

# ScholarWorks@GSU

## Factors Predicting The Self-efficacy Of Instructional Coaches Of Mathematics In Urban Elementary Schools

|               |  |
|---------------|--|
| Authors       | Oden, Ayana  |
| Citation      | Oden, Ayana. "Factors Predicting The Self-efficacy Of Instructional Coaches Of Mathematics In Urban Elementary Schools." Dissertation, Georgia State University, 2022. <a href="https://doi.org/10.57709/28975862">https://doi.org/10.57709/28975862</a> |
| DOI           | <a href="https://doi.org/10.57709/28975862">https://doi.org/10.57709/28975862</a>  |
| Download date | 2026-04-12 22:14:19  |
| Link to Item  | <a href="https://hdl.handle.net/20.500.14694/4346">https://hdl.handle.net/20.500.14694/4346</a>  |

## ACCEPTANCE

This dissertation, FACTORS PREDICTING THE SELF-EFFICACY OF INSTRUCTIONAL COACHES OF MATHEMATICS IN URBAN ELEMENTARY SCHOOLS, by AYANA K. ODEN, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education & Human Development, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

---

Susan Swars Auslander, Ph.D.  
Committee Chair

---

Ryan J. Ziols, Ph.D.  
Committee Member

---

Robert C. Hendrick, Ph.D.  
Committee Member

---

Teri Peitso-Holbrook, Ph.D.  
Committee Member

---

Date

---

Laura A. May, Ph.D.  
Chairperson, Department of Early  
Childhood & Elementary Education

---

Paul A. Alberto, Ph.D.  
Dean  
College of Education &  
Human Development

## **AUTHOR'S STATEMENT**

By presenting this dissertation as a partial fulfillment of the requirements for the advanced degree from Georgia State University, I agree that the library of Georgia State University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote, to copy from, or to publish this dissertation may be granted by the professor under whose direction it was written, by the College of Education and Human Development's Director of Graduate Studies, or by me. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation that involves potential financial gain will not be allowed without my written permission.

---

Ayana K. Oden

## **NOTICE TO BORROWERS**

All dissertations deposited in the Georgia State University library must be used in accordance with the stipulations prescribed by the author in the preceding statement. The author of this dissertation is:

Ayana Kenisha Oden  
679 Alexander Farms LN SW  
Marietta, GA 30064  
College of Education and Human Development  
Georgia State University

The director of this dissertation is:

Dr. Susan Swars Auslander  
Department of Early Childhood and Elementary Education  
College of Education and Human Development  
Georgia State University  
Atlanta, GA 30303

## CURRICULUM VITAE

Ayana K. Oden

### **School Address:**

Georgia State University  
Early Childhood and Elementary Education  
30 Pryor St.  
Atlanta, GA 30302  
(404) 413-8060  
Email: [aoden1@student.gsu.edu](mailto:aoden1@student.gsu.edu)

### **Home Address:**

679 Alexander Farms LN SW  
Marietta, GA 30064  
(313) 399-9589  
Email: [ayoden3@gmail.com](mailto:ayoden3@gmail.com)

## EDUCATION

- Ph.D. May 2022  
Early Childhood and Elementary Education: Georgia State University  
Dissertation Title: *Factors Predicting the Self-Efficacy of Instructional Coaches of Mathematics in Urban Elementary Schools*
- M.A.Ed. May 2005  
University of Phoenix  
Elementary Education
- B.A. May 2001  
University of Michigan  
Sociology/Women's Studies

## HIGHER EDUCATION PROFESSIONAL EXPERIENCE

### GEORGIA STATE UNIVERSITY

#### **Graduate Research Assistant, Mathematics Education (2014–2020).**

**Department of Early Childhood and Elementary Education.  
College of Education & Human Development**

Assisted with various research projects, book chapters, and special projects as assigned by supervising instructors. Substitute instructor for mathematics endorsement courses as needed.

#### **Teaching Apprenticeship, Mathematics Education (Summer 2016).**

**Department of Early Childhood and Elementary Education.  
College of Education & Human Development**

Worked under the direction of Dr. Shonda Lemons-Smith to teach a graduate-level mathematics methods course for a cohort of master's students.

## K-12 PUBLIC SCHOOL EMPLOYMENT HISTORY

### **Assistant Principal, 3-5 (2019–Present).**

#### **Marietta Center for Advanced Academics.**

#### **Marietta, Georgia**

Responsibilities include standardized testing, student scheduling, teacher evaluation, and student discipline. On-going professional development with staff on various academic topics is also required as well as leading and supporting various school-based committees including the School Governance Team and STEAM Collaboration Team.

### **Instructional Coach, K–5 (2010–2019).**

#### **Heritage Academy Elementary.**

#### **Atlanta, Georgia**

Responsibilities included planning and collaboratively with classroom teachers and educational specialists and designing data-driven instructional interventions in a Response to Intervention (RTI) model. Professional development for in-service elementary school teachers teaching mathematics was designed and implemented.

### **Elementary School Teacher, Grades 1, 2, 3, 4, and 5, all subjects (2001–2010).**

#### **A.F. Herndon Elementary and Bolton Academy Elementary**

#### **Atlanta, Georgia.**

Responsibilities included planning, designing, and teaching curricula in all content areas to students in a fully inclusive environment. Ongoing professional development and committee participation was required to promote professional growth and establish school-wide leadership skills. I led committees, clubs, and activities such as Financial Literacy Club, Spelling Bee, Mathematics School Night activities, and Student Government for students in Kindergarten to Fifth grade.

## PRESENTATIONS AND PUBLICATIONS

**Oden, A. K.** (2018, October). *Identifying High Level Mathematics Tasks.*

59th Annual Georgia Mathematics Conference, Eatonton, Georgia.

**Oden, A. K.** (2013). Review of the book *Recess: Its Role in Education and Development.*

*Play, Policy, & Practice Connections, Fall, 14(1).*

## PROFESSIONAL SOCIETIES AND ORGANIZATIONS

2005–2019 Georgia Council of Teachers of Mathematics (GCTM)

2011–2014 National Council of Teachers of Mathematics (NCTM)

# FACTORS PREDICTING THE SELF-EFFICACY OF INSTRUCTIONAL COACHES OF MATHEMATICS IN URBAN ELEMENTARY SCHOOLS

by

AYANA K. ODEN

Under the Direction of Dr. Susan Swars Auslander

## ABSTRACT

This quantitative study examined if external and internal factors predict elementary instructional coaches of mathematics beliefs about their mathematics coaching effectiveness in urban school settings. Internal factors were within the instructional coaches' control, such as years of coaching experience and educational level; external factors were outside of their control, specifically school and district policies and practices, including the number of teachers served, the number of subjects coached, and the amount of time allotted with teachers. Participants in this study were 51 full-time elementary instructional coaches who supported mathematics in a large, urban school system in the Southeastern United States. Data collection was via the Coaching Skills Inventory, which includes 20 items focused on mathematics coaches' self-efficacy related to their professional responsibilities, such as building teacher relationships, coaching skills, and knowledge of mathematical content and pedagogy. Additional data collection was via demographic and informational items that provided insights into various

external and internal factors. Multiple regression methods were the statistical approaches used for analysis to determine if internal and external factors have an aggregate influence on mathematics coaching self-efficacy. The collective results of the regression model were not statistically significant, indicating that there is not a strong predictive relationship between internal factors, external factors, and aspects of mathematics coaching self-efficacy. However, the analysis showed that elementary instructional coaches of mathematics had relatively high self-efficacy related to student-centered pedagogy. Participants ranked the amount of time available to spend with teachers and the number of years of experience teaching elementary mathematics as the most important factors for their mathematics coaching effectiveness. The findings indicate potential factors that could help school and district leaders make decisions about the selection, support, and work setting of mathematics coaches.

INDEX WORDS: Instructional Coaches of Mathematics, Elementary Mathematics Specialists, Self-Efficacy, Mathematics Reform, Mathematics Coaching Effectiveness, Mathematics Content and Pedagogy, Coaching Relationships

FACTORS PREDICTING THE SELF-EFFICACY OF INSTRUCTIONAL COACHES OF  
MATHEMATICS IN URBAN ELEMENTARY SCHOOLS

by

AYANA K. ODEN

A Dissertation

Presented in Partial Fulfillment of Requirements for the

Degree of

Doctor of Philosophy

in

Early Childhood and Elementary Education

in

the College of Education and Human Development  
Georgia State University

Atlanta, GA  
2022

Copyright by  
Ayana K. Oden  
2022

## ACKNOWLEDGMENTS

There are several people who deserve recognition for their support and contributions to this study. I am so grateful to my village of supporters, both near and far, who have had a part in helping make my dream a reality. First, my most sincere gratitude to my chairperson, Dr. Susan Swars Auslander, as well as my former chairperson, Dr. Lynn Hart (retired). Thank you for your guidance and reassurance throughout this process. You believed in me in the moments when I questioned myself, and for that, I will always be grateful.

I would also like to express appreciation to my committee members: Dr. Robert Hendrick, Dr. Ryan Ziols, and Dr. Teri Peitso-Holbrook. You each offered advice and insights that helped move this project forward. Dr. Hendrick, thank you for the countless meetings and assistance with my data analysis. I could not have done this without your expertise in this area. Dr. Ziols, thank you for your thoughtful feedback on my work and your willingness to assist, even though I was unknown to you. Dr. Peitso-Holbrook, thank you for your positivity and thoughtful questioning. I also want to express my sincere gratitude to all of my Georgia State University professors. Each has been instrumental in providing the knowledge and encouragement I needed as a doctoral scholar. I hope to pay this gift forward someday as I support others in their educational goals.

A very special thanks to my family, who have put up with my endless hours of work and sometimes tired disposition. To my husband, Mike, you are my rock! You supported me wholeheartedly through it all. You did double duty around the house and with our kids so I could have the time I needed to focus. You listened to me complain, reassured me when I got weary, and kept me focused when I got distracted. You are my best friend, and your love and support have sustained me through this process. I could not have done this without you. To my beautiful daughters, Gabrielle and Mackenzie, thank you for your patience over the years. I devoted a lot of time to this pursuit, and I am so grateful for your love, understanding, and support. Thank you to my mom (Leannetta White), mother- and father-in-law (Geraldine and Rumor Oden), and my two best friends (Sheryl Combs and Nicole Walker). You all were my personal cheerleaders urging me to keep going, and it made a difference every time; thank you. Last but not least, I

want to thank God for allowing me to make it through this journey. Everything I have accomplished is because of Him (Philippians 4:13).

## TABLE OF CONTENTS

|   |            |
|---|------------|
| <b>LIST OF TABLES .....</b>   | <b>VI</b>  |
| <b>LIST OF FIGURES .....</b>  | <b>VII</b> |
| <b>1. THE PROBLEM.....</b>  | <b>1</b>   |
| <b>Introduction.....</b>  | <b>1</b>   |
| <b>Need for the Study .....</b>   | <b>3</b>   |
| <b>Research Questions.....</b>  | <b>7</b>   |
| <b>Significance of the Study .....</b>  | <b>8</b>   |
| <b>Theoretical Framework.....</b>   | <b>10</b>  |
| <b>2. REVIEW OF THE LITERATURE .....</b>                                      | <b>16</b>  |
| <b>Instructional Coaching as a Mechanism for Educational Reform.....</b>      | <b>16</b>  |
| <b>Coaching in Literacy and Mathematics.....</b>                              | <b>21</b>  |
| <b>Teachers' Perceptions of Instructional Coaches.....</b>                    | <b>25</b>  |
| <b>External Factors Related to Instructional Coaches of Mathematics .....</b> | <b>28</b>  |
| <b>Internal Factors Related to Instructional Coaches of Mathematics .....</b> | <b>35</b>  |
| <b>3. METHODOLOGY .....</b>   | <b>37</b>  |
| <b>Overview of the Study .....</b>  | <b>37</b>  |
| <b>Context.....</b>   | <b>38</b>  |
| <b>Participants and Recruitment.....</b>                                      | <b>40</b>  |
| <b>Instrument .....</b>   | <b>41</b>  |
| <b>Trustworthiness.....</b>   | <b>42</b>  |
| <b>Data Collection .....</b>  | <b>44</b>  |
| <b>Data Analysis.....</b>   | <b>44</b>  |

|   |           |
|---|-----------|
| Composite Variables.....  | 48        |
| Expectations.....   | 50        |
| <b>4. RESULTS .....</b>   | <b>52</b> |
| <b>Research Questions and Associated Hypotheses.....</b>                                  | <b>52</b> |
| <b>Findings.....</b>  | <b>53</b> |
| <b>Demographic Characteristics .....</b>  | <b>54</b> |
| <b>Regression 1: External and Internal Factors Predicting Mathematics</b>                 |           |
| <b>Content and Specific Pedagogy.....</b>   | <b>57</b> |
| <b>Regression 2: External and Internal Factors Predicting Student-Centered</b>            |           |
| <b>Pedagogy .....</b>   | <b>60</b> |
| <b>Regression 3: External and Internal Factors Predicting Coaching Relationships ...</b>  | <b>63</b> |
| <b>Coaching Skills Inventory .....</b>  | <b>65</b> |
| <b>5. DISCUSSION .....</b>  | <b>69</b> |
| <b>Demographics.....</b>  | <b>70</b> |
| <b>Multiple Linear Regression Analysis .....</b>  | <b>71</b> |
| <b>Elementary Instructional Coaches of Mathematics Self-Efficacy.....</b>                 | <b>74</b> |
| <b>Significant and Insignificant Factors for Mathematics Coaching Effectiveness .....</b> | <b>76</b> |
| <b>Limitations.....</b>   | <b>78</b> |
| <b>Implications .....</b>   | <b>79</b> |
| <b>Suggestions for Further Research .....</b>   | <b>81</b> |
| <b>REFERENCES.....</b>  | <b>82</b> |

## LIST OF TABLES

|    |  |    |
|----|--|----|
| 1  | Observed Coaching Roles and Responsibilities .....   | 25 |
| 2  | Coaching Skills Inventory (CSI) Reliability .....  | 43 |
| 3  | Coaching Skills Inventory (CSI) Factor Analysis .....  | 43 |
| 4  | Internal Composite Items .....   | 49 |
| 5  | External Composite Items .....   | 50 |
| 6  | Frequency for Nominal Variables .....  | 55 |
| 7  | Number of Mathematics Courses Taken in Degree Programs .....   | 56 |
| 8  | Variance Inflation Factors (VIFs) for Predictor Variables .....  | 59 |
| 9  | Results for Linear Regression With External Factors and Internal Factors<br>Predicting Mathematics Content and Specific Pedagogy ..... | 60 |
| 10 | Results for Linear Regression with External Factors and Internal Factors<br>Predicting Student-Centered Pedagogy .....                 | 63 |
| 11 | Results for Linear Regression With External Factors and Internal Factors<br>Predicting Coaching Relationships .....                    | 65 |
| 12 | Coaching Skills Inventory by Category: Means and Standard Deviations .....   | 65 |
| 12 | Coaching Skills Inventory by Category: Means and Standard Deviations .....   | 66 |
| 14 | Frequency for External and Internal Ranked Items .....   | 67 |
| 15 | Frequency for Administration Support and Coaching Responsibilities Ranked Items .....  | 68 |

**LIST OF FIGURES**

|   |  |    |
|---|--|----|
| 1 | Internal and External Factors Predicting Mathematics Coaching Self-Efficacy .....                  | 14 |
| 2 | Internal and External Factors That Align With Components of Bandura's<br>Self-Efficacy Theory..... | 15 |
| 3 | Normal P-P Scatterplot for Regression 1 .....  | 58 |
| 4 | Residuals Scatterplot for Regression 1 .....   | 59 |
| 5 | Normal P-P Scatterplot for Regression 2.....   | 61 |
| 6 | Residuals Scatterplot for Regression 2 .....   | 62 |
| 7 | Normal P-P Scatterplot for Regression 3.....   | 63 |
| 8 | Residuals Scatterplot for Regression 3 .....   | 64 |

# 1 THE PROBLEM

## Introduction

As is the case in many other countries, too few students in the United States are attaining high levels of mathematics learning (National Center for Education Statistics [NCES], 2016; Organization for Economic and Cooperative Development, 2018). This finding should be a concern, as successful mathematical capacity provides the critical thinking skills needed to address complex problems, the abilities needed to thrive as global citizens, and the tools useful for meaningful participation in the country's functioning and economy (National Council of Teachers of Mathematics [NCTM], 2014; Partnership for 21st Century Learning, 2011). Improving the mathematics education of students is crucial, especially in the elementary grades, as the mathematical understanding built in these early years is the foundation for secondary and postsecondary mathematics success. A recent large-scale study by the National Center for the Analysis of Longitudinal Data in Education Research found that a student's third-grade ranking for mathematics assessments was 80% predictive of the student's 10th-grade mathematics performance (Austin et al., 2020). A key step in improving the mathematics education of elementary students is improving the effectiveness of their teachers.

The goal of mathematics education reform in the United States is to improve teacher effectiveness and student learning. Reform is a widely accepted pressing concern (Bengo, 2016; Campbell & Griffin, 2017; Ellington et al., 2017; Teemant et al., 2011); however, reform can be a challenge to implement. Despite apparent disagreements among state and local education systems on the constitution and processes of mathematics education reform, mathematics education leaders have largely agreed on the need to change the ways of teaching, learning, and assessing mathematics education in K–12 schools (Common Core State Standards, 2010;

Leinwand et al., 2014; NCTM, 2000, 2014). Over time, the focus on reforming mathematics education has resulted in the allocation of millions of dollars to professional development for teachers to improve their instructional practices in mathematics.

Professional development for teachers is a necessary means of improving teachers' instructional quality. Fundamentally, professional development has been an accepted policy for increasing the number of highly qualified teachers and closing the achievement gap for all students (Colbert et al., 2008). However, persistent challenges remain in mathematics education reform and the professional development of teachers. Many education reforms in which teachers are technical conduits who implement prescribed programs or policies have lacked success (Priestley, 2011). Teachers who do not embrace and adopt the ideologies of the educational reform may use new resources superficially but fail to make meaningful changes to their instructional practices (Handal & Herrington, 2003). Several mathematics education scholars have concluded that teachers need guidance and support to properly implement new curricula or education reform models in their teaching (Charalambous & Philippou, 2010; McGee et al., 2013; Roth McDuffie et al., 2018). Other studies have indicated the significance of the time spent participating in professional development. According to Yoon et al. (2007), teachers who receive considerable professional development (an average of 49 hours) can increase their students' academic achievement by approximately 21 percentile points. The most effective professional development focuses on active learning, collective participation, coherence, and content knowledge. Additionally, successful professional development must also occur over a sufficient duration. However, despite the research, the National Science Foundation National Center Science and Engineering Statistics (2014) indicated, "Among teachers who received professional development in their subject area in 2011, only 28% of mathematics and science

teachers received 33 hours or more” (p. 68). The unavailability of professional development opportunities that directly address teachers’ individual content needs and the need for ongoing support are obstacles to implementing high-quality professional development (Kleiman, 2004).

One means of supporting teachers’ professional growth in K–12 school contexts is instructional coaches. Instructional coaches of mathematics are lead teachers who act as resources for their colleagues by providing leadership, information, and professional development for the mathematics programs within schools or districts (National Mathematics Advisory Panel, 2008). Recently, school district leaders have employed instructional coaches of mathematics in elementary schools to mitigate the gap between professional development and classroom instructional implementation (Campbell & Griffin, 2017; Campbell & Malkus, 2013; Desimone & Pak, 2017). Instructional coaches of mathematics often serve as on-site professional developers supporting teachers as they change their teaching practices to align with the vision of the mathematics education reform. The instructional coaches support teachers in schools and districts with various goals, including understanding learning trajectories for particular topics in mathematics and using this knowledge to organize and deliver developmentally appropriate and responsive instruction to individual learners. In addition, the instructional coaches support teachers in creating social learning contexts to engage learners in discussions and embark on mathematical explorations among peers to motivate and extend learning opportunities (Association of Mathematics Teacher Educators [AMTE], 2013).

### **Need for the Study**

The somewhat new practice of using instructional coaches of mathematics is a means of dispelling the long-standing tradition of one-time professional development. The practice likely emerged from recognizing that traditional professional development does not usually result in

meaningful and enduring changes in teachers' instructional practices (Knight, 2009). When considering instructional coaches of mathematics, it is important to understand what helps individuals perceive more competence in this role based on external and internal factors. External factors are district- or school-based features or aspects outside of the control of instructional coaches of mathematics that could influence their professional work. Internal factors are individual-level characteristics more or less controlled by the instructional coach of mathematics (for a complete list of factors, see Figure 1). It is a fallacy to believe that highly effective mathematics teachers can simply shift from their classroom duties to serve effectively in this role. Like teachers, coaches need a variety of support, including internal and external support, to increase their self-efficacy and effectively coach mathematics teachers.

Many elementary schools have instructional coaches of mathematics; therefore, the use of these professionals requires further examination. Some researchers have examined coaching in various content areas, and studies on literacy coaching comprise the largest volume of empirical research. Literature has addressed the challenges related to mathematics coaches' effectiveness (Bengo, 2016; Campbell & Griffin, 2017; Luebeck & Burroughs, 2017). Some studies have shown that mathematics coaching as a professional development model could be a way to improve classroom teaching practices and increase student achievement (Bengo, 2016; Campbell & Griffin, 2017; Ellington et al., 2017; Teemant et al., 2011). In many ways, mathematics coaching remains understudied, including the external and internal factors that predict their self-efficacy.

Instructional coaches of mathematics must feel confident in their abilities to coach and effectively share their expertise with mathematics teachers (Campbell & Griffin, 2017). Generally speaking, self-efficacy has a connection with both external and internal factors in other

populations and other contexts (Bandura, 1997). For example, scholars have widely studied teaching efficacy as an explanatory variable of the disparities in teacher effectiveness. Teachers with strong teaching efficacy utilize effective classroom management (Woolfolk et al., 1990), implement more innovative teaching methods (Ghaith & Yaghi, 1997; Guskey, 1988), and establish more robust learning goals for their students (Ross, 1998; Wolters & Daugherty, 2007). Kanadlı (2017) found that external and internal factors, such as perceived autonomy and support, undergraduate education, attitudes toward the teaching profession, instructors' attitudes and proficiencies, and school experience, influenced preservice teachers' feelings of teaching efficacy. Studies have focused on preservice and in-service teachers' teaching efficacy for various topics and the factors influencing their teaching efficacy. However, there has been limited research on the factors influencing mathematics coaches' self-efficacy.

A variety of external and internal factors could influence the work of instructional coaches of mathematics. Some of the internal and external factors connect to Bandura's self-efficacy theory (see Figure 2). While not directly connected to the theory, other factors still have significance based on the research and scope of work related to instructional coaching (see Figure 1). The theoretical framework sections address the factors that link to self-efficacy theory.

In this study, external factors—those outside the control of the instructional coaches of mathematics that influence their professional work—included the number of teachers coached, perceived administrative support, number of subject areas supported, professional development hours in mathematics, and time spent coaching. The number of teachers coached could be a predictor of the self-efficacy of instructional coaches of mathematics, as coaches could feel stretched and intimidated if they must coach a high number of teachers, resulting in reduced self-efficacy. For example, Gam et al. (2016) found that art therapists' number of cases per week

correlated with self-efficacy through increased stress and reduced self-efficacy. There has been little research on the self-efficacy of instructional coaches of mathematics, despite the importance of this topic.

