on the salary schedule or rewarding effective teachers with favorable extracurricular assignments for which they receive additional compensation (Ballou & Podgursky, 1997; Goldhaber, et al., 2008).

In offering the awards, the districts tended to be more likely to use salary raises, extra steps/channels, or annual stipends than to offer one-time bonuses. This finding is different from Ballou (2001), who pointed out that public schools most often award merit pay as a one-time cash bonus. However, because no districts in the study reported offering PRP, it is unclear whether districts have changed the methods of rewarding teachers within the accountability and standards-based reforms. In addition, those methods of awards usually permanently increase the teachers' base pay. On the one hand,

the accumulated impact of the awards can far exceed that of one-time bonuses in recruiting and retaining quality teachers. On the other hand, the cumulative nature of those rewards may limit the amount of the awards in each type of incentive pay programs due to a school district's financial constraints.

The magnitude of the awards is an important factor affecting the effectiveness of the incentive pay programs in recruiting and retaining the targeted teachers. Previous studies suggested that the incentive awards need to be 10% or more of the teacher's salary before the teachers find it worthwhile to change their behaviors or career decisions (Hanushek, et al., 2004; Lawler, 1990). This study found that the amounts of the incentive awards were generally between 2% and 10% of the teacher's base salary and were smaller than the recommended scale. This may be because most of the incentive pay programs rewarded teachers with awards that become permanent increases in the teachers' base pay and the cumulative feature of the awards may have limited the amounts. Although the supplementary income may be of help, the awards may not be substantial enough to recruit and retain quality teachers.

Furthermore, this study found that rural districts are consistently less likely than suburban districts to use teacher incentive pay programs. Controlling for the other characteristics, the probability of using a teacher incentive pay program for rural districts is 21% lower than that of suburban districts. This finding is consistent with another study (Liang & Akiba, 2011a), which found that the probability of using a PRP program for rural districts is 11.8% lower than that for the suburban districts. Compared with suburban districts, rural districts have higher rates of teacher turnover and are in greater need of quality teachers (Kirby, et al., 1999; Monk, 2007). Because teacher incentive pay

programs may serve as important tools for the rural districts to recruit and retain highly qualified teachers, the finding that rural districts are less likely than suburban district to offer various types of teacher incentive pay programs is a concern.

Different from the previous research (West & Mykerezi, 2011), this study found that teacher union influence was not associated with a district's use of teacher incentive pay programs. Because teacher unions are generally supportive of the major types of incentive pay programs used in this study (i.e., awards for National Board certification and pay incentives for assuming extra duties), there may be a positive relationship between union influence and the district's use of teacher incentive pay programs (excluding the case for PRP programs). However, the sample size in this study is relatively small so that it may not discern the relationship. A previous study using national datasets of SASS (Liang & Akiba, 2011a) found that teacher union influence was inversely related to the district's use of PRP programs. However, because no districts reported using PRP programs during the 2009-10 school year, this study can not test whether that finding applies to the school districts in Missouri as well.

Before discussing the policy implications, it is important to identify the limitations of this study. In the first place, due to the highly skewed distribution of student enrollment in school districts in Missouri, this study focused on the midsize to large districts with at least two buildings and a minimum enrollment of 1,000 students. It is therefore unclear whether the findings can be extended to smaller districts as well. In addition, this study focused on the school districts in one state. Because the states may vary substantially in their political and financial capabilities to support incentive pay programs, the findings of this study may not be generalized to districts in other states.

Furthermore, this study focused on formal teacher incentive pay programs and did not address informal incentive pay practices. Instead of implementing formal programs to recruit and reward teachers, school districts may also choose to reward teachers with informal incentive practices such as crediting teachers with additional experience on the salary schedule or rewarding effective teachers with favorable extracurricular assignments for which they receive additional compensations (Ballou & Podgursky, 1997; Goldhaber, et al., 2008). Such informal practices may also be effective in recruiting and retaining quality teachers and motivating them to improve their teaching practice.

Finally, this study focused on the identification of the characteristics of the different types of teacher incentive pay programs and the district characteristics involved in those programs. Because the longitudinal data on teacher mobility after the implementation of those programs are still not available, this study cannot answer whether the use of the incentive pay programs will help recruit and retain quality teachers. Although the effectiveness of the incentive pay programs is a major concern for the district leaders who are considering the implementation of incentive pay programs, it is also important for them to know the characteristics of the different types of pay incentives other districts are already implementing. Thus, future studies on the relationship between teacher incentive pay programs and teacher or student outcomes should also consider the processes including whether the highly qualified teachers in high demand are earning a larger amount of pay incentives and how such awards motivate teachers to improve their teaching and student learning. This study examined one such process—how districts are using incentive pay programs to recruit and retain highly qualified teachers—and the findings have important policy and leadership implications.

### **Policy and Leadership Implications**

The findings of the study advance the knowledge base of the different types of teacher incentive pay programs. It provides the district-, state-, and federal-level policymakers with important implementation data and up-to-date information on the characteristics of the teacher incentive pay programs for the future direction of the teacher incentive pay programs. Although high-poverty districts in rural areas are often in greatest need of highly qualified teachers, this study found that they are less likely to implement incentive pay programs to recruit and retain quality teachers. Given the national interest in improving student achievement under the standards-based and accountability reforms and the high rates of teacher turnover, it is important for these high-need districts to receive continuous and adequate funding for sustainable incentive pay programs to recruit and retain highly qualified teachers in high demand.

In addition, this study found that only a small percentage of districts in Missouri offered financial incentives to recruit teachers in the subject areas of shortage (e.g., mathematics, science, and special education). Because these teachers are often in high demand, it is important for district leaders to revisit the district incentive pay programs and better align the program implementation and the program goal of recruiting and retaining highly qualified teachers in high demand.

Furthermore, research suggested that the magnitude of the awards needs to be substantial so that it can effectively motivate teachers to change their behaviors or career decisions (Hanushek, et al., 2004; Lawler, 1990). To make better use of the constrained financial resources and provide continuous and substantial financial input to the incentive pay programs, it is important for the district leaders to prioritize providing or extending

the incentive pay programs to the teachers the districts need most, who are often the highly qualified teachers in the subject areas of shortage such as mathematics, science, and special education. By targeting those quality teachers in high demand, the incentive pay programs provide them with more earning opportunities, which in turn helps recruit and retain those teachers in the school districts and in the teaching profession.



## Chapter 4 Teacher Evaluation, Performance-Related Pay, and Constructivist Instruction

There is a revived interest in teacher performance-related pay (PRP) programs in the United States to recruit and retain highly qualified teachers (Podgursky & Springer, 2007). In his 2011 State of the Union address, President Obama reiterated a strong desire to improve teacher quality through reforming teacher compensation to the state governments, saying, “If you show us the most innovative plans to improve teacher quality and student achievement, we’ll show you the money. . . . We want to reward good teachers and stop making excuses for bad ones” (The White House, 2011).

Under the American Recovery and Reinvestment Act of 2009, the federal government issued the \$4.35 billion Race to the Top (RTT) Fund, a competitive grant program for states to implement widespread education reform initiatives. One goal of the program is to reform educator compensation systems by providing additional pay to highly effective teachers and principals. Previously, the U.S. Congress had appropriated \$99 million for the Teacher Incentive Fund (TIF) in 2006 to develop and implement sustainable performance-based compensation systems for principals and teachers in high-need schools; the appropriation soared to \$400 million for the 2010 fiscal year. Educational agencies in the District of Columbia and 37 states have received grants from TIF (U.S. Department of Education, n.d.). Currently, 13 states have state-level teacher PRP programs and 17 states have district-level PRP programs (National Center on Performance Incentives, n.d.). In 2011, the state of Ohio passed a law to eliminate salary schedules and step increases for full-time public teachers and could become the first state in the United States with a mandatory system to pay teachers based on their performance (*Education Week*, 2011b).

Despite the growing interest in teacher PRP programs, literature reviews showed that the knowledge base on PRP for teachers is still limited with regard to successful program development and implementation (Loeb, et al., 2009; Podgursky & Springer, 2007). Although there exists a body of empirical studies both in the United States and abroad that reported increased student test scores as a result of individual PRP (Atkinson, et al., 2009; Eberts, et al., 2002; Figlio & Kenny, 2007; Kingdon & Teal, 2007; Lavy, 2009; Muralidharan & Sundararaman, 2009; Winters, et al., 2009; Woessmann, 2011) and group- or school-based PRP (Clotfelter & Ladd, 1996; Glewwe, et al., 2010; Ladd, 1999; Lavy, 2002; Muralidharan & Sundararaman, 2009), the few studies that examined the impact of PRP on teacher behavior consistently found no improvement in teaching practices, such as implementing new instructional strategies (Glewwe, et al., 2010; Lavy, 2009; Winters, et al., 2009). Therefore, we know little about whether or how PRP can motivate teachers to improve their teaching practices.

In addition, literature has shown that high-stakes accountability tests may encourage teachers to engage in unintended behaviors and gaming of the system. The previous studies found that instead of improving instructional practices and focusing on the students' cognitive skills and critical thinking abilities, some teachers and schools manipulated test results by short-term strategies including increasing the caloric content of meals on the day of the high-stakes tests (Figlio & Winicki, 2005); offering more preparatory classes and increasing the students' test-taking skills (Glewwe, et al., 2010); placing students from ethnic minorities, from low socioeconomic backgrounds, and/or with low academics into special education categories (Cullen & Reback, 2006; Figlio & Getzler, 2006; Jacob, 2005); or even outright cheating (Jacob & Levitt, 2003).

This situation could escalate when teachers' pay is determined by students' test scores. Because the ultimate purpose of PRP is to motivate teachers to engage in better teaching practices and thus improve student understanding, it is critically important to examine the characteristics of teacher assessment for the determination of PRP and how the awards improve teacher instruction. Because constructivist instruction is a major approach to improving the students' conceptual understanding, it is important to examine the relationship between PRP and the practice of constructivist instruction.