Likewise, the number of subject areas supported by an instructional coach of mathematics could be a factor linked to self-efficacy. In many districts, including this study's district, instructional coaches of mathematics support mathematics and other subject areas, such as reading, science, and social studies, largely due to budget constraints. Instructional coaches of mathematics who support other subject areas often require increased content knowledge across many subject areas. No research has specifically shown the link between teaching efficacy and the number of subject areas supported; however, several studies have shown the link between the content knowledge of subject areas and self-efficacy (Catalano et al., 2019; Evans, 2011; Nicholson & McIntosh, 2020; Tschannen-Moran et al., 1998). Possessing content knowledge of subject areas can correlate with enhanced self-efficacy (Nicholson & McIntosh, 2020). However, needing content knowledge in multiple subject areas could cause stress and diminished self-efficacy.

Internal factors can also be predictors of the self-efficacy of instructional coaches of mathematics. In this study, internal factors were individual-level characteristics and the characteristics more or less controlled by the instructional coaches of mathematics. Internal factors included the level of degree attained, mathematics coursework completed, previous years teaching mathematics, previous years coaching, and special certification for teaching K–12 mathematics and coaching teachers. The degree level attained consisted of whether the coaches had earned bachelor's, master's, specialist, or doctoral degrees and in which fields. Leader-Janssen and Rankin-Erickson (2013) found that increased content knowledge, including

knowledge of subject-area coursework, correlated to teaching efficacy in preservice teachers. Similarly, elementary mathematics endorsements/specialized certification and coaching endorsements/specialized certification could provide needed content knowledge. Despite the increasing popularity of these programs and the school or district requirements for instructional coaches of mathematics to have these endorsements, few studies have focused on self-efficacy and these particular credentials. However, some researchers have found increased teaching efficacy among mathematics teachers after participation in mathematics methods courses (Cakiroglu, 2000; Gresham, 2009; Swars et al., 2006; Wenta, 2000). Notably, the researchers who created the Coaching Skills Inventory (CSI) used in this study found little evidence of differences in coaches' mathematics knowledge, as measured by the Mathematics Knowledge for Teaching (Hill et al., 2008), to explain variation in teacher practice (Yopp et al., 2019). However, the study also showed that the coaches described improved coaching skills when coaching teachers on mathematical problem solving, particular teaching strategies, and building professional relationships. The higher scores correlated with increases in other teacher measures, such as mathematics knowledge and self-efficacy. However, the researchers could not distinguish direct relationships between increases in the coaches' mathematics knowledge and overall mathematics coaching effectiveness. The goal of this study was to expand on the literature research.

### **Research Questions**

Although the literature has addressed instructional coaches of mathematics to a degree, the findings are just the beginning. There is a need for more information about the skills, backgrounds, habits, and characteristics of effective instructional coaches of mathematics, as well as the attributes and features of the schools where these coaches can flourish. In particular,

there is a need to study mathematics coaching in a more significant way, as mathematics coaching could be a means of changing teachers' instructional practices and improving student learning. Thus, there is a need to identify the external and internal factors that are predictors of instructional coaches of mathematics' self-efficacy for various mathematics coaching responsibilities. This study had the following research questions:

1. Do external and internal factors predict elementary instructional coaches of mathematics' beliefs about their mathematics instructional coaching effectiveness with various responsibilities in urban school settings?
2. What are elementary instructional coaches of mathematics' beliefs about their mathematics coaching effectiveness?
3. Which external and internal factors do elementary instructional coaches of mathematics report as the most and least important for their mathematics coaching effectiveness?

### **Significance of the Study**

The use of instructional coaches of mathematics has become a more prevalent practice. According to the NCES (2016), 65.9% of the 59,600 public schools in the United States have staff in coaching or specialist assignments; of those schools with coaches, 33.5% of the positions focused on mathematics. Mathematics coaching has emerged as a popular form of in-house professional development support for elementary teachers. The expectation is that instructional coaches of mathematics are change agents who help teachers transform their instructional decision-making and practices to enhance student achievement in mathematics.

Disconcertingly, there are vast, inconsistent, or nonexistent requirements for the preparation and experience of this important professional role based on the state, district, or

school. There has been some progress in defining the knowledge and experience needed to coach mathematics effectively (Rigelman, 2017). Virginia, Ohio, and North Carolina produced the first graduate programs for advanced licensure in elementary mathematics. Since the creation of these programs, 20 U.S. states have provided preparation pathways for these professionals, and another 10 states have pending programs (Elementary Mathematics Specialists & Teacher Leaders Project, n.d.). However, despite some states' response to the gap by hiring increasing numbers of instructional coaches of mathematics, there are no standard criteria. For example, with the Association of Mathematics Teacher Educators Standards, educational leaders in Oregon created the Elementary Mathematics Instructional Leader specialization as an option for current teaching licensure. Most importantly, specialization requires that all licensees meet the following conditions: 3 years of successful mathematics teaching experience at the elementary level, a passing score on a state-approved multiple subject examination, and proven competency of the Standards for Elementary Mathematics Specialist as indicated by the successful completion of coursework in a state-approved program (Harrington et al., 2017). State leaders have enacted more policies in response to the realization that instructional coaches of mathematics require specialized preparation and experience to act effectively.

Despite the progress, there is a need for more research on instructional coaches of mathematics' self-efficacy in their roles and responsibilities based on the factors presented. The goal of this study was to discover the mitigating factors that could be predictors of the self-efficacy of instructional coaches of mathematics in schools. The intent was to understand how factors such as educational level and experience correlate with the features of a school and district, such as the number of teachers and subject areas supported. Therefore, this study could contribute to instructional coaches of mathematics beliefs' about success in their role. The

findings could provide direction for the support and preparation instructional coaches of mathematics need to act effectively. This study showed the building-level characteristics of schools that provided support for efficacious mathematics beliefs among coaches. Further, this study provided a snapshot of the characteristics of a segment of instructional coaches of mathematics experience and workplaces for future research.

### **Theoretical Framework**

Self-efficacy was the theoretical framework of this study. According to Bandura (1977), self-efficacy is an aspect of social cognitive theory that focuses on “people’s judgments of their capabilities to produce designated levels of performance” (p. 194). Bandura posited that self-efficacy in one’s abilities correlates with greater success. Self-efficacy is a subject- and context-specific phenomenon. In this study, mathematics coaching self-efficacy consisted of the confidence of instructional coaches of mathematics to effectively enact the coaching behaviors needed to influence teachers’ instructional practices in mathematics. Scholars have widely studied teaching efficacy as an important factor in teachers’ confidence in their abilities to perform their teaching duties. Teaching efficacy is a form of self-efficacy that consists of teachers’ beliefs in their abilities to teach effectively and influence student learning. Teaching efficacy positively correlates with student achievement outcomes (Mohamadi & Asadzadeh, 2012; Skaalvik & Skaalvik, 2007). Scholars have also studied mathematics teaching efficacy, measuring prospective mathematics teachers’ attitudes, anxiety, and self-efficacy toward mathematics education (Alnoor et al., 2007; Tatar et al., 2016).

There are a few distinctions worth noting, including that self-efficacy is not the same as self-esteem. Unlike self-esteem, self-efficacy is task-specific and consists of what people believe they can do in a particular situation (Mohamadi et al., 2011), such as coach mathematics.

Researchers in a wide variety of fields have asserted that self-efficacy influences numerous aspects of the human experience, including goals, the energy expended for goal achievement, and the probability of attaining certain levels of behavioral performance (Bray-Clark & Bates, 2003; Donohoo et al., 2018; Mohamadi et al., 2011).

Bandura (1997) identified four sources of self-efficacy: mastery experiences, vicarious experiences (also referred to as social modeling), verbal persuasion (also referred to as social persuasion), and emotional and physiological states. Two of these, mastery experiences and verbal persuasion, were particularly applicable to this study. Bandura defined mastery experiences as the process of building confidence by overcoming obstacles through effort and perseverance. Therefore, mastery experiences are powerful sources of self-efficacy. Prior successes enable individuals to raise their expectations and believe they can master future challenges; repeated failures have the opposite effect. In this study, two factors aligned with the self-efficacy component of mastery experiences: previous years teaching mathematics (internal) and previous years coaching mathematics (internal).

The internal factors of years of previous experience coaching and teaching mathematics are mastery experiences that could result in increased mathematics coaching self-efficacy. In a mixed methods study on the efficacy and sustainability of instructional coaching outcomes among urban elementary teachers, Teemant (2014) found that experienced coaches exhibited more self-efficacy than novice coaches. In a similar study on teachers, Berger et al. (2018) found years of teaching experience positively correlated to self-efficacy. Likewise, Tschannen-Moran and Woolfolk Hoy (2007) concluded that more experience teaching contributes to increased teaching efficacy. Years of experience could be a predictive factor of the self-efficacy of instructional coaches of mathematics.

Verbal persuasion was another significant influencer of self-efficacy in this study. Verbal persuasion is a way to strengthen individuals' beliefs that they can succeed (Bandura, 1997). People of influence persuade individuals that they possess the capabilities to master certain activities. In turn, the people of influence enhance individuals' beliefs in their abilities to meet challenges (Bandura, 1997). In this study, administrative support consisted of the administrators' positive reinforcement of the work of instructional coaches of mathematics via verbal persuasion. Relatedly, Stipek (2012) noted that reinforcement and encouragement from school administration was a way to make teachers feel more confident in their abilities. Other researchers found that administrative support had an essential role in the self-efficacy of instructional coaches (Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003).

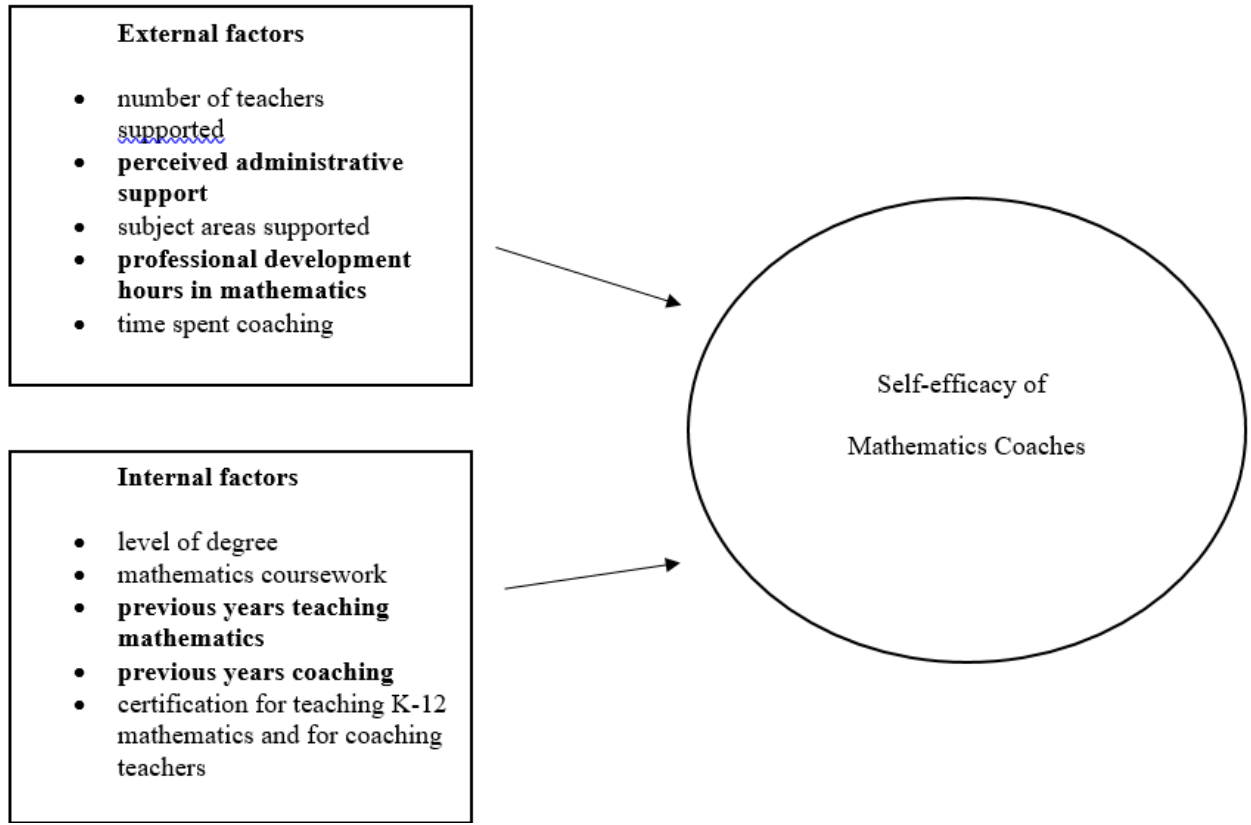
In this study, the final factor with a probable link to verbal persuasion was the number of professional development hours, which consisted of the hours the participating coaches focused on mathematics in the past year. Typically, someone with expertise and experience in mathematics leads professional development and supports and reinforces coaches' beliefs in their coaching abilities. Huggins et al. (2017) found strong professional development for mathematics leadership provided mathematics teacher leaders with the space needed to participate in dialogue and learning that enabled them to internalize their leadership abilities. Similarly, in a study on the relationship of andragogy (the method and practice of teaching adult learners) with teacher leadership, McCauley et al. (2017) argued for a range of professional development experiences that enable participants to develop their skills and increase their self-efficacy. Bray-Clark and Bates (2003) also found that professional development was a means of supporting and reinforcing teachers' skill development and self-efficacy. Other researchers have linked

professional development to enhanced self-efficacy in instructional coaches (Cobb & Jackson, 2011; Coburn & Russell, 2008).

The goal of this study was to discern whether external and internal factors were predictors of the self-efficacy necessary for instructional coaches of mathematics to effectively enact the coaching behaviors needed to influence teachers' instructional practices in mathematics. Figure 1 shows the external factors selected for this study. The external factors had an influence on the work of instructional coaches of mathematics but were outside of their control. The external factors were the number of teachers supported, perceived administrative support, subject areas supported, professional development hours in mathematics, and time spent coaching. Figure 1 also shows the internal factors that had an influence on the work of instructional coaches of mathematics and were largely within their control. The internal factors were degree level, mathematics coursework, previous years teaching mathematics, years spent coaching, and certifications for teaching mathematics and coaching. This figure includes all of the factors measured with the study instrument. The factors in bold align with Bandura's theory of self-efficacy, whereas those in regular typeface do not align but are relevant influences for instructional coaches of mathematics work, as indicated by the literature. Figure 2 presents how the external and internal factors and the sources of self-efficacy of Bandura's (1977, 1997) self-efficacy theory with the work of instructional coaches of mathematics. Perceived administrative support and the number of professional development hours aligned with verbal persuasion, whereas previous years spent teaching and coaching aligned with mastery experience.

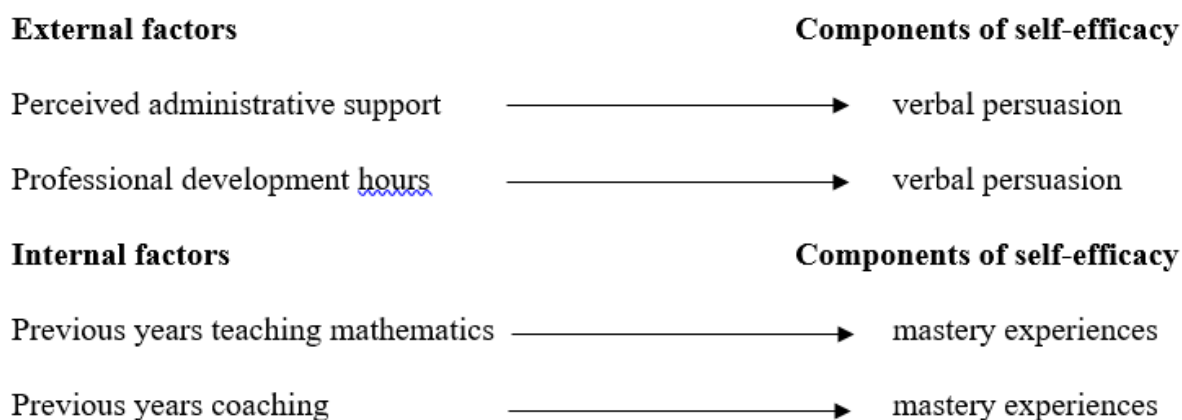
**Figure 1**

*Internal and External Factors Predicting Mathematics Coaching Self-Efficacy*



**Figure 2**

*Internal and External Factors That Align With Components of Bandura's Self-Efficacy Theory\**



*Note.* \*Models representing external and internal factors that align to and predict some components of self-efficacy in instructional coaches of mathematics

### **Researcher Positioning and Interest**

As a veteran educator, I have worked for nearly 21 years in public elementary schools. I spent 9 of those years as an instructional coach of mathematics in an urban school. During this time, I worked in various capacities to support veteran and novice elementary teachers. I also coached multiple content areas and grade levels simultaneously. I experienced firsthand the challenges that face an instructional coach of mathematics as I navigated district expectations, administrative expectations, teacher expectations, and the realities of student achievement. This experience led to my interest in this topic of study. I hope that it will contribute to the body of work on instructional coaches of mathematics and give insight into their daily work lives.

## 2 REVIEW OF THE LITERATURE

Improving mathematics instruction has long been a concern for K–12 stakeholders, educational researchers, teacher educators, and policymakers. As such, research on instructional coaching in K–12 schools has increased. Scholars have addressed classroom teachers' role in enhancing students' mathematics performance; however, the role of the instructional coach of mathematics remains understudied.

Instructional coaches of mathematics were this study's participants. Scholarly texts have provided a specific definition for an instructional coach; however, the term did not strictly match the roles and responsibilities of the instructional coaches in the district under study. Depending on the school, the coach's responsibilities are often based on the three types of coaches most commonly defined in the literature, as presented in the following section. This study included the term *instructional coach of mathematics*. The goal of the study was to investigate whether external factors (i.e., number of teachers supported, perceived administrative support, subject areas support, professional development hours in mathematics, and time spent coaching) and internal factors (i.e., level of degree, mathematics coursework, previous years teaching mathematics, previous years coaching, and certification for teaching K–12 mathematics and for coaching teachers) were predictors of the coaches' self-efficacy.

### **Instructional Coaching as a Mechanism for Educational Reform**

#### ***Coaching Definitions***

Joyce and Showers (1982) were some of the first researchers to formally study coaching as it relates to academic improvement. The authors introduced the term *peer coaching* to describe teachers working in pairs to provide support and feedback to one another and improve their practice (Campbell & Malkus, 2011). Presumably, peer coaching was the first model of coaching

explored; however, other researchers have classified coaching in additional ways, including cognitive coaching, content coaching, and instructional coaching.

Cognitive coaches guide teachers' thought processes, beliefs, and motivations through professional conversations focused on reflection and the cognitive coaching cycle (Costa & Garmston, 2002). Alternatively, content coaches work to improve student instruction through thoughtful and well-planned lesson designs. Content coaches can also work with teachers to build content knowledge (usually in specific subject areas), analyze teachers' underlying beliefs about learning, and improve teachers' ability to understand and diagnose students' thinking (West & Staub, 2003). Lastly, instructional coaches work with teachers on lesson delivery models and use the three-phase cycle to focus on teacher behavior, content/instruction, and formative assessment (Brewton, 2011).

The current literature on elementary mathematics coaches includes a variety of titles, roles, and responsibilities for mathematics (instructional) coaches. Examples from the research include nonevaluative support for teachers in increasing their mathematics teaching capacity (Henrikson & Lumpe, 2021); mathematics specialists, whose responsibilities include working with both teachers and students (Markworth et al., 2016); and mathematics intervention specialists, whose primary responsibility is to provide support for students (Hjalmanson & Baker, 2020). Although this study's participants had the title of instructional coach of mathematics, their job duties did not strictly align with any of the aforementioned descriptors but were a blend of one or more of the roles.

### ***Influence of Coaching on Teacher Practice***

A growing body of research has indicated that coaching can have a positive impact on teacher practice. Promising effects on teacher practice occur with teacher in-service professional

development of specific instructional strategies and consistent support from coaches after the professional development. Thomas and Collier (2002) focused on 21 elementary teachers who received 30 hours of workshop training and seven individual coaching sessions in one academic year on the Five Standards for Effective Pedagogy (as cited in Teemant et al., 2011). Unlike most similar research, the study included validated and reliable classroom rubrics from coaches instead of teacher self-reports. Statistically significant growth occurred in using the Five Standards during instruction (Teemant et al., 2011). Similar results emerged with support for teachers posing higher-level mathematics questions when implementing advanced instructional tasks in Grades 3–5 (Polly, 2012). In a case study within an elementary school setting, Gibbons (2017) found an influence on teacher practices after working with instructional coaches of mathematics. The author examined the data collected in the fourth year of the instructional coaches' work with mathematics reform at the elementary school. The teachers implemented practices aligned with the vision of school leaders, including participation in professional learning communities, that provided teachers with support for ambitious, equitable teaching, analysis of student thinking, and use of data to inform their instructional practices. The aforementioned studies suggest that professional development in mathematics, when combined with ongoing support from an instructional coach of mathematics, can result in meaningful changes in teacher mathematical teaching practices.

Researchers have also examined how instructional coaches of mathematics spend their time and, more specifically, the quality and nature of their interactions with teachers. The consensus is that coaches have the most impact when they engage teachers in in-depth reflective conversations about mathematics and student learning (Barlow et al., 2014; Yopp et al., 2011). Some studies have aligned with this view, indicating that positive changes in teachers'

mathematics instructional practices occur with meaningful interactions with coaches (Bengo, 2016; Campbell & Griffin, 2017; Hopkins et al., 2017). Examining national Schools and Staffing Survey data, Jong and Campoli (2018) found a reduction in early-teacher attrition in urban elementary schools where instructional coaches spent time with teachers. Coaching is the most effective when instructional coaches prioritize the time spent in classrooms, conduct observations, and work one-on-one and side by side with teachers (Bean et al., 2010; Gibbons & Cobb, 2017; Kane & Rosenquist, 2018; Martin et al., 2010; Mudzimiri et al., 2014; Polly, 2012; Rapacki & Francis, 2014; Sailors & Price, 2010). The importance of time spent coaching indicated the need to include this feature as an internal factor with an influence on the self-efficacy of instructional coaches of mathematics.

Whether focused on mathematical language, mathematics errors, mathematics questioning, mathematic reasoning, or teaching mathematics, research has shown the same results: coaches influence teacher beliefs and, in turn, beliefs influence practice (Blazar, 2015; Green & Kent, 2016; Kretlow et al., 2012). There is clear evidence that coaching can be a powerful professional tool. Nevertheless, factors such as school climate and leadership (both measured in this study as the external factor of administrative support), the willingness of teachers to participate in professional growth initiatives, and the coach's skills (Neuberger, 2012) could have a significant effect on the coach's overall effectiveness. Overall, the research has indicated a strong, positive relationship between coaching and teacher practice in the areas of craft or practical knowledge (Zwart et al., 2007), teachers' domain knowledge (Brady et al., 2009), teaching efficacy (Cantrell & Hughes, 2008; Lovett et al., 2008), enhanced practices for special education (Gersten et al., 1995), writing instruction (Frey & Kelly, 2001), mathematics

instruction (Staub & Stern, 2002), and preservice science teacher education (Scantlebury et al., 2008).

### ***Influence on Student Outcomes***

Of the limited research on the influence of coaching on student outcomes, most has been small-scale qualitative studies. Balfanz et al. (2006), Campbell (1996), and Foster and Noyce (2004) found that coaching correlated to student academic gains in various content areas. However, in each study, the coaching element was part of a sizeable school reform initiative; therefore, it was challenging to quantify the extent to which the coaching contributed. Teemant (2014) conducted one study worth mentioning but focused on perceptions of student achievement versus actual achievement data. The researcher performed a longitudinal, mixed methods investigation of instructional coaches' efficacy and sustainability in supporting diverse learners and found a statistically significant pedagogical transformation in teachers in Year 1. In Year 2, the findings showed sustained improvement and that coaching not only had a positive influence on teachers' attitudes and feelings of efficacy but also their perceptions of student achievement.

Other scholars have loosely supported the potential positive influence of coaching on student achievement. Blank (2013) conducted a meta-analysis of over 400 professional development studies. The author identified 16 studies that showed a significant positive result of teachers' professional learning on student achievement, with coaching one of the six common elements of effective programs. Nevertheless, few scholars have focused on student achievement and coaching, specifically in mathematics. This literature review includes research specific to coaching teachers in literacy to show the lack of research in mathematics.

## **Coaching in Literacy and Mathematics**

### ***Coaching in Literacy***

The literature on the relationship between coaching and student achievement in reading suggests that teachers who receive contact hours with coaches have students with more significant gains in fluency, vocabulary acquisition, and reading comprehension. The studies presented in this section showed these results. Each study was relatively large-scale research, and some occurred over multiple years. Hindman and Wasik (2012) conducted a 2-year study on the extent of the influence of language and literacy coaching on teacher and student outcomes. In Year 1, coaching correlated with gains in the quality of teachers' classroom environment and instructional collaboration, which, in turn, contributed to children's vocabulary, alphabet, and phonemic awareness skills. In Year 2, the researchers found that coaching was a distinct predictor of children's ( $N = 983$ ) vocabulary acquisition, as measured with the Peabody Picture Vocabulary Test.

Using coaching as professional development could have a positive impact on student achievement. Van Keer and Verhaeghe (2005) compared two intensive coaching models for second- and fifth-grade teachers over a year. One model provided 35 hours of professional development contact hours and coaching compared to a 15-hour model. The researchers measured only student outcomes and found both treatments equally effective in students' fluency, reading comprehension, use of strategies, and self-efficacy compared to the control group. In a similar study, Lovett et al. (2008) studied the effects of coaching high school teachers on reading strategies for students with disabilities. The student outcome data from end-of-year testing showed that the teachers with coaching support had students with more significant gains.

Biancarosa et al. (2010) assessed the effects of a collaborative literacy program with a substantial coaching component on student learning over 2 years. The scholars used a value-added model to determine the positive effects on literacy scores over time. Bean et al. (2010) studied the relationship between student achievement and how the coaches spent their time. The authors concluded that the schools where the coaches spent more time on tasks that included actual coaching components had significantly larger percentages of students scoring proficient in reading in Grades 1 and 2, as indicated by standardized testing measures. Although these focused on reading instead of mathematics, instructional coaching as a vehicle for reform shows apparent promise. There is a need for more research on the influence of instructional coaching in all academic areas.

### ***Coaching in Mathematics***

Few scholars have directly examined mathematics coaches' influence on student achievement. Also, limited studies have focused on the work of instructional coaches of mathematics and their connection to student achievement. In a multilevel analysis with 2011 NAEP data for fourth-grade mathematics, Harbour et al. (2018) compared the results of 7,400 schools with more than 190,000 students nationwide that did and did not have access to instructional coaches of mathematics. Hierarchical linear modeling was the means used to address the research question: "What is the relationship between having an elementary school-based MCS [Mathematics Content Specialist] (full-time or part-time) and fourth-grade students' achievement on the NAEP?" (Harbour et al., 2018, p. 658). The findings were that all the fourth-grade students in schools with full-time instructional coaches of mathematics had statistically significant, slightly higher mathematics achievement than students at schools with part-time or no instructional coaches of mathematics. Similar results emerged in a smaller study of 36

elementary schools from five school districts (Campbell & Malkus, 2011, 2013), divided into 12 sets based on similar demographics. Among each group of schools, the researchers randomly selected one school to receive the support of a full-time instructional coach of mathematics for 1 year, one for 3 years, and one as a control that received no mathematics coaching. Similar to Harbour et al.'s (2018) findings, students in all three tested grades at the 3-year coaching treatment schools had significantly higher mathematics scores than the 1-year treatment and control groups. A few scholars have indicated the positive influence of coaching on student achievement, particularly in standardized mathematics assessments (Campbell et al., 2017; Harbour & Saclarides, 2020).

Other research has suggested but not made direct correlations between mathematics coaching and student achievement. However, the studies have shown that coaching has a positive influence on building a school culture of collaboration and raising the rigor of mathematics instruction (Foster & Noyce, 2004; Neufeld & Roper, 2003).

Due to limited research, the influence of mathematics coaching on student achievement remains unclear. Nonetheless, the need for high-quality and ongoing professional development for mathematics teachers has been a dominant theme of several important documents (NCTM 1991, 2000, 2014; National Research Council [NRC], 2001). Underperforming elementary schools often employ instructional coaches of mathematics for teacher support to deepen pedagogical and content knowledge and improve student achievement. However, the roles and responsibilities of elementary instructional coaches of mathematics vary from school to school; thus, the effect of this movement could be a challenge to study.

### ***Roles and Responsibilities of Instructional Coaches of Mathematics***

The roles and responsibilities of elementary instructional coaches of mathematics, including their activities and the content of their meetings with teachers, vary widely depending on the audience they serve and the tasks required throughout the day. Coaches tend to work in the moment based on the needs of teachers and administrators (Mudzimiri et al., 2014), and their daily routines frequently undergo alteration. For example, after observing seven elementary instructional coaches of mathematics in five school districts, Mudzimiri et al. (2014) split the roles and responsibilities into three broad domains: the coaching cycle, other related coaching duties, and administrative duties (see Table 1). Some scholars have recognized the diversity of instructional coaches' roles (Kho et al., 2019; Mudzimiri et al., 2014; Russell et al., 2020; Wang, 2017). Wang (2017) characterized coaching into four domains: instructor, collaborator, facilitator, and empowerer. Comparably, Hauser (2014) described coaches' roles as advisors, educators, catalyzers, and assimilators. Although the terms used to describe the roles of instructional coaches vary, the literature has shown the daunting nature of assuming these often antithetical duties. Instructional coaches often occupy various roles and even fill in for other traditional staff roles, such as substitute teachers and lunch monitors. In focus group interviews, Holloway et al. (2018) showed the participants' profound frustration with the work expectations. The instructional mentors in their study saw themselves as "glorified evaluators" who had to perform administrative duties rather than the mentoring practices suggested by their titles.

**Table 1***Observed Coaching Roles and Responsibilities*

| Coaching cycle                | Other-coaching related duties                      | Administrative tasks                          |
|-------------------------------|--|---|
| Pre-/post-lesson conference   | Covering classes                                   | Meeting with counselors and administration    |
| Lesson observations           | Visiting informally with teachers                  | Checking email/voicemail                      |
| Working with students         | Facilitating lesson study                          | Cafeteria duty                                |
| Co-teaching a lesson          | Handling assessment data                           | Class schedules                               |
| Modeling effective strategies | Locating resources for teachers                    | Managing and ordering instructional materials |
|                               | Leading professional development workshops         |   |
|                               | Planning interventions                             |   |
|                               | Support with classroom organization and management |   |
|                               | Planning meetings                                  |   |
|                               | Monitoring/developing school improvement plans     |   |

**Teachers' Perceptions of Instructional Coaches**

This study focused on the factors that could be predictors of the self-efficacy of instructional coaches of mathematics. However, teachers are influenced by these professionals. Research on teachers' perceptions has provided insight into the professional relationship between coaches and teachers. The studies in this section focused on the teachers' desire to collaborate with instructional coaches on the topics they deemed important and the need for nonevaluative support.

Westmoreland and Swezey (2015) explored teachers' perceptions of three aspects of their experiences working with instructional coaches: the impact of the instructional coach's professional learning on student learning, views of the instructional coach's use of data to help teachers plan for instruction, and opinions on the effectiveness of the instructional coach observing lessons and providing feedback. The study focused on instructional coaching from the teachers' point of view, a perspective underrepresented in the research. Westmoreland and

Swezey used the transcendental phenomenological approach to collect data from several people who had experienced the same phenomenon. Analysis of the 13 rural Georgia teacher interviews and journal reflections produced five major themes related to expectations about instructional coaching: keeping current with the best educational practices, collaborating to integrate successful teaching strategies, identifying the needs and validating the strengths of the teachers, modeling new strategies, and monitoring the expectations of teachers.

Westmoreland and Swezey's (2015) research had relevance for this study because they provided insight into coaching efficacy from the perspectives of teachers working with instructional coaches. The findings also indicate the role and desire (based on teacher accounts) for instructional coaches to deliver high-quality professional development and work side by side with teachers as they learn to implement effective strategies. In this way, a coach can share best practices or model new instructional strategies—in line with the verbal persuasion component of self-efficacy—to encourage teachers. In addition, both teachers and coaches could increase their self-efficacy through mastery experiences as the teachers grapple with the instructional strategies and the coaches practice the art of coaching.

Likewise, Tanner et al. (2017) examined aspects of instructional coaching implementation and efficacy through the viewpoints of three stakeholders: teachers, instructional coaches, and principals. The researchers also reflected on their experiences in one of these roles. Gamboa, the teacher participant/researcher in the study, described working with instructional coaches, providing a valuable viewpoint due to the limited in-depth research on teachers' views of instructional coaching. Gamboa discussed how teacher apprehension with working with instructional coaches often stems from viewing instructional coaches as evaluative instead of nonevaluative support. The teacher participants also discussed the need for the administrators

and instructional coaches to “assess the diverse skills, personalities, and experiences of teachers as elements of the framework for the instructional coaching program in their organization” (Tanner et al., 2017, p. 36).

Similarly, Monroe and Marvin (2020) examined and compared teachers’ and instructional coaches’ perspectives of coaching; however, they compared the perspectives of teachers in high-performing and low-performing elementary schools in Tennessee. Monroe and Marvin used an online survey with closed- and open-ended questions to collect data and analyzed the data with qualitative methods of coding and finding themes within the participant responses. The study included instructional coaches from 28 higher-performing (Level 1) and 19 lower-performing (Level 1) schools across various regions of Tennessee, as well as 20 randomly selected teachers.

Monroe and Marvin (2020) found some similarities between the responses from the teachers in high-performing schools and the responses from those at low-performing schools. Teachers from both high- and low-performing schools identified the barriers of teacher buy-in and targeted support (i.e., the belief that the instructional support given was unnecessary and a waste of planning time). The coaches from high-performing schools listed limited time and teacher buy-in as the primary barriers to instructional coaching; in contrast, those from low-performing schools identified trust and the utilization of instruction coaches (how principals and district leaders use coaches) as major barriers to effective instructional coaching. The findings showed similar school cultures in both school types. A positive rapport between instructional coaches and teachers is a primary step in improving teachers’ learning and instructional strategies (Campbell & Malkus, 2014; Green & Kent, 2016; Knight, 2009; Polly et al., 2013). Additionally, Monroe and Marvin found that the school administrators determined how to use

and support the instructional coaches daily. Administrative support was an important external factor measured in this study because of its likely link to the verbal persuasion component of self-efficacy.

### **External Factors Related to Instructional Coaches of Mathematics**

According to Taylor (2008), the success of an instructional coach stems from various factors: administrative support, the consistency of instructional support, the context of the reform, the norms of the professional learning community, and the distribution of resources such as training, time, and logistics. The external factors in this study reflect Taylor's success criteria and are the external aspects of coaching outside the control of the instructional coach that have an influence on the work. Factors such as perceived administrative support, time spent coaching, the number of teachers coached, subject areas supported, and in-service training hours play a significant role in the quality and time spent coaching. Following is a review of the research on each factor.

#### ***Administrative Support***

In this study, administrative support was the collaboration between the instructional coach of mathematics and building administrators to create shared beliefs about the coach's work. This collaboration allows for aligned beliefs about teaching and learning mathematics and the vision and goals needed to improve mathematics instruction at a school. Administrative support of instructional coaches provides the time and resources needed to perform their duties; therefore, this type of support should be a priority.

Scholars in the field have agreed that principals play a key role in the success or failure of school-based instructional coaches of mathematics (Gibbons et al., 2019; Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003). However, despite this

commonly held belief, there is little research on the intersection of administrative support and mathematics coaching. In a qualitative study, Smith et al. (2017) addressed the many factors affecting instructional teacher leadership from an ecological standpoint. Through the lens of Bronfenbrenner's ecological systems theory, the scholars viewed teacher leaders as part of a complex social ecosystem consisting of other individuals, groups, institutions, policies, and cultural norms. Smith et al. followed three case studies of experienced elementary mathematics teachers during their transition from classroom teachers to instructional coaches of mathematics. In each case, school administrators' influence in shaping leadership opportunities was apparent, as the administrators were part of the teacher leaders' ecosystems. In two cases, the school administrators created leadership opportunities by designating time and situations for the coaches to lead other teachers in mathematics development. In the third case, the principal rendered the opportunity to lead almost nonexistent by giving the coach teaching responsibilities in conjunction with the coaching role. Smith et al. stated, "Those who prepare and support teacher leaders must recognize the critical role that principals play and help them understand how to effectively utilize the leaders in their schools" (p. 17).

A 2-year, large-scale study on the work of middle school instructional coaches of mathematics showed the importance of intentional support from the building administrator for coach effectiveness. This mixed methods study included 10 instructional coaches of mathematics at 10 school districts who supported 201 mathematics teachers. The researchers described how the coaches spent their time and contributed to meaningful changes in teacher instructional practices. The study found that higher student achievement correlated with the teachers who became more engaged due to the support of the instructional coaches of mathematics (Ellington et al., 2017). This finding suggests that mastery experiences are the most influential source of

self-efficacy, a finding that aligned with this study of instructional coaches of mathematics. Two case studies showed distinct differences between the schools' approaches to and support for the instructional coaches of mathematics. In the more successful of the two case studies (as indicated by student achievement), the principal and assistant principal worked closely with and supported the coach's daily work. This finding aligned with the goals of this study because administrative support is an external factor that correlates with the verbal persuasion component of the self-efficacy of the instructional coaches of mathematics.

The final study centered on the factor of administrative support was a longitudinal study in a suburban Midwestern state from 2010–2015. Surveys, social network analysis, and qualitative interview analysis provided the data used to explore the impact of the changing roles of instructional coaches of mathematics on a district-wide instructional improvement initiative for elementary mathematics education. Among the 14 elementary schools studied, district administrators at the school and district levels regulated the curriculum regarding specified pedagogy and resources. After attending training and receiving ongoing support from administrators, the coaches served as intermediaries who shared resources and information about new mathematics curriculum expectations with the classroom teachers. When discussing the role of administrative support in mathematics coaching, the researchers indicated the success of the mathematics coaches' role as a regulator of specific instructional strategies and resources. However, the coaches had less success when attempting to facilitate collaborations with teachers in schools that lacked strong instructional leaders and collaborative cultures. This finding aligned with previous research suggesting that strong school leadership is a critical component of any coaching program (Matsumura et al., 2009; Obara, 2010). Thus, principals play a significant role in helping coaches build connections with teachers to navigate political and normative tensions

(Huguet et al., 2014). Without strong leaders who assist with creating collaborative norms, teachers who feel resistant to coaching may not be motivated to open their practices or engage in learning opportunities (Hopkins et al., 2017).

### ***Time for Coaching***

Research has suggested added value when teachers and coaches can work side by side in collaboration for planning and instruction. Effective coaching occurs when school and district leaders prioritize coaches working one-on-one with teachers and spend most of their time engaged in classrooms (Mudzimiri et al., 2014). Deussen et al. (2007) studied Reading First coaches in five U.S. Western states and concluded that, on average, coaches only spent 28% of their time working with teachers. Strikingly similar results emerged in a parallel study of Reading First coaches: “On average, coaches allocated the highest percent of effort to working with individual teachers (23.6%) followed by management (21.1%), school-related tasks (20.6%), planning and organizing (14.2%), working with groups of teachers (12.1%) and working with students (8.2%)” (Bean et al., 2010, p. 95). Collaboration between coaches and teachers requires that the time and space to do so must be a priority, and the coach should be seen as a supportive resource, not as an evaluator. Also worth noting is Sailors and Price’s (2010) study of teacher implementation of cognitive reading strategies with the support of a reading coach. The results showed a statistically significant difference related to opportunities to engage in cognitive reading strategies. The researchers explored the use of constructed explanations and the coaches’ roles by measuring the time spent coaching teachers. The study had results congruent with other studies on mathematics and science teachers. The findings showed that professional development, coupled with the duration of supportive contact hours,

could result in a perceived difference in the teacher implementation of new teaching practices (Garet et al., 2001).

The most effective use of instructional coaches occurs when coaches spend time working directly with teachers on content and pedagogy. However, past research has indicated that coaches spend relatively little time working with teachers. Thus, it remains unknown how coaches spend their time and what their daily workloads consist of. In a 2-year study, Campbell and Griffin (2017) examined and quantified the categories of the daily work of elementary instructional coaches of mathematics. All Year 1 ( $n = 21$ ) and Year 2 ( $n = 19$ ) participants were full-time instructional coaches of mathematics assigned to a single school who did not have responsibilities related to evaluating teachers or students. The coaches recorded their daily work activity online from 2011–2013. The findings showed that, on average, the participants spent only 28.4% of their time in Year 1 and 27.1% of their time in Year 2 working directly with teachers or reflecting on teachers' work. Other tasks outside this sphere included locating, distributing, and purchasing materials; analyzing student data; holding classes; sending emails; handling bus duty; managing assessments; attending meetings with no mathematics agenda; and providing or attending professional development. The results were that the instructional coaches of mathematics primarily charged with increasing teacher content knowledge and best practices in mathematics felt burdened (nearly 70% of the time) with duties that did not align with this important aim.

Similar results occurred in another 2-year, large-scale research project on the work of middle school instructional coaches of mathematics in 10 school districts. Ellington et al. (2017) found that, in Year 1, the instructional coaches of mathematics spent an average of 17.48% of

their contract time coaching teachers. In Year 2, the instructional coaches spent an average of 16.8% of their time coaching teachers.

### ***Number of Teachers Supported***

The time spent with teachers is an important component of instructional coaches' work; however, the number of teachers supported is also significant. Atteberry and Bryk (2011) examined teachers' exposure to literacy coaching within and between 17 schools across eight Southern, Eastern, and Midwestern regions of the United States. The study found that the number of teachers a coach had to support accounted for over half the variation in coaching. Unsurprisingly, coaches in larger schools with more teachers had markedly different demands than coaches in much smaller schools with fewer teachers. Atteberry and Bryk suggested that the threshold for the strong implementation of these literacy coaches was 12 teachers for every one coach. Similar results emerged in a Kenyan study funded by the United States Agency for International Development on the impact of literacy coaching in public and nonformal primary schools (Piper & Zuilkowski, 2015). Piper and Zuilkowski (2015) found strong evidence that a teacher-to-coach ratio of 10:1 was somewhat more effective than a 15:1 ratio and significantly more effective than a 20:1 ratio.

### ***Subject Areas Supported (Content Coaching)***

In some districts, instructional coaches support mathematics in addition to other subjects. This broader instructional focus could be a factor in perceived coach self-efficacy. Instructional coaches who must coach multiple teachers across various content areas might not have the expertise or time necessary to provide effective instructional support. However, a search of the literature found that no studies had addressed the influence of the number of subject areas on the self-efficacy of instructional coaches.

### *In-Service Training for Coaches*

The importance of high-quality and ongoing professional development for mathematics teachers has been a dominant theme addressed in several important studies (NCTM, 1991, 2000; NRC, 2001). Elementary school instructional coaches of mathematics often take on the role of teacher support, in which they must deepen pedagogical and content knowledge to improve student achievement. A reasonable assumption is that the amount and quality of ongoing professional development for instructional coaches are essential components of their success in their job roles. Unfortunately, little research has focused on the amount and type of ongoing in-service professional development offered to coaches to provide support with their job duties.

Cobb and Jackson (2011) analyzed a policy implemented in a large urban school district to improve middle school mathematics teacher practice and student achievement. The instructional coaches of mathematics placed in the middle schools acted as more knowledgeable others and supported learning for the teachers and school leaders. The researchers concluded that despite the content expertise of the instructional coaches of mathematics, most had “yet to develop an understanding of how elements of instruction (e.g., student discussion) could be organized to support students’ learning of mathematics” (p. 26). Cobb and Jackson suggested that the district offer could be a way to sustain professional development for both principals and coaches to participate jointly. Along with this recommendation, the authors presented a separate set of proposed aids for the learning of instructional coaches of mathematics.

Another study of district policies around teacher practice, coaching, and professional development (Coburn & Russell, 2008) suggested that creating the coaching role alone is not an automatic means of strengthening the quality and rigor of teachers’ conversations or the ability for mathematics. Coburn and Russell (2008) examined eight elementary schools in two school

districts to explore the role of district policy in the teachers' social networks when implementing mathematics education reform. The authors used an exploratory comparative case study design to look at the policies and practices in each district and their influence on the teachers' access to knowledge and support. One prominently discussed district policy was using coaches to build teacher capacity in mathematics in the study districts. Both school districts provided coaches who supported mathematics instruction; however, the quality and results differed in the districts. The findings indicate the importance of careful attentiveness to professional development for coaches. Promoting expertise in coaches could be a central strategy for increasing knowledge in the social networks where teachers make daily decisions about curriculum implementation.

### **Internal Factors Related to Instructional Coaches of Mathematics**

Certain external factors can influence the work of instructional coaches of mathematics. However, coaches' educational background and experience levels are also important internal factors, as individuals have developed them from their experiences. Coaches can successfully collaborate with teachers if they have strong leadership skills, excellent mathematics content knowledge, familiarity with the curricula and standards, and exceptional knowledge of mathematics pedagogy (Polly et al., 2013). According to the literature, effective instructional coaches must possess specific professional capabilities to successfully support teachers in improving their practice. Coaches must have mastery over the content and pedagogical theories. However, also important are a strong command of the curriculum and standards and interpersonal skills that enable coaches to interact with teachers in a nonthreatening and approachable way. Knight (2007) stated,

Instructional Coaches have to have a repertoire of excellent communication skills and be able to empathize, listen, and build relationships and trust. Also, like cognitive coaches,

ICs must be highly skilled at facilitating teachers' reflection about their classroom practices. Finally, like literacy coaches, ICs have to know a large number of scientifically proven instructional practices. (p. 9)

An instructional coach's ability to facilitate these conversations and learning experiences depends on the individual's educational background and experience as both a teacher and coach. The internal factors examined in this study were degree level, mathematics and coaching endorsement or certification, experience teaching mathematics, and experience coaching mathematics.

There is a need to understand the skills and experience predicting the self-efficacy of instructional coaches of mathematics. Coaches should be change agents who improve teacher practices and academic achievement in mathematics. However, the specific educational backgrounds and experience levels of productive coaches remain unstudied. Therefore, the purpose of this quantitative, multiple regression study was to determine if and how external and internal factors are predictors of the beliefs of elementary instructional coaches of mathematics about their mathematics coaching effectiveness in urban school settings.