To fill this knowledge gap, this study used statewide survey data collected in 2009 and 2010 from middle school mathematics teachers in Missouri and administrative data from the Missouri Department of Elementary and Secondary Education (MoDESE). This study examined the characteristics of teacher evaluation used for determining PRP awards and the association between PRP and improvement in teacher practice of constructivist instruction. Specifically, it addressed the following research questions:

1. What percentage of middle school mathematics teachers in Missouri received PRP and how much did they receive in the 2008-09 academic year?
2. What are the characteristics of teacher evaluation used to determine PRP?
3. How is mathematics teachers' PRP associated with improvement in their practice of constructivist instruction from 2009 to 2010, controlling for their background characteristics?

This study examined three aspects of teacher evaluation: (a) who conducted the evaluation (e.g., principal, outside expert); (b) what methods were used (e.g., observation, portfolio); and (c) what data were used for determining PRP awards (e.g., teaching practice, student achievement). This study found that 10.9% of middle school

mathematics teachers in Missouri reported having received some form of PRP in the 2008-09 academic year, and the average amount of the award was \$1,463. Most of the PRP recipients were evaluated by their school principals, who conducted classroom observations and face-to-face meetings to assess the teachers' teaching practice and professional development activities. Only a small percentage of teachers were evaluated by peers or using teaching portfolios, and only one out of four teachers was evaluated on student achievement data for the PRP award. After controlling for teacher and school characteristics, this study found a modest yet positive association between PRP and improvement in teacher practice of constructivist instruction.

The findings from this study advance the knowledge base on the implementation of teacher evaluation for determining PRP, as well as the relationship between PRP and teacher practice of constructivist instruction. This study provides state, district, and school policymakers and administrators with important, up-to-date information on teacher evaluation practices used to determine PRP at the middle-school level. In addition, an examination of the relationship between PRP and constructivist instruction illuminates an important downside to PRP: The programs may encourage teachers to teach to the test and to game the system for higher test scores instead of improving their classroom teaching and promoting students' mathematical understanding. This is especially likely when teachers were evaluated mainly or solely by student scores in high-stakes tests. Given that the ultimate purpose of PRP is to motivate teachers for better teaching practice and improving student understanding, it is crucially important to systematically examine whether PRP will improve teacher practice of constructivist instruction. Furthermore, this study focused on middle school mathematics teachers, who are working under the

greatest public pressure for higher student achievement in state-mandated standardized tests within the context of accountability reform. Findings on these teachers may be of particular interest and importance to the educational stakeholders.

## **Literature Review**

### **Theoretical Framework**

Following the previous studies (e.g., Podgursky & Springer, 2007), this study defined a PRP program as “a compensation system that rewards teachers with extra financial rewards beyond the annual salary raise on the salary schedule for outstanding performance in the performance evaluation”. It provides teachers with extra financial resources including cash bonuses, salary raises, or extra steps/channels on the salary schedule based on predetermined teacher and/or student outcomes rather than inputs such as qualifications or preparation. School districts or schools may use teacher data pertaining to teacher professional development activities and teaching practices and student data including test scores, attendance, and graduation rates for the evaluation.

Johnson and Papay (2009) presented a useful three-dimensional framework for analyzing PRP programs. The first dimension examines whether a PRP program uses (a) student test scores; (b) professional evaluations (e.g., portfolios and conferences with the principals); or (c) mixed measures (e.g., a combination of test scores and professional evaluations) to assess teacher performance. The second dimension focuses on whether the PRP program rewards teachers using a rank-order tournament or rewards them for achieving specified external goals or standards. The third dimension addresses whether a PRP program is at the individual, group, or school level. Because a PRP program may

reward individual teachers for individual performance, a group of teachers for group-level performance, or all the teachers in a school for school-level performance, the PRP recipients may be individual teachers, a group of teachers, or all teachers in a school. Johnson and Papay pointed out that most districts today with PRP plans reward individual teachers on standardized test scores through student growth measures and the reward is determined based on relative teacher rankings.

In addition to these three aspects of program characteristics, districts may choose to reward teachers either with a formal program or with informal incentive practices such as crediting the teachers with additional experience on the salary schedule or rewarding effective teachers with favorable extracurricular assignments for which they receive additional compensations (Ballou & Podgursky, 1997; Goldhaber, et al., 2008). Such informal practices may also motivate teachers to achieve the rewarded outcomes.

### **Teacher Evaluation and Performance-Related Pay**

An effective and reliable evaluation of teacher performance is essential for the successful implementation of PRP programs. Criticism over a lack of fairness, reliability, and objectivity has been a primary concern in teacher evaluation, especially when the evaluation was used for high-stakes purposes such as promotion, termination, and determination of PRP rewards (Desander, 2000). In the United States, teacher evaluation went through several stages and the focus has shifted from teachers' personal characteristics in the early 20th century to observable teaching behaviors from the 1950s to the 1980s and to accountability, professional development, and school improvement from the 1980s into the 21st century. Teacher evaluation continues to be a major focus of

school reforms for accountability, promotion, and staff development (Ellett & Teddlie, 2003; Teddlie, Stringfield, & Burdett, 2003).

Kennedy (2010) pointed out that the most important way to evaluate teacher performance today is the standards-based approach represented by the framework of Danielson (1996). Within this framework, there are four major domains for standards-based teacher evaluation: (a) planning and preparation, which includes knowledge of content, pedagogy, students and resources, coherent instruction, and student assessment; (b) classroom environment, which creates an environment of respect and rapport and manages classroom procedures and student behaviors; (c) instruction, which includes clear and accurate communication and student engagement; and (d) professional responsibilities of self-reflection and communication with families with professionalism.

Historically, teacher evaluation has been delegated from state governments to local educational agencies (Teddlie, et al., 2003). With the implementation of the No Child Left Behind (NCLB) Act of 2001 and the demand for highly qualified teachers in every classroom, teacher evaluation has become a state-level policy target and tool for promoting teacher improvement and student learning (Ellett & Teddlie, 2003; Hazi & Rucinski, 2009). Hazi and Rucinski (2009) studied the changes of statutes and state department regulations in teacher evaluation since the enactment of the NCLB in 50 states. They found that state governments are asserting more oversight and involvement in local evaluation practices, including specifying evaluation criteria and requiring specific instruments and procedures. In addition, 12 states are using peer review and/or portfolios in teacher ratings and 12 states are incorporating student achievement data into teacher performance evaluation. A study with state survey data (*Education Week*, 2011b)

found that during the 2009-10 school year, 44 states required formal evaluations of all teachers' performance, 15 states required annual teacher evaluations, 27 states requested all evaluators of teachers to receive formal training, and 10 states had formal or pilot PRP programs that rewarded teachers for raising student achievement.

The effectiveness of a teacher evaluation system may be influenced by many factors. Among the important factors are who conducts the evaluation, what the methods are, and what data are used. In the first place, different evaluators have unequal levels of expertise, skills, and experience in teacher assessment, and therefore the validity and reliability of their evaluation may vary substantially. In addition, teaching is a complex endeavor and different evaluation methods may capture different aspects and characteristics of teacher performance. Furthermore, the data used in the evaluation signal the teachers as to what should be the focus of their teaching practice. The previous studies on those three important factors are discussed below.

**Evaluators.** Teacher performance evaluations can involve a variety of evaluators such as principals, peer teachers, and parents and students. In practice, school principals are the most common evaluator in assessing teacher performance (Peterson, 2004). Despite its dominant role, findings on the reliability and validity of principal evaluation are mixed and inconclusive. Early research suggested low accuracy of principal judgment and a weak relationship between principal ratings and student achievement (Medley & Coker, 1987; Peterson, 2000). Although several recent studies in California (Gallagher, 2004), Cincinnati (Milanowski, 2004), and Nevada (Kimball, White, Milanowski, & Borman, 2004) reported a positive relationship between principal assessment and student test score gains, the strengths of the association are generally weak or modest at most.



More specifically, Jacob and Lefgren (2008) found that principals are more effective in identifying the best teachers and the worst teachers as measured by the magnitude of the test score gains produced, but they have far less ability to distinguish between teachers in the middle of the achievement distribution, which constitutes the largest portion of teachers for performance evaluation. Kimball and Milanowski (2009) also reported a major variation among the evaluators in the size and direction of the relationship between the evaluator ratings of the teachers and value-added measures of the average achievement of the teachers' students. Some studies also found that principals are often lenient and tend to inflate their ratings of teacher performance, especially for high-stakes purposes (Milanowski, 2004; The New Teacher Project, 2007). Therefore, although principals are the most common evaluators for teacher performance assessment, there are concerns regarding the accuracy of principal ratings.

Teachers' colleagues (e.g., peer teacher, mentor, coach, or teacher leaders) may also serve as important evaluators. This approach to teacher evaluation received support from the teacher unions (American Federation of Teachers and National Education Association, 1998). In a longitudinal case study of one urban school district in California, which initiated a statewide Peer Assistance and Review (PAR) program in 1999 and required all school districts to have a PAR program in place for veteran teachers, Goldstein (2007) found that teachers serving as coaches are able to effectively conduct evaluations of their peers. Compared with the traditional teacher evaluation by principals, coaches in the PAR programs have more time to support and evaluate the participating teachers, and the evaluation is more transparent and is linked to support and professional development. In addition, a good teacher evaluation system may involve outside experts (Peterson, 2000).

The external experts bring knowledge from other organizations and their evaluations are often more unbiased and objective. Their credentials and expertise also increase the credibility of the evaluation results.