### 3 METHODOLOGY

#### Overview of the Study

In this study, multiple regression analysis was the statistical approach used to investigate the beliefs of instructional coaches of mathematics about their mathematics coaching effectiveness with instructional coaching responsibilities and the influence of internal and external factors. The collected data were from instructional coaches of mathematics in a large, urban school district in the Southeastern United States. Instructional coaching in the study district varied based on a range of external factors, such as school structure, building administrator priorities, the number of teachers supported by the instructional coaches, and other factors. In addition to these external factors, the instructional coaches also varied significantly due to internal factors, such as professional experience and educational background. The instructional coaches in the district's elementary settings tended to be generalists, as they coached all content areas. In this study, mathematics instructional coaching responsibilities were a requirement of the participants' role as instructional coaches. The CSI (Yopp et al., 2010) was the instrument used to measure the participants' beliefs about their effectiveness with various coaching responsibilities. Additional data collected included demographic and informational items related to the external and internal factors. The strength of these factors had an influence on the variation of the outcomes of self-efficacy among the participants, as measured with the CSI. The study's guiding research questions were:

1. Do external and internal factors predict elementary instructional coaches of mathematics' beliefs about their mathematics instructional coaching effectiveness with various responsibilities in urban school settings?

2. What are elementary instructional coaches of mathematics' beliefs about their mathematics coaching effectiveness?
3. Which external and internal factors do elementary instructional coaches of mathematics report as the most and least important for their mathematics coaching effectiveness?

### **Context**

The context for this study was a large, urban school district that provided services for significant percentages of students of color and students economically disadvantaged (Governor's Office of Student Achievement, 2018). Specifically, of the district's 50,433 students, 73% were Black, 16% were Caucasian, 7.5% were Hispanic, 2% were multiracial, and 1.5% were Asian/American Indian/Alaskan/other. Data from 2020–2021 showed that the free and reduced lunch rate for students in the district was 68.8%. The district had approximately 2,991 elementary teachers and 89 elementary instructional coaches, with an average student-teacher ratio of 22:1 in the elementary classroom setting.

The district began hiring instructional coaches of mathematics in 1999 to support lower-performing schools in adopting a standardized mathematics curriculum. At the time of this study, of the 55 elementary schools in the district, 40 had at least one full-time instructional coach who supported mathematics, for a total of 69 instructional coaches of mathematics. In addition, 16 other staff operated as instructional coaches or specialists and supported mathematics instruction but did not have the title of instructional coach. There were data collected from both groups. The 40 schools with instructional coaches had 1,517 teachers, including special-area teachers (e.g., art, music, physical education, special education, and gifted teachers) not usually supported by instructional coaches. The overwhelming majority of these teachers were women, and there was

a smaller percentage of male teachers (85% and 15%, respectively). Most of the teachers in schools with instructional coaches had master's degrees (45%), and fewer teachers had specialist degrees (18%) or doctoral degrees (6%). Regarding years of teaching experience, 3% of teachers had 30 or more years of experience, 49% had 11–29 years of experience, 39% had 1–10 years of experience, and 9% had less than 1 year of teaching experience. There was no descriptive information regarding instructional coaches' background and experience in the district; however, this study included the collection of this information for the participants.

### ***Site-Based Instructional Coaching Role in the Study District***

All the schools in this study had a minimum of one site-based instructional coach who supported mathematics, with some schools having as many as three. Some of the instructional coaches supported multiple school sites, but these coaches did not participate in this study. The instructional coaching models used at the individual school sites varied. Some instructional coaches supported specific grade levels in all subjects; others supported one or more subjects for the entire school or specified grade levels. Instructional coaching responsibilities also varied depending on the building administrator. Further, some of the instructional coaches handled administrative tasks and focused less on actual instructional support. Some of the instructional coaches also had to follow specific signature programs or curricula with certain requirements for mathematics instruction. These signature programs and curricula included Eureka Mathematics; science, technology, engineering, and mathematics; and the International Baccalaureate Program. One of the primary goals of this study was to identify the external and internal factors influencing instructional coaches' self-efficacy related to mathematics instructional coaching. The instructional coaching model used at a school could have had an influence on the instructional coaches' beliefs and abilities to support teachers. Additionally, the instructional

programs such as the ones mentioned could have affected the expectations for mathematics instruction or limited or guided the instructional coaches' strategies for supporting teachers' mathematics instruction. Perceptions of some instructional coaching models and structures could have been more favorable than others and linked to greater self-efficacy of instructional coaches of mathematics.

### **Participants and Recruitment**

The participants in this study were 51 site-based instructional coaches who supported mathematics in elementary schools in the study district. A sample of 51 instructional coaches resulted in power lower than .70, with a medium effect size for the two variables (internal and external factors). This study was limited to elementary instructional coaches, most of whom were generalists. The participating instructional coaches had mathematics instructional coaching responsibilities as a requirement of their instructional coaching load. The recruitment occurred after receiving approval from the Research and Accountability Department of the school district and the Georgia State University Institutional Review Board (IRB). The district's elementary mathematics coordinator provided a list of the email addresses of all instructional coaches of mathematics. The distribution of an introductory letter, the informed consent, and a link to the survey occurred via email due to the requirement for virtual teaching in the district at the time of data collection due to the COVID-19 pandemic. The email presented the potential participants with the details of the project and a request for participation if they were responsible for instructional coaching of mathematics and coached at only one school site. All instructional coaches in the district received the letter, informed consent, and survey via email. The letter presented the study and its importance to the school district for the future planning and support of instructional coaches of mathematics. The email included directions for completing the

informed consent form if the individual chose to participate. Each coach who completed the informed consent and survey received a \$15 Amazon gift card via email.

### **Instrument**

The data collection occurred via a survey produced by the Examining Mathematics Coaching Project at Montana State University from 2009–2014 (Sutton et al., 2011), funded by the National Science Foundation. The researchers developed the CSI to measure mathematics instructional coaches' beliefs about their effectiveness with various instructional coaching responsibilities. In the survey, instructional coaches think about their mathematics instructional coaching and assess their perceived level of effectiveness (i.e., self-efficacy). The 20-item survey has a 5-point Likert-type scale ranging from 1 (*not at all effective/confident*) to 5 (*very effective/confident*). Sutton et al. (2011) divided the 20 items into three categories: mathematics content and mathematics-specific pedagogy (10 items), student-centered pedagogy (six items), and building coaching relationships (four items). After the 20 CSI items, the developers also included 20 items (some with multiple parts) to gain insight into the background and practices of the survey respondents as educators. In this study, the demographic and informational items provided data on internal and external factors (see Appendix B for full CSI and demographic and informational items). The survey used in this study included all of the demographic and informational items on the CSI except the five that focused on internal factors, including educational background, teaching experience, and instructional coaching experience. In addition, several items on the CSI focused on the external factors addressed in this study. There were seven items added to the study's survey to address the external factors not included in the CSI. On these items, the participants indicated the number of subject areas they supported, the extent to which they felt supported by their administrators, the approximate percentage of the day

allocated to the mathematics instructional coaching of teachers, and the types of curricula or programs used at their school sites. In total, 11 items focused on internal factors (Items 25–31 and Items 33–36), and 10 items focused on external factors (Items 39–48).

### **Trustworthiness**

The methods used to establish trustworthiness included internal/external validity, reliability, and objectivity (Lincoln & Guba, 1988). This study had internal validity because the findings were sufficient to indicate whether there was a causal relationship between the independent variables and the dependent variable. This study had external validity because the sample included participants who represented a subset of the population. The validity and reliability of the CSI were components determined via the participation of the EMC project coaches ( $N = 57$ ) who completed the survey. The instrument showed strong validity and reliability; however, there was a small sample size (Yopp et al., 2010). The internal reliability of clustered factors on the CSI showed a high level of reliability for the three reported factors (see Table 2). A reliable assessment has a Cronbach's alpha greater than .70 (Cortina, 1993; Salkind, 2013). Yopp et al. (2010) assessed the construct validity of the information produced by the survey tool by using maximum likelihood extraction with varimax rotation for all 24 items. Once again, the small sample size of this data set indicates the need for caution when interpreting the factor analysis. Table 3 shows the factor structure of the CSI, with Factor 1 of mathematics content and mathematics-specific pedagogy, Factor 2 of student-centered pedagogy coaching, and Factor 3 of building coaching relationships.

**Table 2***Coaching Skills Inventory (CSI) Reliability*

| Scale   | Cronbach's alpha |
|---|------------------|
| Mathematics content/mathematics specific pedagogy | .935             |
| Student-centered pedagogy coaching                | .932             |
| Coaching relationship                             | .822             |

**Table 3***Coaching Skills Inventory (CSI) Factor Analysis*

| Factor 1 | Factor 2 | Factor 3 | Item # |
|----------|----------|----------|--------|
| .840     |          |          | 10     |
| .829     |          |          | 9      |
| .808     |          |          | 2      |
| .784     |          |          | 1      |
| .772     |          |          | 7      |
| .738     |          |          | 4      |
| .737     |          |          | 6      |
| .730     |          |          | 8      |
| .626     |          |          | 3      |
| .600     |          |          | 5      |
|          | .894     |          | 12     |
|          | .801     |          | 14     |
|          | .774     |          | 13     |
|          | .729     |          | 11     |
|          | .723     |          | 16     |
|          | .695     |          | 15     |
|          |          | .817     | 20     |
|          |          | .655     | 17     |
|          |          | .584     | 19     |
|          |          | .564     | 18     |

*Note.* Maximum likelihood extraction: Factor 1 = 40.87%, Factor 2 = 16.87%, Factor 3 = 5.06.

Total variance explained = 62.80%

## **Data Collection**

Data collection occurred one time in the Spring 2020 semester via Qualtrics. Qualtrics is an online survey tool that enables researchers to build surveys, distribute surveys, and analyze the results online. The survey instrument was uploaded to Qualtrics with simple instructions for the participants to reflect on their experiences as instructional coaches of mathematics and candidly complete all the items on the survey. The survey included the demographic and informational items of the CSI focused on internal factors, including educational background, teaching experience, and instructional coaching experience. Other items on the CSI centered on the external factors in this study, including seven items that addressed external factors, such as the number of subject areas supported, the extent to which the participants felt supported by their administrators, the approximate percentage of the day allocated to the mathematics instructional coaching of teachers, and the types of curricula or programs used at their school sites. The information collected included a description of the eligible participants. All instructional coaches of mathematics received informed consent and survey links via email, as well as the details of the study. The email respondents could opt to participate by completing the informed consent and survey. The links remained active for 4 weeks so the instructional coaches could complete the survey when convenient. Individuals who had not responded to the invitation email received one follow-up email. A total of 51 participants completed the informed consent and survey.

## **Data Analysis**

Multiple regression analysis was the statistical method used to determine if internal and external factors had an aggregate influence on the participants' self-efficacy. The dependent variable of mathematics coaching self-efficacy was instructional coaches' beliefs about their effectiveness with various instructional coaching responsibilities in mathematics. Three multiple

linear regressions occurred to examine whether the external and internal factors were predictors of the participants' beliefs about their effectiveness (mathematics content and specific pedagogy, student-centered pedagogy coaching, and coaching relationships). The survey used in this study, the CSI, was an instrument designed specifically for this purpose. There were two independent variables: internal factors and external factors. Internal factors are those in the instructional coaches' control, such as their preparation and experience; external factors are outside the participants' control, such as the aspects controlled by building administrators or the local school district.

The internal and external factors all had value; however, alone, they would not have provided sufficient information about mathematics coaching self-efficacy for this sample. Addressing this limitation entailed creating composite variables by combining the individual internal indicators into a single variable and the external indicators into a single variable. Each indicator contributed unique information to the final score. Calculating the range of raw scores for each indicator occurred on a Likert scale to maintain the same polarity for each factor. In this conversion, the higher the scale score for internal and external factors, the higher the mathematics coaching self-efficacy. Each respondent received a single internal factor composite score and a single external factor composite score, which underwent comparison to the dependent CSI score. In addition to this analysis, descriptive statistics were the means used to report the items by category and individually.

### ***External Factors***

The assessment of an aggregate of the following external factors occurred: (a) number of teachers supported, (b) perceived administrative support, (c) number of subject areas supported, (d) number of professional development training hours in mathematics, and (e) the percentage of

the day allocated to mathematics instructional coaching. All the survey data from Qualtrics were compiled and uploaded into SPSS 9.0 software for data analyses. Multiple regression analysis was the statistical approach used to determine if an external factor score was a predictor of the participants' self-efficacy, as measured with the CSI. A positive regression coefficient showed that as the external composite factor increased, so did the self-efficacy score. The participants' actual roles and responsibilities (external factors) varied by school. Regression analysis provided insight into the external factors related to the participants' mathematics coaching self-efficacy. Instructional coaches tend to work in the moment based on the needs of teachers and administrators (Mudzimiri et al., 2014), with their daily routines often altered. The results of this study could indicate the need to clearly define the roles, responsibilities, and effective uses of instructional coaches of mathematics. Instructional coaches and administrators might also need professional development for high-leverage actions and school structures to support mathematics improvement.

### ***Internal Factors***

The assessment of an aggregate of the following internal factors occurred: (a) level of degree, (b) mathematics coursework completion, (c) mathematics endorsement completion, (d) coaching endorsement completion, (e) previous years coaching mathematics, and (f) previous years teaching mathematics. Multiple regression analysis was the approach used to determine if the internal factors of preparation and experience accounted were means of explaining the CSI results. All the survey data were compiled from Qualtrics and uploaded into SPSS 9.0 software for analysis. A positive regression coefficient showed that as the internal composite factor increased, so did the mathematics coaching self-efficacy score.

There is significant evidence that mathematics instructional coaching can be a powerful professional teaching tool. The mathematics instructional coaches who make the most meaningful impact use various strategies to support teachers based on their needs. Mathematics instructional coaches can model instruction, co-teach, co-plan, observe, debrief with reflection, or support teachers with a data-driven decision-making design (Campbell & Malkus, 2011). Successful collaboration with teachers requires instructional coaches to have strong leadership skills, well-developed mathematical content knowledge, knowledge of the curricula and standards, and exceptional knowledge of mathematics pedagogy (Polly et al., 2013). According to the literature, effective instructional coaches must possess specific professional capabilities and experiences to successfully support teachers in improving their practices. Instructional coaches must have mastery of the content and pedagogical. However, just as important is a strong command of the curricula and standards, as well as interpersonal skills that enable instructional coaches to interact with teachers in a nonthreatening and approachable way. The responses from this survey underwent regression analysis to find the degree to which the internal factors indicated mathematics coaching self-efficacy.

The goal of the second research question was to determine the participants' beliefs about their mathematics coaching effectiveness. The calculation of mean and standard deviations occurred for each category of the CSI: mathematics content and mathematics-specific pedagogy, student-centered pedagogy, and coach relationships. The mean and standard deviations were also calculated for the three highest questions to find the areas where the participants felt the most confident. Similar analyses for the final research question enabled the identification of which external and internal factors the participants reported as the most and least important for their mathematics coaching effectiveness. There were mean and standard deviations calculated for the

questions where the participants ranked items in terms of importance to their mathematics coaching effectiveness.

### **Composite Variables**

This study had two independent variables, including external factors and internal factors. Both factors consisted of several categorical items combined to find the sum to form two composite variables and maximize the information each item contributed to the final score. Tables 4 and 5 show the items combined to form each internal composite variable and external composite variable score. The scale contribution columns show the extent to which the item response contributed to the composite score, from highest (4 points) to lowest (0 points). For example, a doctoral degree had a heavier weight in the composite score than a bachelor's degree because, in the field of education, higher educational attainment generally has more value than less education. The same weighting applied to other internal and external items, such as professional development hours, mathematics coaching sessions, and the number of years teaching and coaching. Reverse coding occurred for a few composite score items, providing less weight for a higher response number in the composite score. The reverse-coded items were the number of teachers coached, the number of subject areas supported, and the percentage of the day allocated to administrative tasks. For these items, having fewer teachers, subjects, and assigned administrative tasks was a favorable outcome, as it could give instructional coaches more time to coach teachers in mathematics. Therefore, for these items, a lower number made a higher contribution to the composite score. The survey included dichotomous items for the mathematics and coaching endorsements. Affirmative responses contributed 1 point to the internal composite score, whereas negative responses contributed 0 points.

**Table 4***Internal Composite Items*

| Item # | Item description                           | Scale contribution (high to low) |            |        |       |     |
|--------|--|----------------------------------|------------|--------|-------|-----|
|        |  | PhD/EdD                          | Specialist | MA/Med | BA/BS |     |
| 21     | Highest degree                             |                                  |            |        |       |     |
| 22     | Mathematics content courses (bachelor's)   | 4+                               | 3          | 2      | 1     | 0   |
| 23     | Mathematics content courses (master's)     | 4+                               | 3          | 2      | 1     | 0   |
| 26     | Years taught in grades K-5                 | 21+                              | 16-20      | 11-15  | 6-10  | 1-5 |
| 27     | Years taught mathematics in Grades K-5     | 21+                              | 16-20      | 11-15  | 6-10  | 1-5 |
| 29     | Years coaching (any subject) K-5           | 21+                              | 16-20      | 11-15  | 6-10  | 1-5 |
| 30     | Years coaching mathematics K-5             | 21+                              | 16-20      | 11-15  | 6-10  | 1-5 |
| 31     | K-5 Mathematics Endorsement or certificate |                                  | Yes        |        |       | No  |
| 32     | Coaching Endorsement or certificate        |                                  | Yes        |        |       | No  |

**Table 5***External Composite Items*

| Item # | Item description                                | Scale contribution (high to low) |                |                      |                    |               |
|--------|---|----------------------------------|----------------|----------------------|--------------------|---------------|
|        |   |                                  |                |                      |                    |               |
| 35     | Number of teachers coaching                     | 1-5                              | 6-10           | 11-15                | 16+                |               |
| 36     | Number of subject areas coaching                | 1                                | 2              | 3                    | 4                  | 5+            |
| 37     | School administrator(s) support                 | Extremely effective              | Very effective | Moderately effective | Slightly effective | Not effective |
| 38     | PD hours in mathematics in 12 months            | 41+                              | 31-40          | 21-30                | 11-20              | 0-10          |
| 39     | % of work day coaching mathematics              | 76-100                           | 51-75          | 26-50                | 0-25               |               |
| 40     | % of work day coaching new mathematics teachers | 76-100                           | 51-75          | 26-50                | 0-25               |               |
| 41     | % of work day serving students in mathematics   | 76-100                           | 51-75          | 26-50                | 0-25               |               |
| 42     | % of work day allocated to administrative tasks | 0-25                             | 26-50          | 51-75                | 76-100             |               |
| 43     | Mathematics coaching sessions weekly            | 6+                               | 3-5            | 0-2                  |                    |               |

**Expectations**

The goal of this study was to determine if external and internal were predictors of the participants' self-efficacy. The study focused on the mitigating internal and external factors that field researchers have identified as having an influence on the perceptions of instructional coaches' work. Although researchers have delineated the types of coaching, individuals at the school or district levels could have a different understanding of the role and have disparate expectations for instructional coaches (Denton & Hasbrouck, 2009; Obara, 2010; Sailors & Shanklin, 2010). Semantics matter. The muddled view of the instructional coaching role and job description could produce school conditions that result in minimized effects of instructional

coaching. Those adverse conditions include situations when instructional coaches have limited time to work with teachers. Campbell and Malkus (2011) noted,

This study's Personal Digital Assistant data suggest that many of the coaches in this study had limited time to coach teachers, as on average coaches spent over twice as much time addressing assessment, teaching students, managing materials, and attending meetings than they did coaching. (p. 451)

This misappropriation of time could cause instructional coaches to struggle to schedule times for all parts of the coaching cycle. Additionally, the misappropriation of time could influence the frequency of the substantive interactions useful for building teacher capacity (Campbell & Malkus, 2011; Martin et al., 2010; Yopp et al., 2011).

Internal factors can also contribute to the success or perceived success of mathematics instructional coaches. Instructional coaches' training and background in mathematics education could contribute to their comfort with coaching mathematics content. According to the research, instructional coaches could benefit from having certain desirable professional characteristics. An effective instructional coach is more than an experienced teacher. Instructional coaches with substantive content, pedagogical, and leadership-related coursework appear to have the most impact on changing teacher practices (Campbell & Malkus, 2011, 2014; Green & Kent, 2016). The most successful instructional coaches can build rapport, communicate effectively, guide through listening and questioning, and desire to learn and adapt (Campbell & Malkus, 2014; Green & Kent, 2016).

## 4 RESULTS

The purpose of this quantitative, multiple regression study was to determine if external and internal factors were predictors of the participants' beliefs about their mathematics coaching effectiveness in urban school settings. The research questions and hypothesis were the means used to identify the specific relationships among the named concepts and determine their influence on mathematics coaching self-efficacy. Although there is some research about the internal factors that influence mathematics coaching, the external factors that influence mathematics coaching, and mathematics coaching self-efficacy, most explore them separately (Atteberry & Bryk, 2011; Cobb & Jackson, 2011; Coburn & Russell, 2008; Gam et al., 2016; Grant & Davenport, 2009; Leader-Janssen & Rankin-Erickson, 2013; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003). There is a lack of studies with all the components of this study.

### **Research Questions and Associated Hypotheses**

The study had the following research questions and hypothesis. The following sections present the results and accompanying analysis of the questions and hypothesis. The research questions were:

1. Do external and internal factors predict elementary instructional coaches of mathematics' beliefs about their mathematics instructional coaching effectiveness with various responsibilities in urban school settings?
2. What are elementary instructional coaches of mathematics' beliefs about their mathematics coaching effectiveness?

3. Which external and internal factors do elementary instructional coaches of mathematics report as the most and least important for their mathematics coaching effectiveness?

The study had the following null hypothesis:

H<sub>0</sub>: There is no relationship between external and internal factors to predict elementary instructional coaches' beliefs about their mathematics instructional coach effectiveness with various responsibilities in urban school settings.

### **Findings**

This chapter presents the key characteristics of the participants, the aggregate influence of the external and internal factors on mathematics self-efficacy, and the external and internal factors the participants deemed the most and least efficacious for their work. The demographic data showed that the participants were primarily Black female instructional coaches of mathematics. Although most participants had master's degrees or higher, many had not completed extensive mathematics content courses or courses related to coaching. Multiple regression analysis occurred for each factor on the CSI (mathematics content/mathematics pedagogy, student-centered pedagogy, and building coaching relationships) against the external and internal factor composite score. The analysis showed no significant relationship between these variables. The CSI results did show that the participants had relatively high self-efficacy scores. The findings also showed that the participants ranked collaborative planning time and years of experience teaching K–5 mathematics as the most important external and internal factors for efficacious mathematics coaching. The following sections provide detailed information on the findings.

## Demographic Characteristics

The participants in the study were 51 instructional coaches of mathematics from 32 elementary schools in an urban school district in the Southeastern United States. An online survey was the tool used to collect the demographic characteristics of the participants. This information included internal factors calculated into the composite scores of the instructional coaches, as well as the background and experiences of the participants overall. The demographic information included racial background, gender identity, highest degree held, number of years teaching elementary mathematics, and the number of years coaching elementary teachers. The participants were overwhelmingly Black women. Most of the participants reported their highest degree as a specialist degree ( $n = 24$ ), followed by a master's degree ( $n = 19$ ). All but one participant had at least a master's degree. The participants reported their experiences with teaching mathematics and coaching teachers in Grades K–5. Table 6 presents all of this information.