In summary, principals are the most common evaluators in teacher performance assessment. However, there are concerns about the validity and reliability of principal ratings in teacher evaluation, especially when involving principals alone for high-stakes assessments. Some research suggested that peers may provide more useful and important information for a comprehensive teacher performance assessment. In our survey, teachers were asked who from the following list conducted the teacher performance evaluation used to determine PRP awards: (a) principal; (b) peer teacher(s); (c) mentor/coach/teacher leaders; (d) outside experts; and (e) others.

**Evaluation methods.** The method of assessment is another important feature influencing the effectiveness of the performance evaluation system. In current practice, the most common method of data collection for teacher evaluation is classroom observations conducted by principals with pre- and post-observation meetings (Peterson, 2004). However, reliance on one or two formal principal observations in evaluation presents serious problems because other dimensions of teacher performance, such as student assessment and professionalism, may not be readily observable during the administrators' classroom visits. These aspects of teacher performance can be more effectively documented in teacher portfolios (Tucker, Stronge, Gareis, & Beers, 2003). The portfolio approach helps capture the complexities and contexts of teaching and promote professional development of teachers (Wolf, Lichtenstein, Bartlett, & Hartman, 1996). Portfolios have also been used extensively throughout the education system in preservice

teacher education and accreditation programs (Delandshere & Petrosky, 2010; Wei & Pechione, 2010) and as a key component for the National Board for Professional Teaching Standards, which received regulatory or legislative support from all the states (Reese, 2010). In our survey, teachers were asked what methods from the following list were used for their evaluation to determine their PRP awards: (a) classroom observation; (b) teaching portfolio; (c) face-to-face meeting; and (d) other.

**Evaluation data.** Teacher evaluation can involve a variety of data such as student achievement, teachers' teaching practices and professional development activities, and student/parent feedback. Because the main responsibility of teachers is to facilitate student learning, researchers argued that student achievement data should play an important role in teacher evaluation (Peterson, 2000, 2004). A leading method and rapidly advancing use of test-score data is value-added modeling (Harris & McCaffrey, 2010). This technique projects a student's future achievement using past test scores and compares the projection to the actual results. The difference is the value that the teacher added to or subtracted from the student's achievement. In the context of standards-based and accountability reforms, as pointed out by Johnson and Papay (2009), most districts with PRP plans reward teachers for increased standardized test scores. Although student test score gains are more objective and can eliminate favoritism and personal bias from principal evaluations, such standardized tests only cover limited aspects of knowledge domains and there are wide concerns regarding the stability, reliability, and validity of this approach. For example, Newton and colleagues (2010) found that even when student characteristics are taken into account, judgment of teacher effectiveness with the value-added models can vary substantially across time and across the classes that teachers teach.

In addition, research suggested that teachers' measured effectiveness can vary quite a bit when results are measured on different tests (e.g., Lockwood et al., 2007). Recognizing that the conventional measures of individual teachers' added value fade out very quickly and are at best weakly related to long-term effects, Rothstein (2010) argued that value-added models should be used as only one of the several measures in an accountability system along with principals' or peers' ratings for evaluating teachers.

Alternatively, evaluators may assess teachers with data on teaching practice (e.g., student-teacher interactions, course materials, student work) or professional development and service activities. Compared with student test score gains, the teacher practice data capture multiple dimensions of teacher practice and enable a more holistic assessment. However, an evaluation of teacher performance based on teachers' practice data requires the evaluators to possess the capacity and expertise to make fair and accurate judgments about the teachers' performance. Concerns about favoritism and nepotism often undermine the teachers' trust in the evaluation decisions.

Furthermore, students and parents may provide important information on teacher performance as well. Their unique perspectives help capture other dimensions of teachers' teaching or educational practice. Some early studies demonstrated that student and parent surveys may be used as important supplementary data sources for teacher evaluation (Epstein, 1985; Kyriakides, 2005; Peterson, 1987; Peterson, Driscoll, & Stevens, 1990; Peterson, Wahlquist, & Bone, 2000). In our survey, teachers were asked what data from the following list were used for the performance evaluation to determine PRP awards: (a) student achievement data; (b) other student data (e.g., attendance rates, dropout rates); (c) professional development or service activities; (d) data on teaching

practices (e.g., observation, course materials, student work); (e) student/parent survey or feedback; (f) teacher test scores (e.g., Praxis II); and (g) other.

In summary, evaluators, evaluation methods, and evaluation data are important features of a teacher evaluation system. To date, the most common practice of teacher assessment is formal classroom observations by school principals. However, researchers advocate for holistic and comprehensive evaluations with multiple evaluators, methods, and data sources. Most of the empirical studies available on teacher assessment are small-scale studies focusing on one particular school district (e.g., Goldstein, 2007; Jacob & Lefgren, 2008; Milanowski, 2004). Therefore, a large-scale survey is needed to permit better understanding of the statewide practices of teacher performance evaluation.

**Teacher performance evaluation in Missouri.** The state of Missouri is one of the 44 states that require formal evaluations of all teachers' performance (*Education Week*, 2011b). In 1983, the state passed legislation and required school districts to implement a performance-based teacher evaluation (PBTE) program. The MoDESE provided school districts with evaluation guidelines in 1984 that assess the teachers' demonstrated standards of competency and academic ability. An early report estimated that by the 1985-86 school year, 98% of the school districts in Missouri had used a PBTE program and a great majority used systems that were essentially identical to the state model (Valentine & Harting, 1988).

In 1999, the MoDESE presented a new evaluation model based on the latest research at that time, including the work of Danielson (1996). The revised model consists of both a teacher evaluation phase and a teacher professional development phase. In the evaluation phase, the administrator or supervisor purposefully collects data from sources

including classroom observations, pre- and postobservation conferences, videotape recordings, or data from unplanned observations and carry out a formal evaluation annually for nontenured teachers during the first 5 years and once every 5 years for tenured teachers. In the professional development phase, nontenured teachers in their first 2 years will have a mentor in developing the evaluation portfolio and they will observe mentors' teaching and be observed by the mentors. Tenured teachers may conduct a self-assessment, develop and implement a professional development plan, and participate in various forms of professional collaborations on instruction and curriculum development.

The new model has six standards: (a) involving students to actively participate in the learning process; (b) using various forms of assessments to monitor student learning; (c) being knowledgeable of the content and effectively maintaining students' on-task behavior; (d) interacting in a professional manner; (e) keeping current on instructional knowledge and seeking changes in teaching behaviors that will improve student performance; and (f) acting as a responsible professional in addressing the overall missions of the school district. Each standard has two to five criteria. For example, the first standard requires the teachers to help students acquire the knowledge and skills (a) to gather, analyze, and apply information and ideas; (b) to communicate effectively; (c) to recognize and solve problems; and (d) to make decisions and act as responsible members of society (Missouri Department of Elementary and Secondary Education, 1999).

This study selected the state of Missouri due to its similarity to many other states on the state-level policies of teacher performance evaluations and the use of PRP programs. During the 2009-10 academic year, Missouri did not require annual evaluation of teachers, assessment of teachers with student achievement, or formal trainings of the

evaluators. In addition, similar to many states, Missouri did not have a state-level policy of PRP programs to reward teachers for raising student achievement (*Education Week*, 2011b). In addition, Missouri does not have a state right-to-work law which prohibits agreements between employers and unions that require workers to join a union as a condition of employment (U.S. Department of Labor, n.d.). It is also a decentralized state (Pipho, 1991) and although the state has a collective bargaining law, public school teachers are excluded from it (Education Commission of the States, 2008). Due to these similarities, findings from this study may be of important reference for other states.

In summary, state governments across the nation are asserting more oversight and involvement in local practices of teacher evaluation. In current practice, the most common way to assess teachers is formal classroom observations by school principals. Due to the limited validity and reliability of principal ratings, however, researchers have advocated for holistic and comprehensive evaluations with multiple evaluators, methods, and data sources. The state of Missouri has implemented a performance-based teacher evaluation system for about 30 years, and it is similar to many other states regarding state-level policies of teacher performance evaluations and the use of PRP programs. Because most of the empirical studies available on teacher assessment are small-scale studies at the district-level and there are few studies with state-level data, a large-scale survey at the state level is needed to better understand the statewide practices of teacher evaluation and the association between PRP and teacher practice.

### **Performance-Related Pay and Teacher Practice of Constructivist Instruction**

Although there is a growing body of studies that suggested a positive effect of PRP on student achievement, we do not know whether the increased test scores evidenced real

student learning through improved teaching practices or a temporary boost due to teaching to the test or gaming the system. Thus, it is important to examine how PRP may influence teachers' classroom instructions, especially the practice of constructivist instruction, to promote students' critical thinking skills and conceptual understandings.

With roots in the work of Dewey (1929), Piaget (1952), and Vygotsky (1978), the theory and philosophy of constructivist instruction have dominated the fields of teaching and learning (Richardson, 2003; Tobias & Duffy, 2009) and have been embraced by the K-12 mathematics education communities (National Council of Teachers of Mathematics, 1989, 2000). Standards-based reforms also require teachers to make a transition from traditional teacher-centered didactic instruction to student-centered constructivist instruction. Viewing learning as an active process of knowledge construction, constructivist instruction emphasizes deep understanding of knowledge, conducting substantive and elaborated communication, and making connections with real-world situations (Brooks & Brooks, 1993; Nie & Lau, 2010).

Despite the importance of the relationship between PRP and teacher practice, only a few empirical studies have examined this relationship so far and they generally have found that receiving a PRP award is not associated with improvement in the teachers' classroom instruction. Winster et al. (2009) examined a PRP program in Little Rock, AR, which rewarded teachers solely on student test score gains in mathematics, reading, and language arts in five elementary schools. They found no difference in improvement of instructional practices including researching new instructional strategies and implementing effective practices in classroom teaching between the teachers participating in the program and their peers in the comparison schools. Lavy (2009) assessed the effect



of a 3-year individual-based PRP program on English and mathematics teachers in Israel that rewarded teachers with cash bonuses for improved student performance in high school matriculation exams. Lavy also found no differences between the participating and nonparticipating teachers on the teacher practices including the use of individualized instruction, ability tracking, and adapting teaching methods to a student's ability. Studies in Kenya (Glewwe, et al., 2010) and India (Muralidharan & Sundararaman, 2009) also did not find difference in instructional practices, including providing individual or group help and encouraging participation between the control and the incentive schools.

In summary, the evaluation literature on PRP's effects on teacher practices focused on the programs that assess teachers on student scores in standardized tests. The studies available tended to suggest that although such PRP programs may temporarily increase student achievement, they do not improve the teachers' teaching practice. In addition, no study has examined the relationship between PRP and improvement in constructivist instruction. Because an ultimate purpose of PRP is to motivate teachers to enhance their teaching and improve the students' critical thinking skills, it is important to examine whether PRP is associated with improved practice of constructivist instruction. The state of Missouri has implemented a performance-based teacher evaluation program for nearly 30 years that focuses on teachers' instructional practices instead of student test scores. Using the teacher data in Missouri, this study may fill the knowledge gap and provide reliable evidence on the association between PRP and improvement in the practice of constructivist instruction.

## **Method**

### **Data**

This study used two sets of data: (a) teacher evaluation and PRP data from the 2008-09 and 2009-10 Teachers' Opportunity To Learn (TOTL) surveys and (b) administrative data from the MoDESE. The Teachers' Opportunity To Learn (TOTL) survey was developed to understand the nature of the teachers' learning opportunities and supporting work contexts for middle school mathematics teachers in Missouri. This is a 3-year longitudinal survey in which a population of middle school mathematics teachers participated in 2009, 2010, and 2011. The 2010 TOTL survey asked teachers about the evaluation conducted by their schools or districts for the purposes of instructional improvement, tenure or promotion decisions, and performance pay or merit pay during the 2008-2009 academic year. For those who reported having had an evaluation, they were further asked questions on (a) who conducted the evaluation; (b) what methods and data were used in the evaluation; and (c) what they received as a result of the evaluation (i.e., tenure/promotion, cash bonus, salary raise, professional development, or teaching resources including funds, materials, release time, and some other rewards).

In all 3 years of the TOTL survey implementation, a population of mathematics teachers in middle schools (Grades 6-8) in Missouri was invited to participate in the survey. In the 2010 TOTL survey, 912 teachers were identified as eligible and received a mail survey. The data were collected through five waves of mailings: (a) the first survey mailing to home addresses in early January 2010; (b) a postcard reminder 3 weeks later; (c) the second survey mailing to school addresses in February 2010; (d) a postcard reminder 3 weeks later; and (e) the final survey mailing to home addresses in late April

2010. Each participant who completed the survey received a \$30 gift card from a major retailer as a financial incentive. A total of 633 teachers returned the complete surveys, for a response rate of 69.4%. The 2009 TOTL survey used the same implementation procedures, and 577 out of 886 middle school mathematics teachers completed the survey, for a response rate of 65.1%. To address the third research question on the relationship between PRP and changes in constructivist instruction, this study merged the 2009 and 2010 TOTL survey data on constructivist instruction using the teachers' IDs. The data from 416 teachers who participated in both the 2009 and 2010 TOTL surveys were analyzed for this question.

## **Measures**

**Teacher evaluation.** The 2010 TOTL survey asked the teachers if they had a teacher evaluation conducted by the school or district for the purposes of instructional improvement, tenure or promotion decision, or performance/merit pay during the 2008-09 academic year. For clarification purposes, the survey instructed the teachers not to include end-of-course evaluations or exams at a university or college or the evaluation for the National Board Certification. If the teacher indicated having had an evaluation, the survey asked a series of yes/no questions about who conducted the evaluation and what methods and data were used. If the teacher marked *other* in the following questions, they were asked to specify and provide more information. Appendix F presents all the survey items on teacher evaluation.

**Evaluators.** Teachers were asked whether they had been evaluated by (a) a principal; (b) peer teacher(s); (c) mentor/coach/teacher leaders; (d) outside experts; and (e) other. Their responses were coded as 1 = yes and 0 = no for each item.

***Evaluation methods.*** Teachers were asked whether the following methods were used for the evaluation: (a) classroom observation; (b) teaching portfolio; (c) face-to-face meeting; and (d) other. Their responses were coded as 1 = yes and 0 = no for each item.

***Evaluation data.*** Teachers were asked whether the following data were used for the evaluation: (a) student achievement data; (b) other student data (e.g., attendance rates, dropout rates); (c) professional development or service activities; (d) data on teaching practices (e.g., observation, course materials, student work); (e) student/parent survey or feedback; (f) teacher test scores (e.g., Praxis II); and (g) other. Their responses were coded as 1 = yes, 0 = no.

**Performance-related pay.** For the teachers who reported having had an evaluation during the 2008-09 academic year, the 2010 TOTL survey further asked if they had received any of the following as a result of their performance evaluation: tenure or promotion, one-time cash bonus, salary raise, professional development or teaching resources (e.g., fund, material, release time), or other rewards. If the teacher indicated having received a cash bonus or salary raise, they were asked to provide the dollar amount. Given the definition of PRP, this study identified a teacher who received a PRP award in the TOTL survey as one who reported having received a one-time cash bonus and/or salary raise as the result of the performance evaluation during the 2008-09 year and defined the amount of the PRP awards as the amount reported for the cash bonus and/or salary raise.

**Constructivist instruction.** The 2009 and 2010 TOTL surveys asked teachers how often their students in a typical mathematics class participate in seven types of constructivist activities: (a) solving mathematics problems in small groups or with a

partner; (b) writing a few sentences about how to solve a mathematics problem; (c) writing reports or doing mathematics projects; (d) discussing solutions to mathematics problems with other students; (e) working and discussing mathematics problems that reflect real-life situations; (f) working with objects like rulers; and (g) talking to the class about their mathematics work. These items were taken from Mayer (1999). The participants' responses were coded as 1 = never or hardly ever, 2 = 1-2 times a month, 3 = 1-2 times a week, and 4 = almost every day. This study used the means of each teacher's responses to the seven items as a composite measure of the teacher's practice of constructivist instruction (Cronbach's  $\alpha = .75$  for the 2009 survey and  $.74$  for the 2010 survey).

**Teacher-level independent variables.** The TOTL survey asked the mathematics teachers to report the following information: (a) gender; (b) mathematics certification; (c) highest degree attained; (d) teaching experience; (e) mathematics major; and (f) mathematics education major. In this study, female teachers were coded as 1 = female and 0 = male. Teacher certification was coded as 1 = having a full certification in mathematics and 0 = not having a full certification in mathematics. The highest degree was originally coded as 1 = bachelor's degree, 2 = master's degree, 3 = specialist degree, and 4 = Ph.D. or other professional degrees. This variable was recoded as 1 = master's degree or above and 0 = bachelor's degree because there were only a few teachers having a specialist or doctoral degree. For teaching experience, mathematics teachers reported their total number of years of teaching and their responses were recoded into three categories: (a) beginning teachers (0-5 years); (b) midcareer teachers (6-15 years); and (c) experienced teachers (16 years or more). Two dummy variables (1 or 0) were created for

beginning teachers and experienced teachers. This study coded the teachers' mathematics major as 1 = majored in mathematics in undergraduate or graduate program and 0 = no major in mathematics in undergraduate or graduate program and did the same for a mathematics education major.

**School-level independent variables.** The following school background data were obtained from the MoDESE: (a) school location (urban, suburban, and rural); (b) school poverty level as measured by the percentage of students receiving free or reduced-price lunch; and (c) school diversity level as measured by the percentage of ethnic minority students. Two dummy variables were created for urban and rural schools.

## Analysis

To answer the first question, “What percentage of middle school mathematics teachers in Missouri received PRP and how much did they receive in the 2008-09 academic year?” and the second question, “What are the characteristics of teacher evaluation used to determine PRP?” this study computed and reported the means and percentages. To answer the third question, “How is mathematics teachers' PRP associated with improvement in their practice of constructivist instruction from 2009 to 2010, controlling for their background characteristics?” this study used ordinary least squares regression to estimate a value-added model taking the form

$$CI_{i,t} = \beta_0 + \beta_1 CI_{i,t-1} + \beta_2 PRP_{i,t} + \beta_3 Teacher_{i,t} + \beta_4 School_{i,t} + \varepsilon_{i,t},$$

where  $CI_{i,t}$  is the measure of constructivist instruction of teacher  $i$  in 2009-10;  $CI_{i,t-1}$  is the measure of constructivist instruction of teacher  $i$  in 2008-09; and  $PRP$  is a dummy variable indicating whether the teacher received a PRP award in 2009-10. The coefficient

for the *PRP* variable represents the association between PRP and improvement in constructivist instruction after accounting for the prior year's constructivist instruction. *Teacher* is a vector of observable characteristics of the teacher including gender, state certification status, highest degree, teaching experience, and major; *School* is a vector of observable characteristics of the school including school location, percentage of students for free or reduced-price lunch, and the percentage of ethnically minority students; and  $\varepsilon$  is the error term.

## Results

### Percentage of Teachers Receiving PRP and the Amount

Table 9 reports the percentage of middle school mathematics teachers in Missouri who received some form of PRP and the dollar amount of the PRP in the 2008-09 academic year. Of the 633 teachers who completed the survey, 492 teachers (77.7%) had an evaluation during the 2008-09 school year. Among these 633 teachers, none (0.0%) received a one-time cash bonus, 69 teachers (10.9%) were given a salary raise, 76 teachers (12.0%) were awarded tenure or promotion, 34 teachers (5.4%) were given resources for professional development or teaching (e.g., funds, materials, and release time), and 14 teachers (2.2%) received other awards such as a contract renewal. Given the definition of PRP in this study, the analysis showed that 10.9% of middle school mathematics teachers in Missouri received some form of PRP in the 2008-09 school year.