**Table 6***Frequency Table for Nominal Variables*

| Variable  | <i>n</i> | %    |
|---|----------|------|
| Race/ethnicity                                      |          |      |
| Black/African American                              | 37       | 72.5 |
| White/Caucasian                                     | 10       | 19.6 |
| Hispanic (may be any race)                          | 3        | 5.9  |
| Did not respond                                     | 1        | 2.0  |
| Gender  |          |      |
| Male  | 6        | 11.8 |
| Female  | 44       | 86.3 |
| Did not respond                                     | 1        | 2.0  |
| Highest degree                                      |          |      |
| Bachelor's degree                                   | 1        | 2.0  |
| Master's degree                                     | 19       | 37.3 |
| Specialist degree                                   | 24       | 47.1 |
| Doctoral degree                                     | 6        | 11.8 |
| Did not respond                                     | 1        | 2.0  |
| Years of elementary mathematics teaching experience |          |      |
| 1–5   | 11       | 21.6 |
| 6–10  | 16       | 31.4 |
| 11–15   | 15       | 29.4 |
| 16–20   | 7        | 13.7 |
| 21+   | 1        | 2.0  |
| Did not respond                                     | 1        | 2.0  |
| Years of coaching experience                        |          |      |
| 1–5   | 36       | 70.6 |
| 6–10  | 10       | 19.6 |
| 11–15   | 2        | 3.9  |
| 16–20   | 2        | 3.9  |
| Did not respond                                     | 1        | 2.0  |

On the survey, participants reported their mathematics educational backgrounds by indicating the number of mathematics content courses they had taken during their bachelor's and master's degree programs (0, 1, 2, 3, or 4+ courses). The participants, as a whole, reported taking more mathematics content courses during their undergraduate programs than in their master's degree programs. The survey had fairly evenly spread results, as 11 of the participants reported taking two courses during their bachelor's degree programs, while 18 reported taking three courses. For their master's degree programs, 11 of the participants reported taking one course, while only five reported taking four or more courses. Table 7 presents this information. The participants also indicated whether they had completed a K–5 mathematics or coaching endorsement programs. Most of the participants had not completed either program. Only 29.4% had completed a K–5 Mathematics Endorsement, and 33.3% had completed a Coaching Endorsement program.

**Table 7**

*Number of Mathematics Courses Taken in Degree Programs*

| Variable          | <i>n</i> | %    |
|-------------------|----------|------|
| <b>Bachelor's</b> |          |      |
| 0                 | 3        | 5.9  |
| 1                 | 3        | 5.9  |
| 2                 | 11       | 21.6 |
| 3                 | 18       | 35.3 |
| 4+                | 15       | 29.4 |
| Did not respond   | 1        | 2.0  |
| <b>Master's</b>   |          |      |
| 0                 | 13       | 2.5  |
| 1                 | 11       | 21.6 |
| 2                 | 13       | 25.5 |
| 3                 | 5        | 9.8  |
| 4+                | 5        | 9.8  |
| Did not respond   | 4        |      |

The first research question was:

1. Do external and internal factors predict elementary instructional coaches' beliefs about their mathematics instructional coaching effectiveness with various responsibilities in urban school settings?

H<sub>0</sub>: There is no relationship between external and internal factors to predict elementary instructional coaches' beliefs about their mathematics instructional coaching effectiveness with various responsibilities in urban school settings.

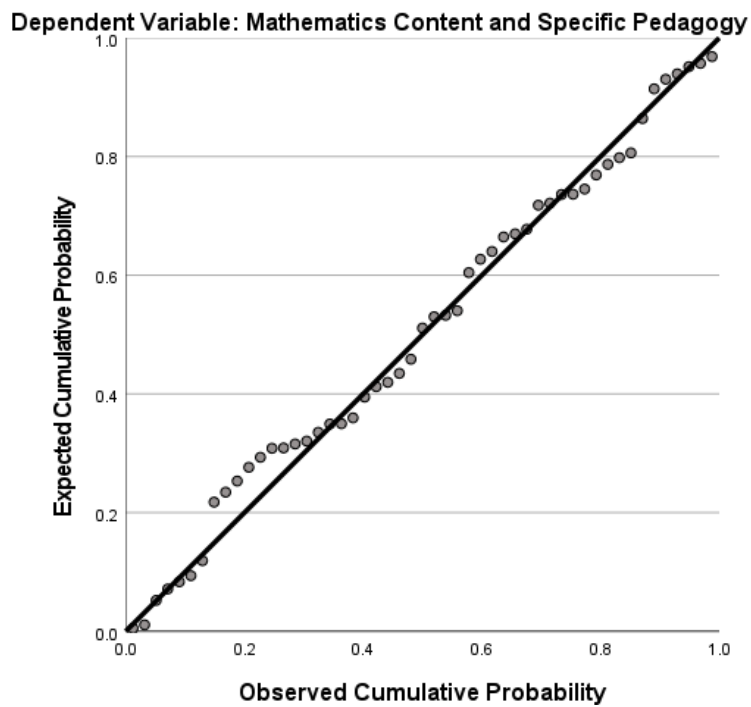
Addressing the research questions entailed conducting three multiple linear regressions to determine whether the external and internal factors were predictors of the participants' beliefs about their mathematics instructional coaching effectiveness (mathematics content and specific pedagogy, student-centered pedagogy coaching, and coaching relationships). Multiple linear regression is an appropriate strategy when testing the predictive relationship between a group of independent variables and a continuous criterion variable (Tabachnick & Fidell, 2019). The predictor variables of interest were the external and internal factors; the continuous dependent variables were the mathematics content and specific pedagogy, student-centered pedagogy coaching, and coaching relationships. There was a separate regression model developed for each dependent variable. Assessment of the assumptions of normality, homoscedasticity, and absence of multicollinearity occurred before the analysis.

### **Regression 1: External and Internal Factors Predicting Mathematics Content and Specific Pedagogy**

The verification of the assumption of normality occurred with a normal P-P scatterplot. The data fell along the normality trend line, indicating that the assumption of normality was met (see Figure 3).

**Figure 3**

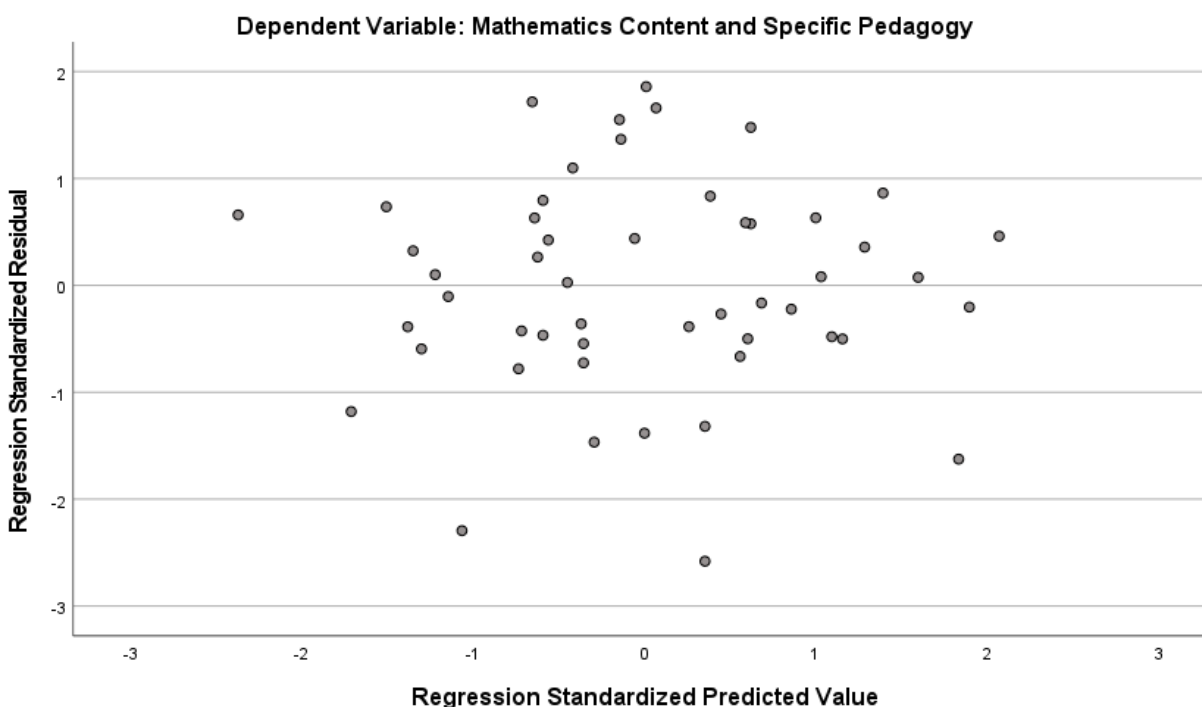
*Normal P-P Scatterplot for Regression 1*



The verification of the assumption of homoscedasticity occurred with a residuals scatterplot. The data did not show a recurring pattern, aligning with the assumption for homoscedasticity (see Figure 4).

**Figure 4**

*Residuals Scatterplot for Regression 1*



Testing the absence of multicollinearity occurred with variance inflation factors (VIFs). Stevens (2009) stated that VIFs less than 10 indicate a low correlation among the variables of interest. Both of the VIFs in this study had values less than 10 and aligned with the assumption. Table 8 presents the findings of the VIFs.

**Table 8**

*Variance Inflation Factors (VIFs) for Predictor Variables*

| Variable         | VIF  |
|------------------|------|
| External factors | 1.00 |
| Internal factors | 1.00 |

The regression model did not have statistically significant collective results,  $F(2, 48) = 2.71, p = .077, R^2 = .101$ . The findings indicate that external factors and internal factors are not significant predictors of mathematics content and specific pedagogy. The coefficient of

determination,  $R^2$ , indicated that the predictors accounted for approximately 10.1% of the variance in mathematics content and specific pedagogy. It is not standard practice to interpret an individual predictor if the model lacks collective significance. However, the overall model had findings near statistical significance ( $p = .077$ ) at the conventional significance threshold,  $\alpha = .05$ . External factors ( $B = 0.04$ ,  $t = 2.32$ ,  $p = .025$ ) were a significant predictor in the model. Every one-unit increase in external factors correlated with an increase in mathematics content and specific pedagogy by approximately 0.04 units. Internal factors ( $B = -0.01$ ,  $t = -0.25$ ,  $p = .807$ ) were not a significant predictor in the model, indicating no strong predictive relationship between internal factors and mathematics content and specific pedagogy. Table 9 presents the results of the regression model.

**Table 9**

*Results for Linear Regression with External Factors and Internal Factors Predicting Mathematics Content and Specific Pedagogy*

| Variable         | $B$   | $SE$ | $\beta$ | $t$   | $p$  |
|------------------|-------|------|---------|-------|------|
| External factors | 0.04  | 0.02 | .32     | 2.32  | .025 |
| Internal factors | -0.01 | 0.02 | -.03    | -0.25 | .807 |

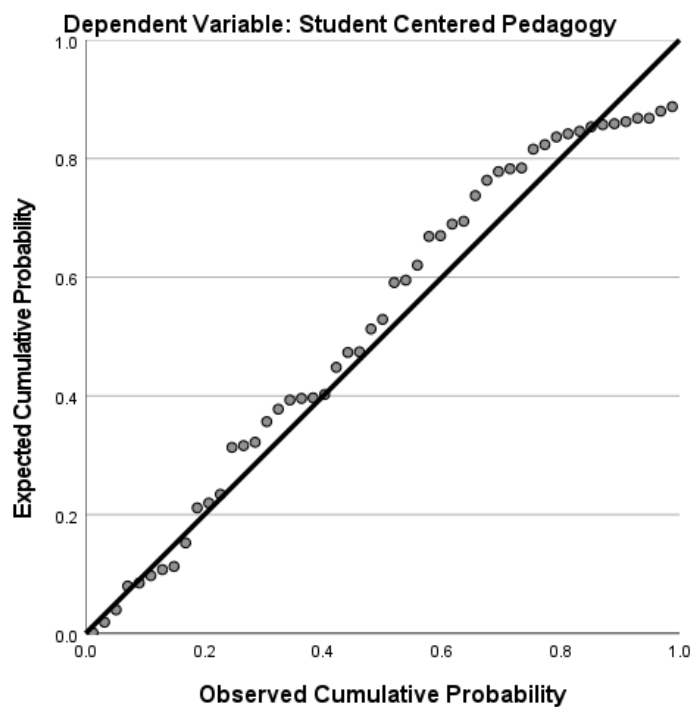
*Note.* Overall model fit:  $F(2, 48) = 2.71$ ,  $p = .077$ ,  $R^2 = 0.101$

### **Regression 2: External and Internal Factors Predicting Student-Centered Pedagogy**

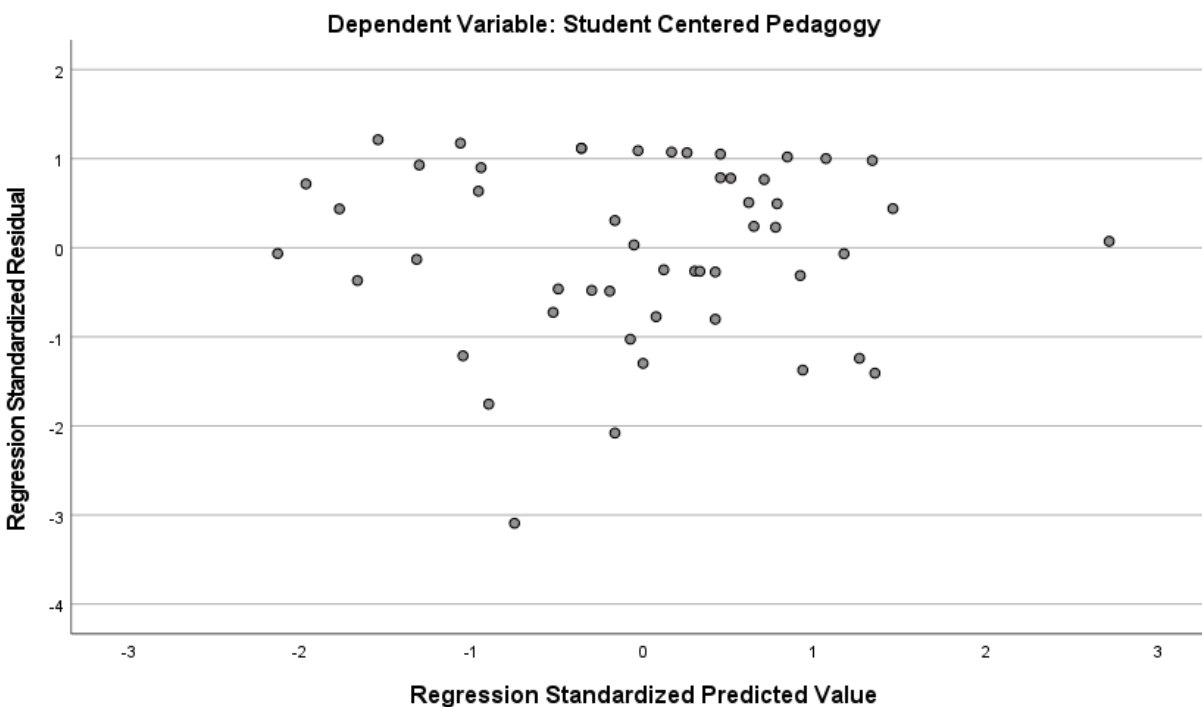
The verification of the assumption of normality occurred with a normal P-P scatterplot. The data fell along the normality trend line, indicating that the assumption of normality was met (see Figure 5).

**Figure 5**

*Normal P-P Scatterplot for Regression 2*



The verification of the assumption of homoscedasticity occurred with a residuals scatterplot. The data did not show a recurring pattern, aligning with the assumption for homoscedasticity (see Figure 6). The same predictors underwent an examination in the previous analysis; therefore, the absence of the multicollinearity assumption was supported.

**Figure 6***Residuals Scatterplot for Regression 2*

The collective results of the regression model lacked statistical significance,  $F(2, 48) = 0.16$ ,  $p = .849$ ,  $R^2 = .007$ , indicating that external factors and internal factors were not significant predictors of student-centered pedagogy. The coefficient of determination,  $R^2$ , indicated that the predictors accounted for approximately 0.7% of the variance in student-centered pedagogy. The individual predictor variables did not undergo further examination due to the nonsignificance of the overall regression model. Table 10 presents the results of the regression model.

**Table 10**

*Results for Linear Regression with External Factors and Internal Factors Predicting Student-Centered Pedagogy*

| Variable         | <i>B</i> | <i>SE</i> | $\beta$ | <i>t</i> | <i>p</i> |
|------------------|----------|-----------|---------|----------|----------|
| External factors | 0.01     | 0.02      | .07     | 0.47     | .640     |
| Internal factors | 0.01     | 0.03      | .05     | 0.32     | .750     |

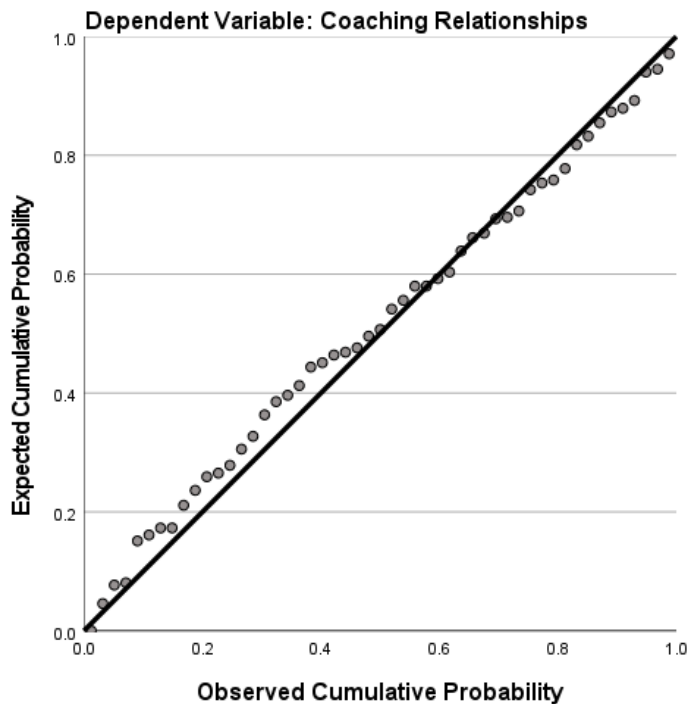
*Note.* Overall model fit:  $F(2, 48) = 0.16, p = .849, R^2 = 0.007$

### **Regression 3: External and Internal Factors Predicting Coaching Relationships**

The verification of the assumption of normality occurred with a normal P-P scatterplot. The data closely occurred along the normality trend line, indicating that the assumption of normality was met (see Figure 7).

**Figure 7**

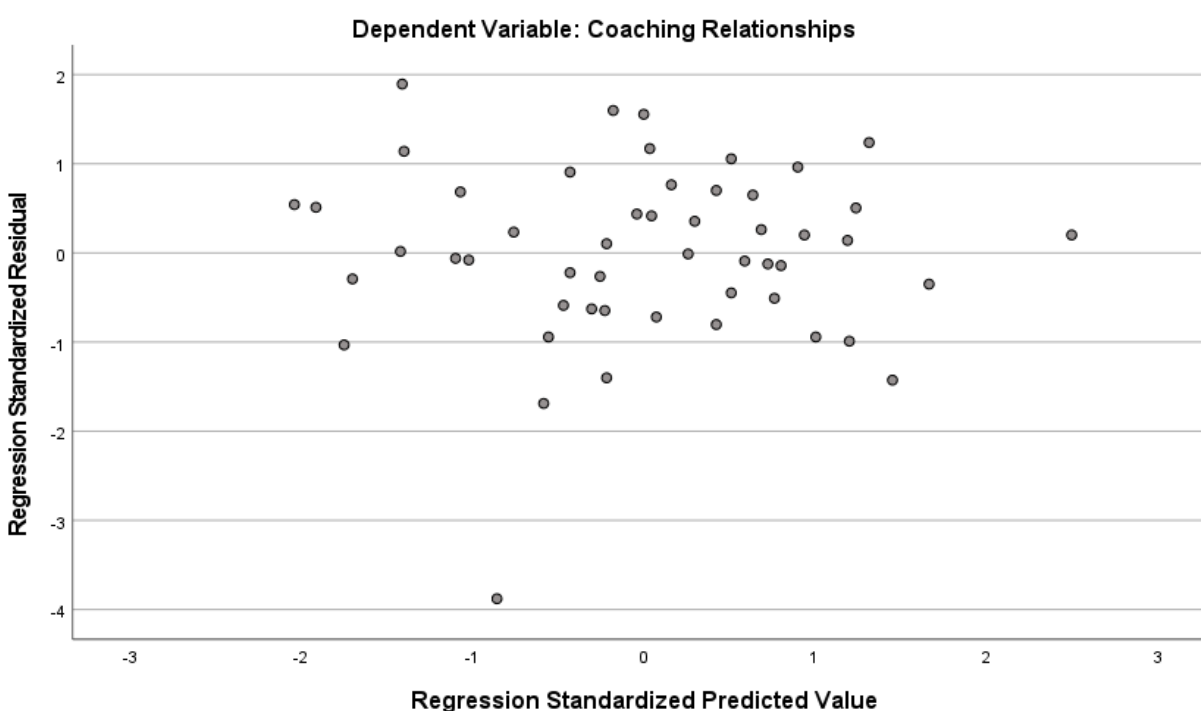
*Normal P-P Scatterplot for Regression 3*



The verification of the assumption of homoscedasticity occurred with a residuals scatterplot. The data did not show a recurring pattern, indicating that the assumption for homoscedasticity was supported (see Figure 8). The same predictors underwent an examination in the previous analysis; therefore, the absence of the multicollinearity assumption was supported.

### Figure 8

*Residuals Scatterplot for Regression 3*



The collective results of the regression model did not have statistical significance,  $F(2, 48) = 1.45$ ,  $p = .245$ ,  $R^2 = .057$ , indicating that external factors and internal factors were not significant predictors of coaching relationships. The coefficient of determination,  $R^2$ , indicated that the predictors accounted for approximately 5.7% of the variance in coaching relationships. The individual predictor variables did undergo further examination due to the nonsignificance of the overall regression model. Table 11 presents the results of the regression model.

**Table 11**

*Results for Linear Regression with External Factors and Internal Factors Predicting Coaching Relationships*

| Variable         | <i>B</i> | <i>SE</i> | $\beta$ | <i>t</i> | <i>p</i> |
|------------------|----------|-----------|---------|----------|----------|
| External factors | 0.03     | 0.02      | .22     | 1.53     | .132     |
| Internal factors | 0.02     | 0.03      | .10     | 0.73     | .471     |

*Note.* Overall model fit:  $F(2, 48) = 1.45, p = .245, R^2 = 0.057$

The second research question was:

2. What are elementary instructional coaches of mathematics' beliefs about their mathematics coaching effectiveness?

### **Coaching Skills Inventory**

In this study, self-efficacy was the continuous dependent variable measured with the CSI (Yopp et al., 2010). The CSI has a 5-point Likert scale, with 1 = *not at all effective or confident* and 5 = *very effective or confident*. The 20-item CSI has three categories: mathematics content and mathematics-specific pedagogy, student-centered pedagogy, and building coaching relationships. Table 12 presents the mean and standard deviation of the sample by category. Appendix C shows all CSI items with their mean scores.

**Table 12**

*Coaching Skills Inventory by Category: Means and Standard Deviations*

| Category                                 | <i>M</i> | <i>SD</i> |
|--|----------|-----------|
| Mathematics content/mathematics pedagogy | 3.97     | .573      |
| Student-centered pedagogy                | 4.32     | .618      |
| Building coaching relationships          | 3.97     | .671      |

The mean and standard deviation of the total sample on the CSI was  $M = 4.07$  and  $SD = 0.77$ . This finding showed that the participants had a relatively high sense of mathematics

coaching self-efficacy. The three items with the highest means and the three items with the lowest means provided more information on the statements that indicated the highest and lowest sense of self-efficacy among the participants (see Table 13). The highest mean, 4.43, emerged for a question about coaching teachers to encourage student participation in mathematics. The lowest mean, 3.65, occurred for a question about coaching teachers on incorporating investigative, inquiry-based, or discovery-based mathematics into their lessons.