The amount of the PRP varied from a minimum of \$150 to a maximum of \$5,000. The average amount of the award was \$1,463 ( $SD = \$1,004$ ), or \$1,414 when converted to 2007 constant dollars after adjusting for the changes in the cost of living.

Table 9. Percentage of Middle School Mathematics Teachers in Missouri Who Received PRP in 2008-09 and the Average Amount of the Awards

	<i>N</i>	Mean/Percentage
In 2008-09, did you have a teacher evaluation? ( <i>N</i> = 633)		
Yes	492	77.7%
No	141	22.3%
As a result of the evaluation, the teachers received:		
<b>PRP: One-time cash bonus</b>	<b>0</b>	<b>0.0%</b>
<b>PRP: Salary raise</b>	<b>69</b>	<b>10.9%</b>
Tenure or promotion	76	12.0%
Professional development or teaching resources (e.g., funds, materials, release time)	34	5.4%
Other	14	2.2%
Amount of the performance-related pay	69	\$1,463
		(Min: \$150)
		(Max: \$5,000)
		(SD: \$1,004)

The results can be compared with the findings from the 2007 SASS dataset by Liang and Akiba (2011a), which found that 4.7% of regular full-time public school teachers received some form of PRP in the United States in 2007 and the average amount was \$1,967. Thus, while a larger percentage of teachers in Missouri received PRP than the national percentage in 2007, the amount of \$1,414 was smaller than the national average of \$1,967. Because the teachers also reported their base salary in the survey (minimum =



\$25,500, maximum = \$79,400, mean = \$44,908,  $SD = 11,771$ ), this study calculated the ratio of the PRP awards to the teachers' base salary as a measure of the size of the awards. The ratio varied from a minimum of 0.3% to a maximum of 14.7%. The average ratio was 3.3%.

### **Performance Evaluation in Determining Performance-Related Pay**

Table 10 presents the findings on the characteristics of teacher evaluation for determining PRP. It shows who conducted the evaluation, what data collection methods were used, and what data were used for the evaluation. The left column of the table reports the frequency of each evaluation item. In addition, because a teacher could be evaluated by multiple evaluators using multiple data and methods, the right column of the table also presents the frequency of the evaluation items in the reported combination. These percentages sum to 100% within each category of evaluators, evaluation methods, and evaluation data.

**Evaluators.** The table shows that the principal is the most common evaluator in teacher evaluation. As reported in the left column, of the 69 middle school mathematics teachers who received a PRP award, 92.8% had the school principal as an evaluator, 8.7% had their peer teachers, 18.8% had the mentor, coach, or teacher leaders, 8.7% had outside experts, and another 8.7% had some other evaluators including assistant principals or area coordinators. The right column further shows that 68.1% of the 69 teachers were evaluated solely by their school principals and 8.7% were evaluated jointly by their principals and mentors, coaches, or teacher leaders. The remaining 23.2% were evaluated by some other combination of the evaluators.

***Evaluation methods.*** Classroom observation and face-to-face meeting are the most commonly used methods in teacher evaluation. As reported in the left column, all 69 teachers (100%) were evaluated by means of classroom observation, and 88.4% had a face-to-face meeting with the evaluator. Only 15.9% of the teachers had teaching portfolios as part of their evaluation and 3% were evaluated with other methods including paperwork and growth plans. The right column indicates that 71% of the teachers were evaluated with classroom observation and face-to-face meeting, and 15.9% with the combination of classroom observation, teaching portfolio, and face-to-face meeting. About one out of 10 teachers were evaluated with classroom observation only.

***Evaluation data.*** Of the 60 teachers who reported the data used for their performance evaluation, 95% were assessed with teaching practice data including observations, course materials, and student work. The second most common evaluation data were from teacher professional development or service activities, with 56.7% of the teachers evaluated in this way. Only one fourth of the teachers reported the use of student achievement data, and 20% reported the use of student or parent surveys or feedback for their evaluations. Smaller percentages of teachers were also evaluated with other student data such as attendance rates or dropout rates (6.7%), teachers' test scores (1.7%), and other data including extracurricular activities and discipline referrals (6.7%). The analysis of multiple evaluation data in combination on the right column shows that 31.7% of the teachers were evaluated based on teaching practice data alone, 25% with a combination of professional development activities and teaching practices, and the remaining 43.3% with other combinations as shown in Table 10. In contrast to the dominant role of principals as the evaluators and the common methods of classroom observations and

Table 10. Teacher Evaluation Used in Determining PRP for Middle School Mathematics Teachers in Missouri in 2008-09

		N	%			N	%
<i>Evaluator (N = 69)</i>		<i>Evaluators in Combination (N = 69)</i>					
Principal		64	92.8	Principal		47	68.1
Mentor/coach/teacher leaders		13	18.8	Other combinations		9	13.1
Other		7	10.1	Principal and mentor/coach/teacher leaders		6	8.7
Peer teacher(s)		6	8.7	Other evaluators		4	5.8
Outside experts		6	8.7	Principal, peer teacher, mentor/coach/teacher leader, and outside experts		3	4.3
<i>Evaluation Methods (N = 69)</i>		<i>Evaluation Methods in Combination (N = 69)</i>					
Classroom observation		69	100	Classroom observation and face-to-face meeting		49	71
Face-to-face meeting		61	88.4	Classroom observation, teaching portfolio, and face-to-face meeting		11	15.9
Teaching portfolio		11	15.9	Classroom observation		7	10.1
Other		2	2.9	Other combinations		2	3.0

<i>Evaluation Data (N = 60)</i>	<i>Evaluation Data in Combination (N = 60)</i>			
Data on teaching practice (e.g., observation, course materials, student work)	57	95.0	Teaching practice	19 31.7
Professional development/service activities	34	56.7	Professional development and teaching practice	15 25
Student achievement data	15	25.0	Other combinations	13 21.6
Student/parents survey or feedback	12	20.0	Professional development, teaching practice, and student/parent survey/feedback	4 6.7
Other student data	4	6.7	Professional development	3 5
(e.g., attendance rates, dropout rates)				
Other	4	6.7	Student achievement and teaching practice	3 5
Teacher test scores (e.g., Praxis II)	1	1.7	Student achievement, professional development, and teaching practice	3 5

face-to-face meetings, there is a major variation in the kinds of data used to evaluate middle school mathematics teachers in Missouri.

### **Performance-Related Pay and Improvement in Constructivist Instruction**

The Appendix G provides the descriptive statistics of the variables in the analysis. Table 11 reports the results of the ordinary least squares regressions on the association between PRP and the constructivist instruction, controlling for the practice of constructivist instruction in the prior year. This study examined three models. The first model estimated the association between teacher-level control variables and constructivist instruction. The second model included the indicator variable on whether the teacher received PRP. The third model was the full model and contained the school-level control variables as well.

Model 1 shows that a teacher's constructivist instruction in the prior year is the most significant predictor on the teacher's practice in the following year. In addition, teachers with a mathematics education major tend to improve less in the use of constructivist instruction than their peers who do not major in mathematics education in their undergraduate or graduate program. The other teacher attributes such as gender and qualification indicators including certification, highest degree, teaching experience, and mathematics major are not significantly associated with the improvement in the teacher use of constructivist instruction.

The analyses in Models 2 and 3 consistently show that receiving a PRP award is positively associated with improvement in the practice of constructivist instruction. After controlling for the constructivist instruction in the 2008-09 academic year and the teacher characteristics, the analysis shows that the improvement in using constructivist

Table 11. PRP and Improvement in the Practice of Constructivist Instruction

	Model 1	Model 2	Model 3
Performance-related pay		0.118 (0.055) *	0.116 (0.056) *
Constructivist instruction	0.701 (0.036) ***	0.694 (0.036) ***	0.686 (0.036) ***
2008-09			
Female	0.034 (0.045)	0.042 (0.045)	0.040 (0.046)
Full certification	0.029 (0.053)	0.030 (0.053)	0.029 (0.053)
Master's degree or above	-0.079 (0.041)	-0.081 (0.041) *	-0.069 (0.042)
New teacher	-0.027(0.049)	-0.033(0.049)	-0.033(0.049)
Experienced teacher	0.024 (0.041)	0.029 (0.041)	0.038 (0.041)
Math major	0.066 (0.049)	0.069 (0.049)	0.054 (0.050)
Math education major	-0.081 (0.039) *	-0.082 (0.039) *	-0.076 (0.039)
Urban school			-0.073 (0.057)
Rural school			0.034 (0.048)
% Minority students			0.001 (0.001)
% Free or reduced-price lunch students			0.001 (0.001)
<i>N</i>	421	421	421
<i>R</i> <sup>2</sup>	0.50	0.51	0.52

*Note.* Standard errors in parentheses.

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

instruction in the 2009-10 academic year for teachers who received PRP is on average 0.12 units higher than for the teachers who did not receive PRP. After further controlling the district characteristics in Model 3, the result is essentially the same: The improvement of teacher practice in constructivist instruction for PRP recipients is 0.12 units higher than for the nonrecipients.

## **Discussion**

Before discussing the findings and the policy and leadership implications, it is important to identify the limitations of the study. First, the survey data in this study did not distinguish individual-based PRP from group- or school-based PRP programs. These programs may have different effects and mechanisms on teacher satisfaction, instructional improvement, and student achievement. The teacher data on PRP analyzed in this study include both individual- and group- or school-based PRP. Future studies should differentiate individual PRP programs from collective PRP programs and examine their associations with constructivist instruction separately. For a similar reason, future studies should distinguish between formal PRP programs and informal practices and examine their associations with constructivist instruction separately.

In addition, this study focused on mathematics teachers in grades 6-8 middle schools. This group of teachers is working under the greatest pressure to improve student achievement in state-mandated standardized tests within the context of accountability reform, and the findings may be of particular interest and importance to state, district, and school administrators and policymakers. However, it is unclear whether the finding on the positive association between receiving PRP awards and improvement in constructivist

instruction can be generalized to teachers of other subjects, grades, or states with different teacher evaluation systems.

Despite these limitations, this study uncovered important processes in the design and implementation of PRP programs: how teachers are evaluated for PRP, who are receiving PRP, how much the awards are, and how such pay is associated with the teachers' teaching practice.

This study found that about 10.9% of Missouri middle school mathematics teachers received PRP in 2009, with an average amount of \$1,414 when converted to 2007 constant dollars after adjusting for the changes in the cost of living. A previous study (Liang & Akiba, 2011a) found that 4.7% of regular full-time public school teachers received PRP in the United States in 2007, with an average amount of \$1,967. This shows that a higher percentage of middle school mathematics teachers in Missouri received PRP, but the amount is smaller than the national average.

The amount of the PRP awards is an important factor affecting the effectiveness of the PRP programs. Previous studies suggested that the financial incentive should be 10% or more of the salary to be sufficient to motivate teachers (Hanushek, et al., 2004; Lawler, 1990). The average amount of \$1,463 for the PRP awards only accounted for on average about 3.3% of the teachers' base salary, far below the recommended scale of the awards.

In addition, this study found that more than 68.1% of the teachers who received PRP were evaluated by the principal only, who conducted classroom observations and face-to-face meetings, and only small percentages of teachers were evaluated by other evaluators only (5.8%), two evaluators (17.3%), and three or more evaluators (8.8%). This finding is consistent with the common practice on teacher evaluation (Peterson,



2004). However, a previous study with the SASS dataset (Liang & Akiba, 2011a) found that highly qualified teachers (e.g., National Board-certified teachers) and teachers in high demand (e.g., mathematics, science, and special education teachers) are not more likely than other teachers to receive a larger amount of PRP. One plausible explanation is that the principals' one-time visits to the classrooms and meetings with teachers are not sufficient to identify excellent teachers who can teach students higher-order and critical thinking skills. Therefore, it is important for district leaders to revisit the evaluation methods for offering PRP and engage a holistic approach with multiple data sources to evaluate teachers.

This study found that less than 20% of the teachers were evaluated by peer teachers or mentors to determine PRP awards. Because the literature showed that principals tend to be less accurate when evaluating the teachers in the middle of the quality distribution, it is important to involve multiple evaluators such as peer teachers, coaches, and teacher leaders in the process. Being familiar with the subject matter, curriculum, and instruction materials, those teachers can provide highly specific and constructive feedback and promote a positive collegial learning environment.

The finding that less than 20% of the PRP recipients were evaluated with teaching portfolios is also a concern. Teaching portfolios provide the evaluators with a genuine measurement of multiple dimensions of teacher performance by including different types of data and materials. The teaching portfolio has also been widely used in the certification process of the established National Board Certification for Professional Teaching Standards.

A good teacher evaluation system requires the use of multiple data sources (Peterson, 2000). This study showed that 36.7% of the PRP recipients were evaluated by only one data source (i.e., 31.7% for teaching practice, and 5% for professional development), 31.7% by only two data sources, and 31.6% by three or more data sources. Therefore, it is important to increase the use of multiple data sources in teacher evaluation and have a more holistic, comprehensive, and unbiased assessment of teacher performance for determining the PRP awards.

Furthermore, the previous studies on PRP and teacher practices focused on the programs that evaluate teachers on student scores in standardized tests and the findings suggested that although such PRP programs may temporarily increase student achievement, they do not improve the teachers' teaching practice (e.g., Glewwe, et al., 2010; Lavy, 2009; Winster, et al., 2009). In addition, no study has examined the relationship between PRP and improvement in constructivist instruction. Using teacher data in the state of Missouri which has implemented a performance-based teacher evaluation program for nearly 30 years that focuses on teachers' instructional practices instead of student test scores, this study examined the relationship between PRP and improvement in the teachers' practice of constructivist instruction.

This study found a modest yet positive association between PRP and improvement in the practice of constructivist instruction. After controlling for background characteristics, this study found that the improvement in using constructivist instruction in 2010 was on average 0.12 units higher for teachers who received PRP than for the teachers who did not receive the awards. Because the ultimate goal of PRP is to improve student critical thinking skills and cognitive abilities in mathematics education versus a

short-term boost in test scores and constructivist instruction is the major tool for promoting the students' conceptual understanding, this finding highlights the importance of teacher practice data in teacher evaluation. In addition, professional development activities that focus on high-order teaching and learning skills will likely increase the teachers' use of those strategies in the classroom and improve the teachers' teaching practices. It is therefore important to incorporate teacher professional development data into teacher evaluation as well.

### **Policy and Leadership Implications**

The findings from this study advanced the knowledge base on the implementation of teacher evaluation for determining PRP, as well as the relationship between PRP and teacher practice of constructivist instruction. This study provides state, district, and school-level policymakers and administrators with important, up-to-date information on teacher evaluation practices used to determine PRP at the middle school level. Given the national interest in improving student achievement and linking teacher evaluation with student test scores, this study highlights the importance of a holistic assessment system with a focus on teacher practice data, especially the practice of constructivist instruction, in teacher performance evaluation.

First, it is important for the state and district policymakers to consider taking a holistic approach and engage multiple evaluators, methods, and data sources in teacher performance evaluation for the determination of PRP awards. The use of multiple sources including peer reviews, portfolios, and student ratings may better capture the multiple dimensions of the characteristics of teacher performance and achieve more valid and reliable teacher assessments.

In addition, given today's national focus on evaluating teachers based on student scores in standardized tests, the findings of this study indicated the importance of teacher practice data and professional development data in teacher evaluation. Both the theory and empirical studies have shown that high-stakes tests may encourage teachers to game the system and teach to the test for higher test scores instead of putting more effort into improving student understanding and cognitive skills. When the PRP programs based the rewards solely on student test scores or other student outcomes, they rarely motivated teachers to improve their classroom teaching practice (e.g., Glewwe, et al., 2010; Lavy, 2002; Lavy, 2009; Winters, et al., 2009). In addition, teachers and their unions oppose evaluating teachers with student scores on standardized tests (e.g., West & Mykerezi, 2011) and are more supportive of increasing pay for teachers who demonstrate better performance, put forth more effort, and receive higher performance evaluations (Farkas, Johnson, Duffett, Moye, & Vine, 2003; Langdon & Vesper, 2000). Therefore, when data on teacher practices are adequately used in teacher evaluation, it is promising for the PRP program to gain more teacher support, improve teachers' constructivist instruction, and eventually improve the students' cognitive skill and achieve authentic student learning.

## Chapter 5 Discussions and Implications

This dissertation examined the characteristics of teacher incentive pay programs with a focus on the performance-related pay (PRP) plans in the state of Missouri and across the nation in the United States. The purposes of this dissertation research were: (a) to examine the characteristics of districts that offered PRP programs and teachers who received PRP awards in 2007 using the Schools and Staffing Survey (SASS) datasets; (b) to examine the characteristics of teacher incentive pay programs to recruit new teachers and to reward existing teachers and the characteristics of the districts that offered incentive pay programs in 2009 based on a statewide district survey; and (c) to examine the characteristics of teacher evaluation used to determine PRP, and the association between PRP and improvement in the practice of constructivist instruction based on a statewide survey of middle school mathematics teachers. I conducted three separate studies for these three purposes, which were presented in chapters 2, 3, and 4.

### **Summary Findings from the Three Studies**

The first study took a national perspective and examined the use of PRP programs in the United States. Using the latest three nationally representative SASS datasets, the first study found that both the percentage of districts offering PRP programs and the percentage of teachers receiving PRP awards increased significantly from 1999 to 2007. Large and ethnically diverse districts in urban areas with less union influence are more likely to offer PRP for teachers than the other districts. Among the PRP recipients, teachers with a higher education degree and more teaching experience and who work in districts with less union influence and a higher percentage of ethnically diverse students,

tend to receive more PRP. However, teachers with demonstrated excellence (e.g., National Board-certified teachers) and teachers in high demand (e.g., mathematics, science, and special education teachers) are no more likely than the other teachers to receive a larger amount of PRP.

Because the SASS do not distinguish the incentive pay programs for new teachers from those for existing teachers and the datasets do not contain important information such as the decision makers for the pay incentives and the amount of the awards, the second study focused on the implementation of teacher incentive pay programs by school districts in Missouri and examined the characteristics of different types of teacher incentive pay programs. Using the Teacher Compensation Programs (TCP) survey data and administrative data from the MoDESE, this study found that during the 2009-10 school year, 32% of the districts in Missouri offered some incentive pay programs to recruit and retain highly qualified teachers with a focus on existing teachers. The school board, the superintendent, and the personnel in the human resources office are the most important decision makers to offer the awards. Incentive pay programs for new teachers mainly targeted at the National Board-certified teachers. Only a small percentage of districts had programs for teachers in the subject areas of shortage or teaching in hard-to-staff schools. For existing teachers, two thirds of the districts provided pay incentives for teachers to assume extra duties or to get certified by the National Board. No districts reported having used formal individual-based PRP or school-based PRP programs. Districts were more likely to use salary raises, extra steps/channels, or annual stipends than one-time bonuses to offer the awards. The amounts of the incentive awards were generally between 2% and 10% of the teacher's base salary, smaller than the

recommended 10% or more of the teacher's salary to motivate the teachers to change their behaviors or career decisions (Hanushek, et al., 2004; Lawler, 1990). Poor districts in rural areas were less likely than wealthy suburban districts to offer teacher incentive pay programs. Teacher unions' influence was not associated with the districts' use of teacher incentive pay programs.