**Table 13**

*Coaching Skills Inventory by Category: Means and Standard Deviations*

| Category  | <i>M</i> | <i>SD</i> |
|---|----------|-----------|
| CSI (total)   | 4.07     | 0.77      |
| Highest means   |          |           |
| 12. Coaching teachers on encouraging student participation in mathematics                                       | 4.43     | 0.70      |
| 11. Coaching teachers on general (not necessarily mathematics-specific) pedagogy                                | 4.42     | 0.70      |
| 16. Coaching teachers on classroom management in mathematics  | 4.41     | 0.67      |
| Lowest means  |          |           |
| 20. Coaching on creating an environment of open discussion and constructive curriculum in mathematics           | 3.76     | 0.76      |
| 10. Coaching on engaging students in mathematics abstraction or sense-making                                    | 3.71     | 0.76      |
| 9. Coaching on incorporating investigative, inquiry-based, or discovery-based mathematics learning into lessons | 3.65     | 0.84      |

The third research question was:

3. Which external and internal factors do elementary instructional coaches of mathematics report as the most and least important for their mathematics coaching effectiveness?

Part of the analysis was to rank the items to explore the external and internal factors participants viewed as the most important for their mathematics coaching effectiveness. The

coaches ranked the items from 1–6 and 1–5, with 1 indicating *most important* and 6 or 5 indicating *least important*. Notably, the participants ranked the amount of time available to plan with teachers and support from the principal as the most important external factors for their coaching effectiveness. Additionally, the participants regarded years of experience teaching K–5 mathematics and completion of mathematics and coaching endorsements as the most important factors to their success. Table 14 shows the results and corresponding percentages of each factor in descending order.

**Table 14**

*Frequency Table for External and Internal Ranked Items*

| Item  | <i>n</i> | %    |
|---|----------|------|
| External factors in order of importance to mathematics coaching effectiveness                   |          |      |
| Amount of time available to spend with teachers   | 19       | 43.2 |
| Support of your principal   | 14       | 31.8 |
| Amount of mathematics professional development  | 4        | 9.1  |
| The number of subject areas you support   | 3        | 6.82 |
| The use of a mandated mathematics curriculum  | 3        | 6.82 |
| The number of teachers you support  | 1        | 2.27 |
| Internal factors in order of importance to mathematics coaching effectiveness                   |          |      |
| Years of experience teaching K–5 mathematics  | 24       | 54.6 |
| Specialized education such as completion of K–5 mathematics or coaching endorsement/certificate | 8        | 18.2 |
| Level of degree obtained  | 5        | 11.4 |
| Years of experience coaching K–5 mathematics  | 4        | 9.1  |
| Number of university mathematics content courses completed                                      | 3        | 6.8  |

Administrative support is a critical factor in the self-efficacy of instructional coaches (Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003). In this study, the participants ranked how their administrators could support their mathematics coaching effectiveness from 1 to 5, with 1 indicating the most importance and 5 indicating the least

importance. According to the literature, coaching responsibilities can vary greatly, although there are some common duties (Kho et al., 2019; Mudzimiri et al., 2014; Russell et al., 2020; Wang, 2017). In this study, a separate item on administrative support enabling the coaching responsibilities that the participants believed contributed the most to their mathematics coaching effectiveness. Once again, the participants ranked items from 1 to 5, with 1 indicating the most importance and 5 indicating the least importance for mathematics coaching effectiveness. Notably, the participants reported collaborative planning time with teachers as the most important. Table 15 presents the results.

**Table 15**

*Frequency Table for Administration Support and Coaching Responsibilities Ranked Items*

| Item  | <i>n</i> | %    |
|---|----------|------|
| Ways administration could support your coaching effectiveness                   |          |      |
| Allot more collaborative planning time with teachers                            | 23       | 54.8 |
| Allot more time for sharing and modeling effective teaching strategies          | 12       | 28.6 |
| Allot more time for observing and providing feedback on teachers' instruction   | 5        | 11.9 |
| Allot more time for supporting teachers' classroom management                   | 2        | 4.8  |
| Allot more time for administrative tasks assigned to you                        | 0        | 0    |
| Coaching responsibilities that contribute to mathematics coaching effectiveness |          |      |
| Collaborative planning with teachers  | 21       | 50   |
| Sharing and modeling effective teaching strategies                              | 11       | 26.2 |
| Observing and providing feedback on teachers' instruction                       | 8        | 19.1 |
| Supporting teachers' classroom management                                       | 2        | 4.8  |
| Working on administrative tasks assigned to you                                 | 0        | 0    |

## 5 DISCUSSION

In this study, data analysis occurred to investigate the participants' beliefs about their mathematics coaching effectiveness (self-efficacy) with specific instructional coaching responsibilities and the influence of external and internal factors (see Figure 1). Bandura's (1977) theory of self-efficacy was the study's guiding framework. The participants were instructional coaches of mathematics ( $N = 51$ ) who completed the CSI (Yopp et al., 2010). Inferential and descriptive statistics were means to investigate the results. Testing the hypothesis consisted of conducting multiple regression analyses for the external and internal factors against each factor of the CSI: mathematics content and pedagogy, student-centered pedagogy, and coaching relationships. The overall model did not have significance; therefore, the null hypothesis was not rejected.

Research Questions 2 and 3 focused on the participants' beliefs about their mathematics coaching effectiveness, specifically the external and internal factors they reported as the most and least important for their mathematics coaching effectiveness. The results from the CSI showed that the participants had a relatively high sense of self-efficacy, as the mean and standard deviation of the total sample on the CSI was  $M = 4.07$  and  $SD = 0.77$ , based on 1–5 Likert-scale scores. The participants ranked several internal and external factors and responsibilities on what they considered the factors the most important for their mathematics coaching self-efficacy. The results showed that the participants overwhelmingly valued collaborative planning time with teachers more than other factors or responsibilities.

This chapter provides insights into the findings and thoughts on what could have contributed to the results. This chapter also shows how the findings connect to the extant literature, the implications of the findings for the field, and questions for future studies. An

exhaustive review of the literature found no researchers who had comprehensively addressed the impacts on the self-efficacy of instructional coaches of mathematics on their ability to perform their responsibilities based on their experience, education, or the elements of their working environments. With the theory of self-efficacy as a framework, this study was a means to determine the relationships between the constructs and explore the factors and responsibilities the participants valued as the most important for their coaching self-efficacy.

### **Demographics**

The survey data provided the information used to describe the participants. Most of the participants were Black (72.5%), followed by White (19.6%) and Hispanic (5.9%). The vast majority of participants were women (86.3%). The study focused on the internal factors of educational level and experience. The expectation is that instructional coaches of mathematics have high content and pedagogical knowledge (Polly et al., 2013) due to advanced education/training and on-the-job experience. The participants overwhelmingly had advanced degrees. Nearly 12% had completed doctoral programs, 47.1% had completed specialist programs, and 37.3% had earned master's degrees. Only one participant reported having only a bachelor's degree. These educational statistics are likely due to the role's requirements indicated by the district or school. Although most participants had master's degrees or higher, 25.5% reported not taking any mathematics content courses during their programs. This finding could have occurred because although a master's degree is likely a requirement for the job of instructional coach of mathematics, the participants could have attained the degrees in any area, not necessarily mathematics. A lack of mathematics course content could have affected the participants' content knowledge of mathematics and self-efficacy in mathematics coaching.

The study had mixed results regarding the on-the-job experience of the participants. Only 21.6% of the coaches had 5 or fewer years of classroom teaching experience, meaning most participants were experienced teachers. A requirement of the Georgia Department of Education Evaluation System is greater oversight of induction teachers with 3 or fewer years of classroom experience. Conversely, 70.6% of the participants had been in their position for 5 years or less, indicating that most of the instructional coaches were relatively new to their role. Instructional coaches might not spend many years in this role but could move on to other educational leadership opportunities. The literature search did not produce large-scale studies on the average years of experience or length of employment of instructional coaches of mathematics. However, some scholars have reported this demographic information. For example, the instructional coaches of mathematics in Yopp et al.'s (2019) study had an average of 11.6 years of experience teaching mathematics and 2.1 years of coaching mathematics. This study's findings mirrored Yopp et al.'s in that the participants were experienced teachers but less-experienced instructional coaches of mathematics.

### **Multiple Linear Regression Analysis**

The study had two independent variables: external and internal factors. Several survey items or factor indicators were combined to create two new composite variables. Multiple regression occurred to analyze the composite variables related to the CSI items on self-efficacy with job-related tasks. The selection of the external items occurred based on the features presented in the literature as influential. External items such as school administrator support (Gibbons et al., 2019; Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003), professional development (Yoon et al., 2007), and the allocation of time for various tasks (Bean et al., 2010; Gibbons & Cobb, 2017; Kane & Rosenquist, 2018; Martin et al., 2010;

Mudzimiri et al., 2014; Polly, 2012; Rapacki & Francis, 2014; Sailors & Price, 2010) were reoccurring themes in the literature. Therefore, these and other external factors were essential components of the external composite score. The selection of the internal items for the composite score occurred based on the experience and background information addressed in published studies on instructional coaches of mathematics. Scholarly articles have provided information on the highest degrees, years of experience teaching, and years of experience coaching mathematics of instructional coaches of mathematics. This common occurrence provided the rationale for the internal composite item composition.

Addressing the first research question consisted of conducting multiple regression to determine whether the internal and external factors were predictors of the participants' self-efficacy. The findings of this study did not provide the evidence needed to refute the null hypothesis that there is no relationship between external and internal factors as predictors of elementary instructional coaches' beliefs about their mathematics instructional coach effectiveness with various responsibilities in urban school settings. These findings do not align with the extant literature showing that efficacious mathematics coaching occurs with support from school leadership (Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003), content knowledge and skill (Campbell & Griffin, 2017; Polly et al., 2013), and regular interaction between coaches and teachers (Bean et al., 2010; Gibbons & Cobb, 2017; Kane & Rosenquist, 2018; Martin et al., 2010; Mudzimiri et al., 2014; Polly, 2012; Rapacki & Francis, 2014; Sailors & Price, 2010).

The factors in this study were not predictors of the participants' self-efficacy with embedded job responsibilities. However, this finding could have occurred due to other factors, including insufficient sample size, inadequate internal factor item selection, and the presence of

confounding variables. Despite the calculation of power analysis before the data collection and recruitment, the study had an insufficient sample size ( $N = 51$ ). Therefore, the test could have had questionable results. The ultimate goal was to recruit 68 participants for a power of .80 (large effect size) or a minimum of 55 participants for (medium effect size) .70 power. The larger the size of the sample, the easier the achievement of the 0.05 level of significance. The recruitment of the participants had to occur remotely via email instead of in person during district monthly coaches' meetings due to the virtual instruction requirement in the study's district due to the COVID-19 pandemic.

The goal of several survey items was to understand and measure the internal factors. These internal factors were the participants' educational background on topics related to the coaching of teachers in mathematics and experience with teaching and coaching mathematics. The study found no significance among any of the three categories of the CSI. This finding could indicate that education and experience do not have an influence on the self-efficacy of instructional coaches of mathematics. Additionally, the survey items on experiences with teaching and supporting coaches might not have accurately reflected the knowledge base and experience of the participants. Perhaps courses and educational programs do not provide a clear or complete picture of coaches' internal abilities with job-related tasks.

Confounding variables often are a silent contributor to the outcome of many studies. One significant confounding variable was that the COVID-19 pandemic was a contextual element of this study. At the time of the survey, the study district had a virtual teaching and learning requirement for all staff. All meetings, classroom observations, and professional learning occurred virtually. The virtual learning impacted the coaches' work and interactions with teachers, as all the coaches had to pivot and work with teachers in an online environment with

which they may have lacked familiarity. The pandemic was and continues to be a trying time for instructional coaches and teachers. Studies have shown the difficulties of the pandemic, specifically for teacher well-being, during its early stages (Allen et al., 2020; Klapproth et al., 2020; Müller & Goldenberg, 2020; Pressley, 2021). In Chan et al.'s (2021) study, 151 elementary teachers in the United States provided retrospective accounts of their experiences of the Spring 2020 school closures of the pandemic. The majority of the participants reported feeling emotionally exhausted and having high levels of task stress and job ambiguity. The present study occurred in September 2020. Therefore, the contextual element of the pandemic could have influenced how the instructional coaches of mathematics responded to survey items about their mathematics coaching self-efficacy.

### **Elementary Instructional Coaches of Mathematics Self-Efficacy**

The results from the CSI underwent examination to address the second research question on the participants' beliefs about their mathematics coaching effectiveness. The CSI instrument has three categories: mathematics content and mathematics-specific pedagogy, student-centered pedagogy, and building coaching relationships. All categories had a high mean; however, there was still variability evident. The creators of the CSI, Yopp et al. (2019), reported similar mean and standard deviation results for their study's participants ( $N = 61$ ), as follows: mathematics content and mathematics pedagogy  $M = 3.63$  and  $SD = 0.63$ , student-centered pedagogy  $M = 3.83$  and  $SD = 0.72$ , and building coaching relationships  $M = 3.58$  and  $SD = 0.65$ . The participants in this study had the highest overall mean for questions on student-centered pedagogy. This finding was unsurprising because this category focused less on mathematics content and more on engaging in cooperative learning, encouraging discussions, and creating positive classroom environments for mathematics. The remaining categories (mathematics

content/mathematics pedagogy and building coaching relationships) had the same overall mean of  $M = 3.97$  but slightly more variability in the building coaching relationships category. The lower mean score in these two categories might have been due to the limited number of participants who had completed K–5 mathematics endorsement (29.4%) and coaching endorsement programs (33.3%). Therefore, the participants could have had less knowledge or experience in these areas. The questions on comfort level with tasks related to creating open discussions/criticisms for mathematics, engaging students in mathematics sense-making, or incorporating inquiry-based mathematics into lessons had lower reported means than the items on mathematics content/pedagogy and building coaching relationships.

### ***Connection to Bandura's Theory of Self-Efficacy***

Self-efficacy was the theoretical framework used to examine whether certain external and internal factors were predictors of the participants' beliefs about their coaching effectiveness. The study found no significant relationship between variables; however, there is a need to examine the participants' responses and their potential connections to mathematics coaching efficacy to contribute to the understudied area of mathematics coaching. Individuals can acquire mastery experience by practicing particular skills and building confidence by overcoming related obstacles. In this study, the participants reported their years of experience teaching elementary mathematics and coaching elementary teachers. The study population consisted of highly experienced teachers, with 76.5% of the participants teaching elementary mathematics for 6 or more years. The sample also included less-experienced teachers, as only 27.4% had coached elementary teachers for 6 or more years. The results showed relatively high self-efficacy scores for each category but a slightly lower mean,  $M = 3.77$  and  $SD = 0.67$ , for building coaching relationships, an area heavily influenced by experience with this skill.

Verbal persuasion, a component of Bandura's self-efficacy theory, occurs when experts or people of influence support others by enhancing the individuals' beliefs in their abilities to meet specific challenges. In this study, assessing the participants' experience with verbal persuasion entailed examining the perceived support of their building administrators and the number of professional development hours they completed in mathematics in the 12 months before the survey. Much of the literature has shown the importance of administrator support for the work and self-efficacy of instructional coaches (Gibbons et al., 2019; Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003). This study's participants had relatively high self-efficacy scores on the CSI (overall  $M = 4.07$  and  $SD = 0.77$  on a 5-point Likert scale). However, the participants reported feeling less supported by their building administrators ( $M = 3.65$  and  $SD = 1.02$ ). In response to the question, "In general, how effective do you feel your school administrator(s) is/are with providing support for your mathematics coaching?" 41.2% of the participants selected *slightly effective*, and 17.6% selected *not at all effective*. Overall, nearly 60% of the participants did not feel supported by school administrators but still had relatively high self-efficacy. These results were somewhat surprising but still understandable due to using composite scores to combine several items in the total score. The study had more evenly spread results after examining professional development hours completed. Of the participants, 52.9% reported 20 or fewer hours of professional development, and 41.2% reported 21–41+ hours of professional development in mathematics.

### **Significant and Insignificant Factors for Mathematics Coaching Effectiveness**

The goal of the final research question was to examine the internal and external factors the participants reported as the most and least effective for their mathematics coaching. The participants ranked the external factors in order of importance. The results were that the top

factors, in sequential order, were the time available to spend with teachers, the support of the school principal, and the amount of mathematics professional development. The top-ranked internal factors for instructional coaches in this study were years of experience teaching K–5 mathematics, completion of mathematics or coaching endorsements, and the level of degrees obtained. The factors selected by the participants aligned with the research on these internal and external factors; therefore, the results were not a surprise.

Collaborative time between teachers and instructional coaches has the most effectiveness when focused on reflective conversations about mathematics teaching and learning (Barlow et al., 2014; Yopp et al., 2011). Understandably, the participants highly valued this factor because the responsibility to meet and plan with teachers is a focal point of their work (Mudzimiri et al., 2014). The second most important external factor for the participants was the encouragement and support of the school principal. Scholarly research has indicated that administrative support has an essential role in the efficacy of instructional coaches (Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003). The third most significant external factor was the amount of time in professional development. Professional development provides a strong foundation for mathematics leadership and space for instructional coaches to develop their skills and self-efficacy (Cobb & Jackson, 2011; Coburn & Russell, 2008; Huggins et al., 2017).

The highest-ranked internal factors for the participants were years of experience teaching K–5 mathematics and years of coaching mathematics. This value of firsthand experience teaching K–5 mathematics content aligned with the current requirements for elementary mathematics instructional leadership licensure. All states with these programs require a minimum of 3 years of successful mathematics teaching experience at the elementary level, as well as other coursework and subject examination requirements (Harrington et al., 2017). The

participants ranked the completion of mathematics or coaching endorsements the third most important factor for efficacious coaching. Again, the research has indicated that specialized learning for subject area content and pedagogical knowledge is a way to enhance self-efficacy (Catalano et al., 2019; Evans, 2011; Nicholson & McIntosh, 2020; Tschannen-Moran et al., 1998).

### **Limitations**

As with all research, this study has limitations. Although relatively small, the sample size was a sensible segment of instructional coaches of mathematics in the district based on power calculations. However, the study did not have generalizable findings. Due to the population size and scope, instructional coaches were not randomly chosen to participate. Thus, there was a need for restraint in generalizing the findings. Further, studies on different demographic areas with varied instructional coaching programs or models could have different findings. The statistical method of this multiple regression study did not find a cause-effect relationship even in the presence or lack of a strong association between the variables. This study focused only on the perceptions of instructional coaches of mathematics. Other school stakeholders, such as teachers and administrators, and student achievement data were not part of this research. The limitations also include the interpretation of the role and strength of specific external and internal factors, as the individual factors did not undergo statistical analysis but were an aggregate of each group. In addition, the assessment of coaching and teaching experience occurred by years of experience, which did not provide insight into the quality of the experience. Despite the limitations, this study provided information about the work of an understudied segment of educators. Therefore, this study could have had findings useful for future research.

## Implications

School districts and school leaders could benefit from an increased awareness of the internal and external factors that could have an influence on the self-efficacy of instructional coaches of mathematics. The literature and Bandura's (1977) self-efficacy theory suggest that self-efficacy correlates with greater success for teachers and others. Modern reform in mathematics education has, in part, been the responsibility of the instructional coaches of mathematics who help classroom teachers improve their instructional practices and student outcomes. The daily working environments, experiences, and backgrounds of instructional coaches could have a role in their work and thus require future study. This study had nonsignificant findings. However, the literature and results of this study indicate the importance of certain external factors in the success or failure of instructional coaches of mathematics. Scholars in the field have agreed that principals play a key role in the success or failure of school-based mathematics coaches (Grant & Davenport, 2009; Mudzimiri et al., 2014; Obara, 2010; Poglinco et al., 2003). Although understudied, professional development for mathematics coaches is an important topic for all educators who aim to close the achievement gap in mathematics. Professional development has been a dominant theme addressed in several significant studies (NCTM, 1991, 2000, 2014, 2020; NRC, 2001). The factors in this study did not correlate with mathematics coaching self-efficacy; however, they could have a connection to student gains, teacher self-efficacy in mathematics, or mathematics teaching practices.

The internal factors were the participants' experiences and backgrounds as instructional coaches of mathematics. The literature has indicated that instructional coaches of mathematics must have a deep-rooted and well-connected understanding of the subject and the ability to transform this understanding into the pedagogical content practices likely to result in meaningful

student learning. Mathematics coaches must then help teachers adopt and embrace these practices in their mathematics classroom (Lannin et al., 2013; Shulman, 1987). These complex skills are imperative components of the work of instructional coaches of mathematics and should be a part of their preparation and training. Instructional coaches of mathematics should have coursework focused on mathematics content and pedagogy; however, the contrary is likely the reality. According to a 2012 survey of U.S. teachers, only about 4% of elementary teachers had degrees in mathematics or mathematics education (de Araujo et al., 2017). Additionally, only 10% of the respondents had completed coursework in all of the five domains of mathematics. The literature search did not produce statistics on the mathematics degrees or mathematics education of instructional coaches in the United States. However, the results from this study showed low percentages for instructional coaches of mathematics, as well. Less than a third of the participants had completed mathematics or coaching endorsements, and less than a third had completed four or more mathematics courses for their bachelor's or master's degree programs. This finding indicates the need for more specific training for the job of instructional coach of mathematics.

Little to no comprehensive research has focused on the factors predicting the self-efficacy of instructional coaches of mathematics. Therefore, there was no literature available for comparison. Like teachers' self-efficacy, mathematics coaches' self-efficacy is a vital topic requiring future study. This study contributed to the limited body of research, as a subset of mathematics coaches gained greater insight into their educational backgrounds, experiences, work environments, and self-efficacy for job-related tasks. This insight, combined with the literature, indicates the importance of various internal and external factors. School and district

leaders could use the findings of this study to make decisions about the selection, training, and work settings of mathematics coaches to increase their self-efficacy and overall efficaciousness.

### **Suggestions for Further Research**

Most of the literature found for this study consisted of small-scale qualitative or case studies. A recommendation is to further the research by implementing more large-scale, quantitative studies with a wide variety of instructional coaches of mathematics from varied school demographics. A study with a larger sample or more experienced participants could have different results, as approximately 70% of the participants in this study had fewer than 5 years of experience as instructional coaches of mathematics. Likewise, future researchers could build the external and internal composites differently, perhaps with some theoretical basis.

Although the factors in this study did not show a connection to mathematics coaching self-efficacy, future scholars could examine the potential links of these factors to student mathematics gains, teacher self-efficacy in mathematics, or classroom mathematics teaching practices. Finally, the COVID-19 pandemic had a significant impact on this study. All stakeholders, including the instructional coaches of mathematics, in the study's district had to work virtually at the time of data collection. Future scholars could replicate the study when the pandemic is not a confounding factor.