The third study examined another important process in PRP implementation, that is, how teachers are evaluated to receive PRP. Using the longitudinal Teacher's Opportunity to Learn survey data collected in 2009 and 2010, this study found that 10.9% of Missouri middle school mathematics teachers received some forms of PRP in the 2008-09 academic year and the average amount of the award was \$1,463. Most of the PRP recipients were evaluated by their school principals who conducted classroom observations and face-to-face meetings to assess the teachers' teaching practice and professional development activities. Only a small percentage of teachers were evaluated by peers or with teaching portfolios. After controlling for teacher and school characteristics, this study found a modest yet positive association between PRP and improvement in teacher practice of constructivist instruction.

### **Discussions of the Three Studies**

My first and second studies showed that poor districts in rural areas are significantly less likely than wealthy districts in suburban areas to offer PRP or other teacher incentive pay programs. Controlling for other factors, the probability of offering a teacher incentive pay program is about 12-20% less for poor districts in rural areas. Given the national interest in improving student achievement under the standards-based and accountability reforms and the high rates of teacher turnover in those high-need

districts, it is important for these districts to receive more continuous and adequate funding for sustainable PRP programs to recruit and retain the excellent teachers in the subject areas of shortage.

It is an important policy question of whether the incentive pay programs are actually rewarding the targeted highly qualified teachers in high demand. Using the national datasets, this study found that it was not the case. The highly qualified teachers (e.g., the National Board-certified teachers) in the subject areas of shortage (e.g., mathematics, sciences, and special education) are not more likely to earn a larger amount of PRP awards than the other teachers. This finding indicates that the PRP programs are not benefiting the teachers the districts want to recruit and retain. Given that these teachers are most effective in improving student achievement and often in greater shortage, it is important for district leaders to revisit the PRP programs and better align the actual program implementation and the program goal of recruiting and retaining highly qualified teachers in high demand.

The amount of the awards constitutes another important feature on the effectiveness of the incentive pay programs. Previous studies suggested that the magnitude of the awards need to be 10% or more of the teacher's salary so that it can effectively motivate the teachers to improve their teaching practice and stay in the profession (Hanushek, et al., 2004; Lawler, 1990). However, the incentive awards across the three studies are all below the recommended scale. The small awards may therefore not be substantial enough to motivate teachers to achieve the expected outcomes.

Teacher evaluation is a key element in the design and implementation of teacher incentive pay programs. The study found that a majority of the teachers who received



PRP were evaluated by the principal only who conducted classroom observations and face-to-face meetings. However, research showed that principals are far less accurate in distinguishing between teachers in the middle of the achievement distribution- the largest portion of teachers for performance evaluation (Jacob & Lefgren, 2008). The previous finding that highly qualified teachers in high demand are not more likely to receive a larger amount of PRP awards may be explained by the fact that the principals' one time visit to the classrooms and meetings with teachers are not sufficient to identify excellent teachers who can teach students higher-order and critical thinking skills.

Furthermore, this study identified a modest yet positive association between PRP and improvement in the practice of constructivist instruction. After controlling for the background characteristics, teachers who received PRP improved their practice of constructivist instruction for 0.12 units higher than the teachers who did not receive the awards. If the average amount of the PRP is larger, the relationship could be stronger. Because the ultimate goal of PRP is to improve students' critical thinking skills and cognitive abilities in mathematics education, and constructivist instruction is the major tool for promoting the students' conceptual understanding, this finding highlights the importance of teacher practice data in teacher evaluation.

### **Policy and Leadership Implications of the Three Studies**

This dissertation research provides important information to district-, state- and federal-level policymakers for considering the future direction of the teacher incentive pay programs. First, it is important for district leaders to reexamine the evaluation methods and data used for offering the PRP awards. The traditional subjective evaluations by principals or other school administrators with a few classroom

observations may not efficiently identify the highly qualified teachers. As a result, those excellent teachers may not actually benefit from the PRP programs by receiving a sufficient amount of PRP awards. Therefore, it is important to take a holistic approach and engage multiple evaluators, methods, and data sources for teacher evaluation in the implementation of PRP programs. The use of multiple sources including peer reviews, portfolios, and student ratings capture the multiple dimensions of the characteristics of teacher performance and achieve more valid and reliable teacher assessments.

In addition, teacher incentive pay programs require continuous and substantial financial input. To make better use of the constrained financial resources, it is important for the federal and state leaders to prioritize providing financial support to poor districts in rural areas to recruit and retain highly qualified teachers in high demand. Accordingly, district leaders need to prioritize providing or extending the teacher incentive pay programs to those teachers in the subject areas of shortage such as mathematics, science, and special education. When the program goal and the actual program implementation are well aligned, the incentive pay programs provide highly qualified teachers in high demand with more earning opportunities in increasing their compensation, which in turn helps recruit and retain these teachers in the teaching profession.

Finally, teacher performance evaluation should incorporate teacher practice data and professional development data. When teacher practices data are adequately used in teacher evaluation, it is promising for the program to gain more teacher support, improve teachers' constructivist instruction, and eventually improve the students' cognitive skill and authentic learning.

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## APPENDICES

### Appendix A: Descriptions of the SASS Variables

Variable	Description (SASS Variable Names)
<i>District Characteristics</i>	
Rural district	URBAND8, 1 = rural school district, 0 = otherwise
Urban district	URBAND8, 1 = urban school district, 0 = otherwise
Meet-and-confer	D0296, 1 = district has an agreement with the teachers' association or union for meet-and-confer discussions, and 0 = otherwise
No Bargaining Agreement	D0296, 1 = district has no agreement with the teachers' association or union on meet-and-confer discussions or collective bargaining, and 0 = otherwise
% minority students	NMINST_D / D0276 *100
% free/reduced-price lunch students	NSLAPP_D
District enrollment	D0276, total enrollment of K-12 students
<i>Teacher Characteristics</i>	
Female	T0352, 1 = female, and 0 = male
White	T0354, 1 = White, and 0 = non-White
Full certification	T0160, 1 = teacher holds a regular or standard state certificate or advanced professional certificate, 0 = otherwise
National Board Certification	T0154, 1 = fully certified by the National Board for



	Professional Teaching Standards, 0 = otherwise
Teaching experience	TOTYREXP, teaching experience
Highest degree	HIDEGR, 1 = teacher holds a master's degree or above, and 0 = otherwise
Mathematics	ASSIGN03, 1 = mathematics teacher, 0 = otherwise
Science	ASSIGN03, 1 = science teacher, 0 = otherwise
Special education	ASSIGN03, 1 = special education teacher, 0 = otherwise
Union member	T0351, 1 = teacher union member, 0 = nonmember

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## Appendix B: Descriptive Statistics of the SASS Variables

	Districts (N = 4,601)	Teachers working in Districts Using PRP (N = 5,111)	Teachers Receiving PRP (N = 1,533)
District using PRP	10.3%		
Teachers receiving PRP		30.0%	
Teacher PRP amount (\$)			1966.5
Location			
Rural	42.7%	7.1%	10.2%
Urban	12.4%	46.5%	38.4%
Suburban	44.9%	46.4%	51.4%
Bargaining agreement			
Collective bargaining	53.5%	54.0%	46.7%
Meet and confer	10.9%	16.2%	21.9%
None	35.6%	29.8%	31.4%
Ethnic minority students	27.9%	52.5%	57.1%
Free/reduced lunch students	43.2%	51.6%	51.2%
District enrollment	2909.3	4338.9	5535.6
Female		75.2%	79.6%
White		81.1%	86.0%
Regular state certification		85.4%	87.6%

National Board Certification	22.1%	18.0%
Teaching experience	12.7	14.1
Master's degree or above	47.0%	42.2%
Teaching subject		
Math	11.2%	12.0%
Science	6.1%	5.6%
Special education	9.5%	10.6%
Other	73.2%	71.8%
Teacher union member	68.4%	62.8%

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*Note.* Schools and Staffing Survey (SASS) 2007-08.

Appendix C: Cover Letter for the Teacher Compensation Programs Survey

**Teacher Compensation Programs (TCP) Survey**

Dear District Human Resources Administrator:

My name is Guodong (Robert) Liang and I am a doctoral student in the Department of Educational Leadership and Policy Analysis (ELPA) at the University of Missouri. I would like to invite you to participate in the *Teacher Compensation Programs (TCP) Survey* for my dissertation research.

This survey seeks to understand the compensation/incentive approaches the districts in the state of Missouri used during the 2009-10 school year to recruit, retain and reward teachers. Findings of the study will inform and shape teacher compensation/incentive policies and practices in Missouri and across the U.S. as well.

Your participation in this survey is voluntary. The data gathered will be kept confidential and be reported only in the aggregate at the state level. The survey takes about 10 minutes. Please use the enclosed pre-paid and self-addressed envelope to mail back the survey. Upon receipt of the completed survey, I will send you a \$15 gift card on Amazon.com as a token of appreciation for your time. If you decline to participate, please return the blank survey and this letter using the enclosed prepaid return envelope.

If you have any questions or comments about this survey, please feel free to contact me at [glp4f@mail.missouri.edu](mailto:glp4f@mail.missouri.edu) or 573-489-7759. My advisor, Dr. Motoko Akiba can be reached at [akibam@missouri.edu](mailto:akibam@missouri.edu). For questions about the rights of research participants, please contact the Campus Institutional Review Board (573-882-9585 or [umcresearchcirb@missouri.edu](mailto:umcresearchcirb@missouri.edu)).

Sincerely yours,

Guodong (Robert) Liang  
202 Hill Hall  
Educational Leadership and Policy Analysis  
College of Education  
University of Missouri

## Appendix D: Teacher Compensation Programs Survey

Survey ID: \_\_\_\_\_

1. Did your district primarily use a formal salary schedule to pay teachers in 2009-10? If so, please include a copy of the 2009-10 salary schedule in the return envelope with the survey.