## REFERENCES

- Allen, R., Jerrim, J., & Sims, S. (2020, September). *How did the early stages of the COVID-19 pandemic affect teacher wellbeing?* [Working paper]. Centre for Education Policy and Equalising Opportunities. <https://repec-cepeo.ucl.ac.uk/cepeow/old-style/cepeowp20-15.pdf>
- Alnoor, A. G., Yuanxiang, G., & Abudhuim, F. S. (2007). *Assessment mathematics teacher's competencies*. <https://files.eric.ed.gov/fulltext/ED495712.pdf>
- Association of Mathematics Teacher Educators. (2013). *Standards for elementary mathematics specialists: A reference for teacher credentialing and degree programs*. [https://amte.net/sites/all/themes/amte/resources/EMS\\_Standards\\_AMTE2013.pdf](https://amte.net/sites/all/themes/amte/resources/EMS_Standards_AMTE2013.pdf)
- Atteberry, A., & Bryk, A. S. (2011). Analyzing teacher participation in literacy coaching activities. *The Elementary School Journal*, *112*(2), 356–382. <https://doi.org/10.1086/661994>
- Austin, W., Figlio, D., Goldhaber, D., Hanushek, E., Kilbride, T., Koedel, C., Jaeseok, S. L., Lou, J., Özek, U., Parsons, E., Rivkin, S., Sass, T., & Strunk, K. (2020, November 11–13). *Where are initially low-performing students the most likely to succeed? A multi-state analysis of academic mobility* [Paper presentation]. APPAM 42nd Annual Fall Research Conference, Washington, DC, United States.
- Balfanz, R., Mac Iver, D. J., & Byrnes, V. (2006). The implementation and impact of evidence-based mathematics reforms in high-poverty middle schools: A multi-site, multi-year study. *Journal for Research in Mathematics Education*, *37*(1), 33–64. <https://doi.org/10.2307/30035051>

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. <https://doi.org/10.1037/0033-295X.84.2.191>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman and Company.
- Barlow, A. T., Burroughs, E. A., Harmon, S. E., Sutton, J. T., & Yopp, D. A. (2014). Assessing views of coaching via a video-based tool. *ZDM*, *46*(2), 227–238. <https://doi.org/10.1007/s11858-013-0558-7>
- Bean, R. M., Draper, J. A., Hall, V., Vandermolen, J., & Zigmond, N. (2010). Coaches and coaching in Reading First schools: A reality check. *The Elementary School Journal*, *111*(1), 87–114. <https://doi.org/10.1086/653471>
- Bengo, P. (2016). Secondary mathematics coaching: The components of effective mathematics coaching and implications. *Teaching and Teacher Education*, *60*, 88–96. <https://doi.org/10.1016/j.tate.2016.07.027>
- Berger, J. L., Girardet, C., Vaudroz, C., & Crahay, M. (2018). Teaching experience, teachers' beliefs, and self-reported classroom management practices: A coherent network. *SAGE Open*, *8*(1), Article 2158244017754119. <https://doi.org/10.1177/2158244017754119>
- Biancarosa, G., Bryk, A. S., & Dexter, E. R. (2010). Assessing the value-added effects of literacy collaborative professional development on student learning. *The Elementary School Journal*, *111*(1), 7–34. <https://doi.org/10.1086/653468>
- Blank, R. K. (2013). What research tells us. *The Learning Professional*, *34*(1), 50–53. <https://learningforward.org/wp-content/uploads/2013/02/what-research-tells-us.pdf>
- Blazar, D. (2015). Effective teaching in elementary mathematics: Identifying classroom practices that support student achievement. *Economics of Education Review*, *48*, 16–29. <https://doi.org/10.1016/j.econedurev.2015.05.005>

- Brady, S., Gillis, M., Smith, T., Lavalette, M., Liss-Bronstein, L., Lowe, E., North, W., Russo, E., & Wilder, T. D. (2009). First grade teachers' knowledge of phonological awareness and code concepts: Examining gains from an intensive form of professional development and corresponding teacher attitudes. *Reading and Writing, 22*(4), 425–455.  
<https://doi.org/10.1007/s11145-009-9166-x>
- Bray-Clark, N., & Bates, R. (2003). Self-efficacy beliefs and teacher effectiveness: Implications for professional development. *Professional Educator, 26*(1), 13–22.  
<http://files.eric.ed.gov/fulltext/EJ842387.pdf>
- Brewton, M. (2011). *A phenomenological examination of the factors associated with high efficacy for teaching mathematics* (Publication No. 3468501) [Doctoral dissertation, Walden University]. ProQuest Dissertations and Theses Global.
- Cakiroglu, E. (2000). *Preservice elementary teachers' sense of efficacy in reform oriented mathematics* (Publication No. 9980980) [Doctoral dissertation, Indiana University]. ProQuest Dissertations and Theses Global.
- Campbell, J. R. (1996). *NAEP 1994 trends in academic progress: Achievement of US students in science, 1969 to 1994; mathematics, 1973 to 1994; reading, 1971 to 1994; writing, 1984 to 1994*. National Center for Education Statistics.  
<http://files.eric.ed.gov/fulltext/ED403328.pdf>
- Campbell, P. F. (1996). Empowering children and teachers in the elementary mathematics classrooms of urban schools. *Urban Education, 30*(4), 449–475.  
<https://doi.org/10.1177/0042085996030004005>

- Campbell, P. F., & Griffin, M. J. (2017). Reflections on the promise and complexity of mathematics coaching. *The Journal of Mathematical Behavior*, *46*, 163–176.  
<https://doi.org/10.1016/j.jmathb.2016.12.007>
- Campbell, P. F., & Malkus, N. N. (2011). The impact of elementary mathematics coaches on student achievement. *The Elementary School Journal*, *111*(3), 430–454.  
<https://doi.org/10.1086/657654>
- Campbell, P. F., & Malkus, N. N. (2013). Elementary mathematics specialists: Influencing student achievement. *Teaching Children Mathematics*, *20*(3), 198–205.  
<https://doi.org/10.5951/teacchilmath.20.3.0198>
- Campbell, P. F., & Malkus, N. N. (2014). The mathematical knowledge and beliefs of elementary mathematics specialist-coaches. *ZDM*, *46*(2), 213–225.  
<https://doi.org/10.1007/s11858-013-0559-6>
- Campbell, P. F., Griffin, M. J., & Malkus, N. N. (2017). *Factors influencing elementary mathematics specialists' impact on student achievement*. Association of Mathematics Teacher Educators.
- Cantrell, S. C., & Hughes, H. K. (2008). Teacher efficacy and content literacy implementation: An exploration of the effects of extended professional development with coaching. *Journal of Literacy Research*, *40*(1), 95–127.  
<https://doi.org/10.1080/10862960802070442>
- Catalano, A., Asselta, L., & Durkin, A. (2019). Exploring the relationship between science content knowledge and science teaching self-efficacy among elementary teachers. *IAFOR Journal of Education*, *7*(1), 57–70. <http://files.eric.ed.gov/fulltext/EJ1217961.pdf>

- Chan, M. K., Sharkey, J. D., Lawrie, S. I., Arch, D. A., & Nylund-Gibson, K. (2021). Elementary school teacher well-being and supportive measures amid COVID-19: An exploratory study. *School Psychology, 36*(6), 533–545. <https://doi.org/10.1037/spq0000441>
- Charalambous, C. Y., & Philippou, G. N. (2010). Teachers' concerns and efficacy beliefs about implementing a mathematics curriculum reform: Integrating two lines of inquiry. *Educational Studies in Mathematics, 75*(1), 1–21. <https://doi.org/10.1007/s10649-010-9238-5>
- Cobb, P., & Jackson, K. (2011). Towards an empirically grounded theory of action for improving the quality of mathematics teaching at scale. *Mathematics Teacher Education and Development, 13*(1), 6–33. <http://files.eric.ed.gov/fulltext/EJ960944.pdf>
- Coburn, C., & Russell, J. (2008, June). Getting the most out of professional learning communities and coaching: Promoting interactions that support instructional improvement. *Learning Policy Brief, 1*(3), 1–5.
- Colbert, J. A., Brown, R. S., Choi, S., & Thomas, S. (2008). An investigation of the impacts of teacher-driven professional development on pedagogy and student learning. *Teacher Education Quarterly, 35*(2), 135–154. <https://files.eric.ed.gov/fulltext/EJ817315.pdf>
- Common Core State Standards*. (2010). National Governors Association. [https://preview.fadss.org/resources/webinars/webinar2/FSBAPresentationforCommunitie\\_s\\_transcribed.pdf](https://preview.fadss.org/resources/webinars/webinar2/FSBAPresentationforCommunitie_s_transcribed.pdf)
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology, 78*(1), 98–104. <https://doi.org/10.1037/0021-9010.78.1.98>

- Costa, A. L., & Garmston, R. J. (2002). *Cognitive coaching: A foundation for renaissance schools*. Christopher-Gordon Publishers.
- de Araujo, Z., Webel, C., & Reys, B. (2017). Preparing elementary mathematics specialists. In M. B. McGatha & N. R. Rigelman (Eds.), *Elementary mathematics specialists: Developing, refining, and examining programs that support mathematics teaching and learning* (pp. 19–32). Information Age Publishing.
- Denton, C. A., & Hasbrouck, J. A. N. (2009). A description of instructional coaching and its relationship to consultation. *Journal of Educational and Psychological Consultation*, 19(2), 150–175. <https://doi.org/10.1080/10474410802463296>
- Desimone, L. M., & Pak, K. (2017). Instructional coaching as high-quality professional development. *Theory Into Practice*, 56(1), 3–12. <https://doi.org/10.1080/00405841.2016.1241947>
- Deussen, T., Coskie, T., Robinson, L., & Autio, E. (2007). ‘Coach’ can mean many things: Five categories of literacy coaches in Reading First (REL 2007-No. 005). Regional Educational Laboratory Northwest.
- Donohoo, J., Hattie, J., & Eells, R. (2018). The power of collective efficacy. *Educational Leadership*, 75(6), 40–44. [https://educacion.udd.cl/files/2021/01/The-Power-of-Collective-Efficacy\\_Hattie.pdf](https://educacion.udd.cl/files/2021/01/The-Power-of-Collective-Efficacy_Hattie.pdf)
- Elementary Mathematics Specialists & Teacher Leaders Project. (n.d.). <http://mathspecialists.org>
- Ellington, A., Whitenack, J., & Edwards, D. (2017). Effectively coaching middle school teachers: A case for teacher and student learning. *The Journal of Mathematical Behavior*, 46, 177–195. <https://doi.org/10.1016/j.jmathb.2016.12.012>

- Evans, B. R. (2011). Content knowledge, attitudes, and self-efficacy in the mathematics New York City Teaching Fellows (NYCTF) program. *School Science and Mathematics, 111*(5), 225–235. <https://doi.org/10.1111/j.1949-8594.2011.00081.x>
- Foster, D., & Noyce, P. (2004). The mathematics assessment collaborative: Performance testing to improve instruction. *Phi Delta Kappan, 85*(5), 367–374. <https://doi.org/10.1177/003172170408500507>
- Frey, N., & Kelly, P. R. (2001, December 5–8). *The effects of staff development, modeling, and coaching of interactive writing on instructional repertoires of K-1 teachers in a professional development school* [Conference presentation]. Yearbook of the National Reading Conference, San Antonio, TX, United States.
- Gam, J., Kim, G., & Jeon, Y. (2016). Influences of art therapists' self-efficacy and stress coping strategies on burnout. *The Arts in Psychotherapy, 47*, 1–8. <https://doi.org/10.1016/j.aip.2015.09.005>
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915–945. <https://doi.org/10.3102/00028312038004915>
- Gersten, R., Morvant, M., & Brengelman, S. (1995). Close to the classroom is close to the bone: Coaching as a means to translate research into classroom practice. *Exceptional Children, 62*(1), 52–66. <https://doi.org/10.1177/001440299506200105>
- Ghaith, G., & Yaghi, H. (1997). Relationships among experience, teacher efficacy, and attitudes toward the implementation of instructional innovation. *Teaching and Teacher Education, 13*(4), 451–458. [https://doi.org/10.1016/S0742-051X\(96\)00045-5](https://doi.org/10.1016/S0742-051X(96)00045-5)

- Gibbons, L. (2017). Examining mathematics coaching practices that help develop school-wide professional learning. In M. B. McGatha & N. R. Rigelman (Eds.), *Elementary mathematics specialists: Developing, refining, and examining programs that support mathematics teaching and learning* (pp. 167–174). Information Age Publishing.
- Gibbons, L. K., & Cobb, P. (2017). Focusing on teacher learning opportunities to identify potentially productive coaching activities. *Journal of Teacher Education*, 68(4), 411–425. <https://doi.org/10.1177/0022487117702579>
- Gibbons, L. K., Wilhelm, A. G., & Cobb, P. (2019). Coordinating leadership supports for teachers' instructional improvement. *Journal of School Leadership*, 29(3), 248–268. <https://doi.org/10.1177/1052684619836824>
- Governor's Office of Student Achievement. (2018). *Data dashboards: Georgia school grades report* [Data file and code book]. <https://schoolgrades.georgia.gov/>
- Grant, C. M., & Davenport, L. R. (2009). Principals in partnership with math coaches. *Principal*, 88(5), 36–41.
- Green, A., & Kent, A. (2016). Developing science and mathematics teacher leaders through a mathematics, science & technology initiative. *Developing Teacher Leaders*, 40(1), 1–20. <http://files.eric.ed.gov/fulltext/EJ1103358.pdf>
- Gresham, G. (2009). An examination of mathematics teacher efficacy and mathematics anxiety in elementary pre-service teachers. *The Journal of Classroom Interaction*, 44(9), 22–38.
- Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. *Teaching and Teacher Education*, 4(1), 63–69. [https://doi.org/10.1016/0742-051X\(88\)90025-X](https://doi.org/10.1016/0742-051X(88)90025-X)

- Handal, B., & Herrington, A. (2003). Mathematics teachers' beliefs and curriculum reform. *Mathematics Education Research Journal*, *15*(1), 59–69.  
<https://doi.org/10.1007/BF03217369>
- Harbour, K. E., & Saclarides, E. S. (2020). Math coaches, specialists, and student achievement: Learning from the data. *Phi Delta Kappan*, *102*(3), 42–45.  
<https://doi.org/10.1177/0031721720970701>
- Harbour, K. E., Adelson, J. L., Pittard, C. M., & Karp, K. S. (2018). Examining the relationships among mathematics coaches and specialists, student achievement, and disability status: A multilevel analysis using National Assessment of Educational Progress data. *The Elementary School Journal*, *118*(4), 654–679. <https://doi.org/10.1086/697529>
- Harrington, R. A., Burton, L., & Beaver, C. (2017). Answering the call by developing an online elementary mathematics specialist program. *The Journal of Mathematical Behavior*, *46*, 303–312. <https://doi.org/10.1016/j.jmathb.2017.01.001>
- Hauser, L. L. (2014). Shape-shifting: A behavioral team coaching model for coach education, research, and practice. *Journal of Psychological Issues in Organizational Culture*, *5*(2), 48–71.
- Henrikson, R., & Lumpe, A. (2021). Implementation of a pilot elementary mathematics specialist endorsement program. *Education Sciences*, *11*(3), Article 93.  
<https://doi.org/10.3390/educsci11030093>
- Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., & Ball, D. L. (2008). Mathematical knowledge for teaching and the mathematical quality of instruction: An exploratory study. *Cognition and Instruction*, *26*(4), 430–511.  
<https://doi.org/10.1080/07370000802177235>

- Hindman, A. H., & Wasik, B. A. (2012). Unpacking an effective language and literacy coaching intervention in head start: Following teachers' learning over two years of training. *The Elementary School Journal*, *113*(1), 131–154. <https://doi.org/10.1086/666389>
- Hjalmarson, M. A., & Baker, C. K. (2020). Mathematics specialists as the hidden players in professional development: Researchable questions and methodological considerations. *International Journal of Science and Mathematics Education*, *18*(1), 51–66. <https://doi.org/10.1007/s10763-020-10077-7>
- Holloway, J., Nielsen, A., & Saltmarsh, S. (2018). Prescribed distributed leadership in the era of accountability: The experiences of mentor teachers. *Educational Management Administration & Leadership*, *46*(4), 538–555. <https://doi.org/10.1177/1741143216688469>
- Hopkins, M., Ozimek, D., & Sweet, T. M. (2017). Mathematics coaching and instructional reform: Individual and collective change. *The Journal of Mathematical Behavior*, *46*, 215–230. <https://doi.org/10.1016/j.jmathb.2016.11.003>
- Huggins, K. S., Lesseig, K., & Rhodes, H. (2017). Rethinking teacher leader development: A study of early career mathematics teachers. *International Journal of Teacher Leadership*, *8*(2), 28–48. <http://files.eric.ed.gov/fulltext/EJ1169799.pdf>
- Huguet, A., Marsh, J. A., & Farrell, C. C. (2014). Building teachers' data-use capacity: Insights from strong and developing coaches. *Education Policy Analysis Archives/Archivos Analíticos de Políticas Educativas*, *22*, 1–28. <https://www.redalyc.org/pdf/2750/275031898069.pdf>

- Jong, D. D., & Campoli, A. (2018). Curricular coaches' impact on retention for early-career elementary teachers in the USA: Implications for urban schools. *International Journal of Mentoring and Coaching in Education*, 7(2), 191–200. <https://doi.org/10.1108/IJMCE-09-2017-0064>
- Joyce, B., & Showers, B. (1982). The coaching of teaching. *Educational Leadership*, 40(1), 4–8.
- Kanadli, S. (2017). Prospective teachers' professional self-efficacy beliefs in terms of their perceived autonomy support and attitudes towards the teaching profession: A mixed methods study. *Educational Sciences: Theory & Practice*, 17(5).  
<https://doi.org/10.12738/estp.2017.5.0597>
- Kane, B. D., & Rosenquist, B. (2018). Making the most of instructional coaches. *Phi Delta Kappan*, 99(7), 21–25. <https://doi.org/10.1177/0031721718767855>
- Kho, S. H., Saeed, K. M., & Mohamed, A. R. (2019). Instructional coaching as a tool for professional development: Coaches' roles and considerations. *The Qualitative Report*, 24(5), 1106–1130.
- Klapproth, F., Federkeil, L., Heinschke, F., & Jungmann, T. (2020). Teachers' experiences of stress and their coping strategies during COVID-19 induced distance teaching. *Journal of Pedagogical Research*, 4(4), 444–452. <http://dx.doi.org/10.33902/JPR.2020062805>
- Kleiman, G. M. (2004). Myths and realities about technology in K-12 schools: Five years later. *Contemporary Issues in Technology and Teacher Education*, 4(2), 248–253.  
<https://www.learntechlib.org/p/19944/>
- Knight, J. (2009). Coaching: The key to translating research into practice lies in continuous, job-embedded learning with ongoing support. *Journal of Staff Development*, 30(1), 18–22.

- Knight, J. (2007). *Instructional coaching: A partnership approach to improving instruction*. Corwin Press.
- Kretlow, A. G., Cooke, N. L., & Wood, C. L. (2012). Using in-service and coaching to increase teachers' accurate use of research-based strategies. *Remedial and Special Education, 33*(6), 348–361. <https://doi.org/10.1177/0741932510395397>
- Lannin, J. K., Webb, M., Chval, K., Arbaugh, F., Hicks, S., Taylor, C., & Bruton, R. (2013). The development of beginning mathematics teacher pedagogical content knowledge. *Journal of Mathematics Teacher Education, 16*(6), 403–426. <https://doi.org/10.1007/s10857-013-9244-5>
- Leader-Janssen, E. M., & Rankin-Erickson, J. L. (2013). Preservice teachers' content knowledge and self-efficacy for teaching reading. *Literacy Research and Instruction, 52*(3), 204–229. <https://doi.org/10.1080/19388071.2013.781253>
- Leinwand, S., Huinker, D., & Brahier, D. (2014). On my mind: Principles to actions: mathematics programs as the core for student learning. *Mathematics Teaching in the Middle School, 19*(9), 516–519. <https://doi.org/10.5951/mathteachmidscho.19.9.0516>
- Lincoln, Y. S., & Guba, E. G. (1988, April 5–9). *Criteria for assessing naturalistic inquiries as reports* [Paper presentation]. Annual Meeting of the Educational Research Association, New Orleans, LA, United States. <https://files.eric.ed.gov/fulltext/ED297007.pdf>
- Lovett, M. W., Lacerenza, L., De Palma, M., Benson, N. J., Steinbach, K. A., & Frijters, J. C. (2008). Preparing teachers to remediate reading disabilities in high school: What is needed for effective professional development? *Teaching and Teacher Education, 24*(4), 1083–1097. <https://doi.org/10.1016/j.tate.2007.10.005>

- Luebeck, J., & Burroughs, E. (2017). A research journey through mathematics coaching. *The Journal of Mathematical Behavior*, 46, 152-162.
- Markworth, K. A., Brobst, J., Ohana, C., & Parker, R. (2016). Elementary content specialization: Models, affordances, and constraints. *International Journal of STEM Education*, 3(1), Article 16. <https://doi.org/10.1186/s40594-016-0049-9>
- Martin, W., Strother, S., Beglau, M., Bates, L., Reitzes, T., & McMillan Culp, K. (2010). Connecting instructional technology professional development to teacher and student outcomes. *Journal of Research on Technology in Education*, 43(1), 53–74. <https://doi.org/10.1080/15391523.2010.10782561>
- Mathematics Teacher Education and Development*, 14(1), 78–93.
- Matsumura, L. C., Sartoris, M., Bickel, D. D., & Garnier, H. E. (2009). Leadership for literacy coaching: The principal's role in launching a new coaching program. *Educational Administration Quarterly*, 45(5), 655–693. <https://doi.org/10.1177/0013161X09347341>
- McCauley, K. D., Hammer, E., & Hinojosa, A. S. (2017). An andragogical approach to teaching leadership. *Management Teaching Review*, 2(4), 312–324. <https://doi.org/10.1177/2379298117736885>
- McGee, J. R., Wang, C., & Polly, D. (2013). Guiding teachers in the use of a standards-based mathematics curriculum: Teacher perceptions and subsequent instructional practices after an intensive professional development program. *School Science and Mathematics*, 113(1), 16-28.

- Mohamadi, F. S., & Asadzadeh, H. (2012). Testing the mediating role of teachers' self-efficacy beliefs in the relationship between sources of efficacy information and students achievement. *Asia Pacific Education Review*, *13*(3), 427–433.  
<https://doi.org/10.1007/s12564-011-9203-8>
- Mohamadi, F. S., Asadzadeh, H., Ahadi, H., & Jomehri, F. (2011). Testing Bandura's theory in school. *Procedia-Social and Behavioral Sciences*, *12*, 426–435.  
<https://doi.org/10.1016/j.sbspro.2011.02.053>
- Monroe, R. L., & Marvin, S. (2020). Perceptions of instructional coaches and teachers on the barriers of multi-level instructional coaching in higher performing vs. lower performing elementary schools in Tennessee. *Journal of Education and Training Studies*, *8*(7), 26–34. <https://doi.org/10.11114/jets.v8i7.4606>
- Mudzimiri, R., Burroughs, E. A., Luebeck, J., Sutton, J., & Yopp, D. (2014). A look inside mathematics coaching: Roles, content, and dynamics. *Education Policy Analysis Archives*, *22*(53). <http://files.eric.ed.gov/fulltext/EJ1050391.pdf>
- Müller, L. M., & Goldenberg, G. (2020, May 15). *Education in times of crisis: The potential implications of school closures for teachers and students*. Chartered College of Teaching. [https://chartered.college/wp-content/uploads/2020/05/CCTReport150520\\_FINAL.pdf](https://chartered.college/wp-content/uploads/2020/05/CCTReport150520_FINAL.pdf)
- National Center for Education Statistics. (2016). *Highlights from TIMSS and TIMSS advanced 2015*. <https://nces.ed.gov/pubs2017/2017002.pdf>
- National Council of Teachers of Mathematics. (1991). *Professional teaching standards for school mathematics*. Author.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Author.