☐ Yes

☐ No

The following questions (i.e. question 2 through question 8.2) will ask you about financial rewards for the purpose of recruiting, retaining and rewarding teachers during the 2009-10 school year. Please read the following definitions first:

1. **Salary Raise:** A percentage increase in the teacher's salary
2. **Extra Steps/Channels:** Advancement of one or more extra steps/channels on salary schedule
3. **One-time Bonus:** A one time cash bonus
4. **Annual Stipend:** A recursive annual cash bonus (e.g., annual extra stipend of \$2000 for national board certified teachers)

2. Does your district offer a salary raise, extra steps/channels, or a one-time bonus to new teachers for the purpose of recruiting?

☐ Yes

☐ No (SKIP TO Q5)

3. Who is in charge of making the decision to offer the reward? *Select all that apply.*

☐ Superintendent

☐ Principal

☐ Other (specify):

☐ School Board

☐ Human resources officer

4. Is each of the following factors considered for a salary raise, extra steps/channels, or a one-time bonus for new teachers beyond a formal step based on experience and degree? If so, please indicate the average dollar amount where appropriate. *If your district provides extra steps or channels, please circle S for extra steps and C for extra channels.*

	Salary Raise	# of Extra Steps/Channels	One-Time Bonus
a. Subject areas of shortage (e.g. math, science, special education)	_____ %	_____ S / C	\$ _____
b. Teaching in hard-to-staff schools	_____ %	_____ S / C	\$ _____
c. Certification by National Board for Professional Teaching Standards	_____ %	_____ S / C	\$ _____
d. Other (specify) _____	_____ %	_____ S / C	\$ _____

5. Does your district offer a salary raise, extra steps/channels, a one-time bonus, or an annual stipend beyond a formal salary schedule to existing teachers?

☐ Yes

☐ No (SKIP TO Q8)

6. Who is in charge of making the decision to offer the reward? *Select all that apply.*

☐ Superintendent

☐ Principal

☐ Other (specify):

☐ School Board

☐ Human resources officer

7. Is each of the following factors considered for a base salary increase, extra step or channel advancement on salary schedule, a one-time bonus, or annual stipend for existing teachers? If so, please indicate the average dollar amount where appropriate. *If your district provides extra steps or channels, please circle S for extra steps and C for extra channels.*

	Salary Raise	# of Extra Steps/Channels	One-Time Bonus	Annual Stipend
a. Assuming extra duties (e.g. lead teacher, department head)	_____ %	_____ S / C	\$ _____	\$ _____
b. Certified by National Board for Professional Teaching Standards	_____ %	_____ S / C	\$ _____	\$ _____
c. Performance-related pay (PRP), or a compensation system that rewards teachers for above-average or outstanding individual performance in student achievement or performance evaluations	_____ %	_____ S / C	\$ _____	\$ _____
d. Bonus given to all teachers to reward performance by the entire school	_____ %	_____ S / C	\$ _____	\$ _____
e. Other (specify)	_____ %	_____ S / C	\$ _____	\$ _____

8. If your district offered performance-related pay, please answer the following questions. If not, skip to Question 9.

8.1 What percentage of teachers in your district received performance-related pay during the 2009-10 school year?

☐ 0%

☐ 3-5%

☐ 11-25%

☐ 51-75%

☐ 1-2%

☐ 6-10%

☐ 26-50%

☐ More than 75%

8.2 Were the following data used in assessing individual teacher performance for the performance-related pay? *Check the data used for performance-related pay, and rank the checked items in the order of importance.*

	Check if used	Rank Order (1= most important)
a. Student achievement data	<input type="radio"/>	_____
b. Other student data (e.g., attendance rates, dropout rates)	<input type="radio"/>	_____
c. Professional development/service activities	<input type="radio"/>	_____
d. Data on teaching practice (e.g. observation, course materials, student work)	<input type="radio"/>	_____
e. Student/parents survey or feedback	<input type="radio"/>	_____
f. Teacher test score (e.g., Praxis II)	<input type="radio"/>	_____
g. Other (specify): _____	<input type="radio"/>	_____

9. Does this district have an agreement with a teachers' association or union for the purpose of collective bargaining or meet-and-confer discussions?

☐ Yes, collective bargaining      ☐ Yes, meet-and-confer      ☐ No

10. Did this school district participate in the Missouri Career Ladder Program in 2009-10? If yes, please indicate the total dollar amount the district received from the state.

☐ Yes \$ \_\_\_\_\_ ☐ No

11. Please list all other **sources** of state or federal funding on teacher incentives the district received in 2009-10 and indicate the corresponding dollar amounts. Use extra sheets of paper if necessary.

Funding Source	Dollar Amount
1. _____	\$ _____
2. _____	\$ _____

12. If there is anything about your district's teacher compensation practices that are not covered in this survey, please describe below and use extra sheets of paper if necessary.

Thank you very much for your participation!

### Appendix E: Descriptive Statistics of the Variables in the TCP Study

	Mean	Standard Deviation
Enrollment	4214.30	4985.59
% Free/reduced price lunch	48.82	15.54
% Minority	17.18	22.48
Urban	0.08	0.27
Rural	0.32	0.47
Collective bargaining	0.06	0.25
Meet-and-confer	0.39	0.49
MAP Score	551.45	29.72
AYP Status	0.13	0.34



## Appendix F: Excerpts of the 2009-10 Teachers' Opportunity to Learn Survey

The following questions ask you about **teacher evaluation** conducted by your school or district for the purposes of instructional improvement, tenure/promotion decision, or performance/merit pay. Please **do not** include end-of-course evaluations (exams) at university/college or the evaluation for the National Board Certification.

5a. During the **2008-2009 academic year**, did you have a teacher evaluation?

- ☐ Yes ☐ No [Skip to 6]

5b. Who conducted the evaluation? Choose *Yes* or *No* for each item.

Yes	No	
<input type="radio"/>	<input type="radio"/>	Principal
<input type="radio"/>	<input type="radio"/>	Peer Teacher(s)
<input type="radio"/>	<input type="radio"/>	Mentor/coach/teacher leaders
<input type="radio"/>	<input type="radio"/>	Outside experts
<input type="radio"/>	<input type="radio"/>	Other (specify):

5c. Were the following **methods** used for your evaluation? Choose *Yes* or *No* for each item.

Yes	No	
<input type="radio"/>	<input type="radio"/>	Classroom observation
<input type="radio"/>	<input type="radio"/>	Teaching portfolio
<input type="radio"/>	<input type="radio"/>	Face-to-face meeting
<input type="radio"/>	<input type="radio"/>	Other (specify):

5d. Were the following **data** used for your evaluation? Choose *Yes* or *No* for each item.

Yes	No	
<input type="radio"/>	<input type="radio"/>	Student achievement data
<input type="radio"/>	<input type="radio"/>	Other student data (e.g., attendance rates, dropout rates)
<input type="radio"/>	<input type="radio"/>	Professional development/service activities
<input type="radio"/>	<input type="radio"/>	Data on teaching practice (e.g., observation, course materials, student work)
<input type="radio"/>	<input type="radio"/>	Student/parent survey or feedback
<input type="radio"/>	<input type="radio"/>	Teacher test score (e.g., Praxis II)
<input type="radio"/>	<input type="radio"/>	Other (specify):

5e. To what extent was the evaluation helpful for. . . Choose *one response* for each item.

	Not at all	Small extent	Moderate extent	Large extent
Improving your classroom teaching?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing new ideas for improving instructional methods?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting communication with your colleagues?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting communication with your principal/administrator?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identifying areas of your strengths and weaknesses?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning future professional learning activities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5f. As a result of your evaluation during the 2008-2009 academic year, did you receive the following things? *Choose Yes or No for each item.*

Yes	No	
<input type="radio"/>	<input type="radio"/>	Tenure or promotion
<input type="radio"/>	<input type="radio"/>	One-time cash bonus
<input type="radio"/>	<input type="radio"/>	Salary raise
<input type="radio"/>	<input type="radio"/>	Professional development or teaching resources (e.g., fund, materials, release time)
<input type="radio"/>	<input type="radio"/>	Other (specify)

5g. If you received a cash bonus or salary raise, please indicate the dollar amount

6. Now think about your **mathematics teaching**. How often do the students in your typical mathematics class do each of the following? *Choose one response for each item.*

	Never or hardly ever	1-2 times a month	1-2 times a week	Almost every day
Solve mathematics problems in small groups or with a partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write a few sentences about how to solve a mathematics problem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write reports or do mathematics projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discuss solutions to mathematics problems with other students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work and discuss mathematics problems that reflect real-life situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work with objects like rulers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Talk to the class about their mathematics work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix G: Descriptive Statistics of the Variables in Teacher Evaluation, PRP, and Improvement in Constructivist Instruction

	Mean	Standard Deviation
Performance-related pay	0.12	0.32
Constructivist instruction 2008-09	2.75	0.50
Constructivist instruction 2009-10	2.75	0.51
Female	0.81	0.40
Full certification	0.86	0.35
Master's degree or above	0.70	0.46
New teacher	0.19	0.40
Experienced teacher	0.32	0.47
Math major	0.18	0.38
Math education major	0.40	0.49
Urban school	0.16	0.37
Rural school	0.21	0.41
% Minority students	38.79	20.13
% Free or reduced-price lunch students	22.19	22.80

## VITA

Guodong Liang was born on February 11, 1977 in Xi'an City, Shaanxi Province of the People's Republic of China. He received his B.A. in English (2000) from the University of Science and Technology of China (USTC) in 2000 and his M.A. in Linguistics and Applied Linguistics from USTC in 2003. He was a Barbara Jackson Scholar in 2007-08 and a David Clark Scholar in 2009. He is the loving husband of his wife, Jing Han, and the proud father of his son, Zihan (Kevin).