- National Council of Teachers of Mathematics. (2014). *Principles to action: Ensuring mathematical success for all*. Author.
- National Council of Teachers of Mathematics. (2020). *Catalyzing change in early childhood and elementary mathematics: Initiating critical conversations*. Author.
- National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel*. U.S. Department of Education.  
<https://files.eric.ed.gov/fulltext/ED500486.pdf>
- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. National Academies Press. <http://nap.edu/9822>
- National Science Foundation National Center for Science and Engineering Statistics. (2014). *2011–12 Schools and Staffing Survey*. National Center for Education Statistics.  
<https://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-1/teachers-of-mathematics-and-science>
- Neuberger, J. (2012). Benefits of a teacher and coach collaboration: A case study. *The Journal of Mathematical Behavior*, 31(2), 290–311. <https://doi.org/10.1016/j.jmathb.2011.12.004>
- Neufeld, B., & Roper, D. (2003, June). *Coaching: A strategy for developing instructional capacity*. The Aspen Institute Program on Education.
- Nicholson, T., & McIntosh, S. (2020). An exploration of the relationship between phonological and phonics knowledge, and self-efficacy for teaching. *Dyslexia*, 26(3), 286–304.  
<https://doi.org/10.1002/dys.1636>
- Obara, S. (2010). Mathematics coaching: A new kind of professional development. *Teacher Development*, 14(2), 241–251. <https://doi.org/10.1080/13664530.2010.494504>

- Organization for Economic and Cooperative Development. (2018). *PISA 2015 results in focus*.  
<http://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf>
- Partnership for 21st Century Learning. (2011). *21st century skills map*.  
<https://files.eric.ed.gov/fulltext/ED543032.pdf>
- Piper, B., & Zuilkowski, S. S. (2015). Teacher coaching in Kenya: Examining instructional support in public and nonformal schools. *Teaching and Teacher Education, 47*, 173–183.  
<https://doi.org/10.1016/j.tate.2015.01.001>
- Poglinco, S. M., Bach, A. J., Hovde, K., Rosenblum, S., Saunders, M., & Supovitz, J. A. (2003). *The heart of the matter: The coaching model in America's Choice schools*. Consortium for Policy Research and Education. [https://repository.upenn.edu/cpre\\_researchreports/35/](https://repository.upenn.edu/cpre_researchreports/35/)
- Polly, D. (2012). Supporting mathematics instruction with an expert coaching model.
- Polly, D., Mraz, M., & Algozzine, R. (2013). Implications for developing and researching elementary school mathematics coaches. *School Science and Mathematics, 113*(6), 297–307. <https://doi.org/10.1111/ssm.12029>
- Pressley, T. (2021). Factors contributing to teacher burnout during COVID-19. *Educational Researcher, 50*(5), 325–327. <https://doi.org/10.3102/0013189X211004138>
- Priestley, M. (2011). Schools, teachers, and curriculum change: A balancing act? *Journal of Educational Change, 12*(1), 1–23. <https://doi.org/10.1007/s10833-010-9140-z>
- Rapacki, L. J., & Francis, D. I. C. (2014). I Am a Math Coach: Now What?. *Teaching Children Mathematics, 20*(9), 556-563.

- Rigelman, N. R. (2017). Creating a viable elementary mathematics specialist program. In M. B. McGatha & N. Rigelman (Ed.), *Elementary mathematics specialists: Developing, refining, and examining programs that support mathematics teaching and learning* (pp. 85–90). Information Age Publishing.
- Ross, J. A. (1998). The antecedents and consequences of teacher efficacy. *Advances in Research on Teaching*, 7, 49–74.
- Roth McDuffie, A., Choppin, J., Drake, C., Davis, J. D., & Brown, J. (2018). Middle school teachers' differing perceptions and use of curriculum materials and the Common Core. *Journal of Mathematics Teacher Education*, 21(6), 545–577.  
<https://doi.org/10.1007/s10857-017-9368-0>
- Russell, J. L., Correnti, R., Stein, M. K., Bill, V., Hannan, M., Schwartz, N., Booker, L. N., Pratt, N. R., & Matthis, C. (2020). Learning from adaptation to support instructional improvement at scale: Understanding coach adaptation in the TN Mathematics Coaching Project. *American Educational Research Journal*, 57(1), 148–187.  
<https://doi.org/10.3102/0002831219854050>
- Sailors, M., & Price, L. R. (2010). Professional development that supports the teaching of cognitive reading strategy instruction. *The Elementary School Journal*, 110(3), 301–322. <https://doi.org/10.1086/648980>
- Sailors, M., & Shanklin, N. L. (2010). Introduction: Growing evidence to support coaching in literacy and mathematics. *The Elementary School Journal*, 111(1), 1–6.  
<https://doi.org/doi/10.1086/653467>
- Salkind, N. J. (2013). *Exploring research: Pearson new international edition*. Pearson Higher Ed.

- Scantlebury, K., Gallo-Fox, J., & Wassell, B. (2008). Coteaching as a model for preservice secondary science teacher education. *Teaching and Teacher Education*, 24(4), 967–981. <https://doi.org/10.1016/j.tate.2007.10.008>
- Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1–23. <https://doi.org/10.17763/haer.57.1.j463w79r56455411>
- Skaalvik, E. M., & Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of Educational Psychology*, 99(3), Article 611. <https://doi.org/10.1037/0022-0663.99.3.611>
- Smith, P. S., Hayes, M. L., & Lyons, K. M. (2017). The ecology of instructional teacher leadership. *The Journal of Mathematical Behavior*, 46, 267–288. <https://doi.org/10.1016/j.jmathb.2016.12.005>
- Staub, F. C., & Stern, E. (2002). The nature of teachers' pedagogical content beliefs matters for students' achievement gains: Quasi-experimental evidence from elementary mathematics. *Journal of Educational Psychology*, 94(2), 344–355. <https://doi.org/10.1037/0022-0663.94.2.344>
- Stevens, J. P. (2009). *Applied multivariate statistics for the social sciences* (5th ed.). Routledge Academic.
- Stipek, D. (2012). Context matters: Effects of student characteristics and perceived administrative and parental support on teacher self-efficacy. *The Elementary School Journal*, 112(4), 590-606.
- Sutton, J. T., Burroughs, E. A., & Yopp, D. A. (2011). Coaching knowledge: Domains and definitions. *Journal of Mathematics Education Leadership*, 13(2), 12–20. <https://www.montana.edu/emc/documents/NCSM.Coaching.Knowledge.Fall2011.pdf>

- Swars, S. L., Daane, C. J., & Giesen, J. (2006). Mathematics anxiety and mathematics teacher efficacy: What is the relationship in elementary preservice teachers? *School Science and Mathematics, 106*(7), 306–315. <https://doi.org/10.1111/j.1949-8594.2006.tb17921.x>
- Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.
- Tanner, J., Quintis, L., & Gamboa, T., Jr. (2017). Three perspectives of planning, implementation, and consistency in instructional coaching. *Journal of Educational Research and Practice, 7*(1), Article 2. <https://doi.org/10.5590/JERAP.2017.07.1.03>
- Tatar, E., Zengin, Y., & Kagizmanli, T. B. (2016). Examining levels of mathematics teaching anxiety of pre-service teachers. *Journal of Theoretical Educational Science, 9*(1), 38–56.
- Taylor, J. E. (2008). Instructional coaching: The state of the art. In M. M. Mangin & S. R. Stoelinga (Eds.), *Effective teacher leadership: Using research to inform and reform* (pp. 10–35). Teachers College Press.
- Teemant, A. (2014). A mixed-methods investigation of instructional coaching for teachers of diverse learners. *Urban Education, 49*(5), 574–604. <https://doi.org/10.1177/0042085913481362>
- Teemant, A., Wink, J., & Tyra, S. (2011). Effects of coaching on teacher use of sociocultural instructional practices. *Teaching and Teacher Education, 27*(4), 683–693. <https://doi.org/10.1016/j.tate.2010.11.006>
- Thomas, W., & Collier, V. (2002). *A national study of school effectiveness for language minority students' long-term academic achievement*. Center for Research on Education, Diversity and Excellence. <https://escholarship.org/uc/item/65j213pt>

- Tschannen-Moran, M., & Woolfolk Hoy, A. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teaching and Teacher Education*, 23(6), 944–956. <https://doi.org/10.1016/j.tate.2006.05.003>
- Tschannen-Moran, M., Woolfolk Hoy, A., & Woolfolk Hoy, K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, 68(2), 202–248. <https://doi.org/10.3102/00346543068002202>
- Van Keer, H., & Verhaeghe, J. P. (2005). Effects of explicit reading strategies instruction and peer tutoring on second and fifth graders' reading comprehension and self-efficacy perceptions. *The Journal of Experimental Education*, 73(4), 291–329. <https://doi.org/10.3200/JEXE.73.4.291-329>
- Wang, S. (2017). 'Teacher centered coaching': An instructional coaching model. *Mid-Western Educational Researcher*, 29(1), 20–39. <https://www.mwera.org/MWER/volumes/v29/issue1/V29n1-Wang-VOICES-FROM-THE-CLASSROOM.pdf>
- Wenta, R. G. (2000). *Efficacy of preservice elementary mathematics teachers* (Publication No. 9999230) [Doctoral dissertation, Indiana University]. ProQuest Dissertations and Theses Global.
- West, L., & Staub, F. C. (2003). *Content-focused coaching: Transforming mathematics lessons*. Heinemann.
- Westmoreland Jr, T. M. (2015). *Teachers' perspectives of instructional coaches' impact on student achievement in middle school*. Liberty University.
- Wolters, C. A., & Daugherty, S. G. (2007). Goal structures and teachers' sense of efficacy: Their relation and association to teaching experience and academic level. *Journal of Educational Psychology*, 99(1), 181–193. <https://doi.org/10.1037/0022-0663.99.1.181>

- Woolfolk, A. E., Rosoff, B., & Woolfolk Hoy, K. (1990). Teachers' sense of efficacy and their beliefs about managing students. *Teaching and Teacher Education*, 6(2), 137–148.  
[https://doi.org/10.1016/0742-051X\(90\)90031-Y](https://doi.org/10.1016/0742-051X(90)90031-Y)
- Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B., & Shapley, K. L. (2007, October). *Reviewing the evidence on how teacher professional development affects student achievement*. Regional Educational Laboratory Southwest.  
<http://files.eric.ed.gov/fulltext/ED498548.pdf>
- Yopp, D. A., Burroughs, E. A., Sutton, J. T., & Greenwood, M. C. (2019). Variations in coaching knowledge and practice that explain elementary and middle school mathematics teacher change. *Journal of Mathematics Teacher Education*, 22(1), 5–36.  
<https://doi.org/10.1007/s10857-017-9373-3>
- Yopp, D., Burroughs, E., & Sutton, J. (2010). *Coaching Skills Inventory*. Examining Mathematics Coaching.
- Yopp, D., Burroughs, E., Luebeck, J., Heldema, C., Mitchell, A., & Sutton, J. (2011). How to be a wise consumer of coaching. *Journal of Staff Development*, 32(1), 50–53.  
<https://learningforward.org/wp-content/uploads/2011/02/how-to-be-a-wise-consumer-of-coaching.pdf>
- Zwart, R. C., Wubbels, T., Bergen, T. C., & Bolhuis, S. (2007). Experienced teacher learning within the context of reciprocal peer coaching. *Teachers and Teaching: Theory and Practice*, 13(2), 165–187. <https://doi.org/10.1080/13540600601152520>

## APPENDICES


### Appendix A: Email Approval for CSI

RE: Coaching Skills inventory

Burroughs, Beth <burroughs@montana.edu>

Mon 6/27/2016 8:49 PM

To: Ayana Kenisha Oden <aoden1@student.gsu.edu>

 3 attachments (2 MB)

Coach Reflection and Impact Survey.pdf; Coaching Skills Inventory.pdf; Teacher Reflection and Impact Survey.pdf;

Dear Ayana,

We're happy to share the instruments with you. We just ask that you use the citation as it is listed. If you find interesting results, of course we'd be glad to hear about them.

They are attached.

All best wishes,  
Beth

--

Elizabeth A. Burroughs, Ph.D.  
Professor and Head  
Department of Mathematical Sciences  
Montana State University  
Wilson Hall 2-194  
PO Box 172400  
Bozeman, MT 59717-2400  
406.994.3322

---

**From:** Ayana Kenisha Oden [mailto:aoden1@student.gsu.edu]

**Sent:** Sunday, June 26, 2016 9:47 AM

**To:** yopp@math.montana.edu; Burroughs, Beth <burroughs@montana.edu>; sutton@rmcdenver.com

**Subject:** Coaching Skills inventory

Hello my name is Ayana Oden, and I am a doctoral student at Georgia State University. I have also worked in a local public school for the past 6 years as an instructional coach. I am beginning work on my prospectus this fall and was interested in potentially using your *Coaching Skills Inventory* and/or *Teacher Reflection and Impact Survey* as part of my dissertation. I have been unable to locate the full survey and was wondering if you could help me access it if it is indeed available. Thank you in advance for your help with this matter. Any support you could give is greatly appreciated.

Ayana Oden  
Doctoral Student GSU  
Department of Early Childhood and Elementary Education

## Appendix B: Coaching Skills Inventory (CSI)

# Coaching Skills Inventory

---

## Start of Block: Block 1

For each of the following 20 questions, please rate the items on a scale from 1 to 5 based on how effective (or confident) you are with the various coaching functions, with 1 meaning *not at all effective (or confident)* and 5 meaning *very effective (or confident)*. Please be candid in your responses, as they are anonymous.

End of Block: Block 1

---

## Start of Block: Block 2

Q1 How effective do you feel coaching teachers on mathematical content?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q2

Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on mathematics-specific pedagogy? (*Examples of mathematics-specific pedagogy include but are not limited to incorporating inquiry, discovery or*

*investigative mathematics into lessons, and incorporating problem solving and conceptual understanding into lessons.)*

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q3

Rate this item on a scale from 1 to 5 based on how confident you are with the coaching function, with 1 meaning *not at all confident* and 5 meaning *very confident*.

How confident are you with the mathematics taught at the grade levels that you coach?

- 5 = Very confident
- 4
- 3
- 2
- 1 = Not at all confident
- 

Q4

Rate this item on a scale from 1 to 5 based on how confident you are with the coaching function, with 1 meaning *not at all confident* and 5 meaning *very confident*.

How confident are you with the mathematical reasoning behind mathematics taught at the

grade levels that you coach, meaning the understanding of *why* we teach it, *how* it relates to other mathematics topics, and *why* it is valid?

- 5 = Very confident
- 4
- 3
- 2
- 1 = Not at all confident

End of Block: Block 2

---

Start of Block: Block 3

Q5 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on number sense and computation topics relevant to their classrooms?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q6 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on creating and using mathematical applications and connections for/in their mathematics classes?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q7 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on incorporating mathematics conceptual understanding into their lessons?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective

End of Block: Block 3

---

Start of Block: Block 4

Q8 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on incorporating genuine mathematical problem solving into their lessons?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q9 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on incorporating investigative, inquiry-based, or discovery-based mathematics learning into their lessons?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q10 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on engaging students in mathematical abstraction or sense-making?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective

End of Block: Block 4

---

Start of Block: Block 5

Q11 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on general (not necessarily mathematics-specific) pedagogy? (*Examples of general pedagogy include but are not limited to engaging students, use of questioning strategies, use of cooperative learning, and classroom management.*)

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q12 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on encouraging student participation in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q13 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on using strategies to increase student collaboration or dialogue among students in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q14 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on creating an environment where students listen to one another in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q15 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on the use of cooperative learning in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective

End of Block: Block 5

---

Start of Block: Block 6

Q16 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel coaching teachers on classroom management in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q17

Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel observing lessons and giving teachers feedback in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q18 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel creating environments where teachers reflect openly on their instructional practices in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q19 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel helping teachers set goals and objectives aimed at improving their instruction in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective
- 

Q20 Rate this item on a scale from 1 to 5 based on how effective you are with the coaching function, with 1 meaning *not at all effective* and 5 meaning *very effective*.

How effective do you feel creating an environment of open discussion and constructive criticism with teachers in mathematics?

- 5 = Very effective
- 4
- 3
- 2
- 1 = Not at all effective

End of Block: Block 6

---

Start of Block: Block 7

Please indicate your responses to the following 24 questions about your background and practices as an educator.

End of Block: Block 7

---

Start of Block: Default Question Block

Q21 What is the highest degree that you hold?

- BA or BS
- MA, MS, or MEd
- Specialist Degree
- PhD or EdD
- Other \_\_\_\_\_
-

Q22 Please indicate the number of mathematics content courses (not including methods courses) that you completed as part of your collegiate study for the bachelor's degree.

- 0
- 1
- 2
- 3
- 4 or more
- 

Q23 If you have earned a master's degree, please indicate the number of mathematics content courses (not including methods courses) that you completed as part of your collegiate study for that degree. Skip this question if you do not have a master's degree.

- 0
- 1
- 2
- 3
- 4 or more
-

Q24 What was your major field of study for your bachelor's degree?

- Early Childhood Education (PreK-5th)/Elementary Education
  - Special Education
  - Curriculum and Instruction
  - Reading Education
  - Early Childhood Education (Birth-Kindergarten)
  - Middle Level Education (Please specify content areas)  
\_\_\_\_\_
  - Secondary Education (Please specify content areas)  
\_\_\_\_\_
  - Other Field (Please specify)  
\_\_\_\_\_
-

Q25 If you have a master's degree, what was your major field of study for that degree?

- I don't have a graduate degree
- Early Childhood PreK-5th/Elementary Education
- Special Education
- Curriculum and Instruction
- Reading Education
- Early Childhood Education (Birth-Kindergarten)
- Middle Level Education (Please specify content areas)  
\_\_\_\_\_
- Secondary Education (Please specify content areas)  
\_\_\_\_\_
- Other Field (Please specify)  
\_\_\_\_\_

-----

Q26 Including this year, and rounding up to a whole numeral, how many school years have you **taught (not coached)** on a full-time basis at any grade level within grades K-5?

- 1-5 years
  - 6-10 years
  - 11-15 years
  - 16-20 years
  - 21 or more years
-

Q27 Including this year, and rounding up to a whole numeral, how many of those school years included **teaching mathematics** within any grade level within K-5?

- 1-5 years
  - 6-10 years
  - 11-15 years
  - 16-20 years
  - 21 or more years
- 

Q28 Which of the following best describes your current assignment?

- I am an instructional coach who supports classroom teachers
  - I am a classroom teacher who also coaches other classroom teachers.
  - I have multiple responsibilities that include coaching other classroom teachers but not working as a classroom teacher.
  - None of the above
- 

Q29 Including this year, and rounding up to a whole numeral, how many years have you served as a **coach** within grades K-5?

- 1-5 years
  - 6-10 years
  - 11-15 years
  - 16-20 years
  - 21 or more years
-

Q30 How many of those school years included **coaching teachers of mathematics** within grades K-5?

- 1-5 years
  - 6-10 years
  - 11-15 years
  - 16-20 years
  - 21 or more years
- 

Q31 Do you have a specific certificate or endorsement for teaching K-5 mathematics?

- Yes
  - No
- 

Q32 Do you have a specific certificate or endorsement for coaching teachers?

- Yes
- No

End of Block: Default Question Block

---

Start of Block: Block 8

Q33 How do you describe your racial or ethnic background?

- Asian
  - Black/African American
  - White/Caucasian
  - Hispanic (may be any race)
  - Multi-racial
  - Other (Please Specify) \_\_\_\_\_
- 

Q34 How do you describe your gender identity?

- Male
- Female
- Transgender Male
- Transgender Female
- Gender variant/Non-Conforming
- Other
- Prefer not to answer

End of Block: Block 8

---

Start of Block: Block 9

Q35 Please indicate the number of teachers that you currently coach in mathematics.

- 1-5
- 6-10
- 11 -15
- 16 or more
- 

Q36 Please indicate the number of subject areas you currently coach **including** mathematics.

- 1
- 2
- 3
- 4
- 5 or more
- 

Q37 In general, how effective do you feel your school administrator(s) is/are with providing support for your mathematics coaching?

- Extremely effective
- Very effective
- Moderately effective
- Slightly effective
- Not at all effective
-

Q38 Please indicate the number of professional development hours focused on mathematics you have completed as a participant in the past 12 months.

- 0-10 hours
  - 11-20 hours
  - 21-30 hours
  - 31-40 hours
  - 41 or more hours
- 

Q39 What percentage of your work day is typically allocated to mathematics coaching of teachers (examples including but not limited to conferences, observations, and PLC meetings)?

- 0-25%
  - 26-50%
  - 51-75%
  - 76-100%
- 

Q40 What percentage of your work day is typically allocated to mathematics coaching of new and first year teachers?

- 0-25%
  - 26-50%
  - 51-75%
  - 76-100%
-

Q41 What percentage of your work day is typically allocated to serving students in mathematics (examples including but not limited to small group instruction, covering classes, and tutorial)?

- 0-25%
  - 26-50%
  - 51-75%
  - 76-100%
- 

Q42 What percentage of your work day is typically allocated to administrative tasks (examples including but not limited to meetings with administrators/counselors, responding to email/voicemail requests, and managing budgets/resources)?

- 0-25%
  - 26-50%
  - 51-75%
  - 76-100%
- 

Q43 For many, a typical coaching session has three primary components: 1) the pre-lesson conference; 2) the lesson observation; and 3) the post lesson conference. On average how many mathematics coaching sessions do you conduct with a teacher in a week?

- 0-2 sessions
  - 3-5 sessions
  - 6 or more sessions
-

Q44 What are the particular mathematics curricula or signature program used at your school?

- STEM
- International Baccalaureate Program
- Eureka Mathematics/Engage NY
- Other (Please Specify)
- 

Q45 Rank these factors in order of importance from 1 to 6, with 1 being most important and 6 being least important, for your mathematics coaching effectiveness.

- \_\_\_\_\_ the number of teachers you support
- \_\_\_\_\_ the amount of time available for you to spend with teachers
- \_\_\_\_\_ the number of subject areas you support
- \_\_\_\_\_ the support of your principal
- \_\_\_\_\_ the amount of mathematics professional development available for you as a coach
- \_\_\_\_\_ the use of a mandated mathematics curriculum
- 

Q46 The number of teachers I coach is

- too many
- not enough
- right amount
-

Q47 Rank these factors in order of importance from 1 to 5, with 1 being most important and 5 being least important, for your mathematics coaching effectiveness.

- \_\_\_\_\_ level of degree obtained
  - \_\_\_\_\_ number of university mathematics content course completed
  - \_\_\_\_\_ specialized education such as completion of a K-5 mathematics endorsement/certificate or coaching endorsement/certificate
  - \_\_\_\_\_ years of experience teaching K-5 mathematics
  - \_\_\_\_\_ years of experience coaching K-5 mathematics
- 

Q48 The number of subject areas I am responsible for coaching is

- too many
  - not enough
  - right amount
- 

Q49 Rank the following items in order of importance from 1 to 5, with 1 being most important and 5 being least important, as ways your administration could support your mathematics coaching effectiveness.

- \_\_\_\_\_ allot more time for collaborative planning with teachers
  - \_\_\_\_\_ allot more time for sharing and modeling effective teaching strategies
  - \_\_\_\_\_ allot more time for observing and providing feedback on teachers' instruction
  - \_\_\_\_\_ allot more time for administrative tasks assigned to you
  - \_\_\_\_\_ allot more time for supporting teachers' classroom management
- 

Q50 Rank the following responsibilities from 1 to 5, with 1 being most important and 5 being least important, of what contributes to your mathematics coaching effectiveness.

- \_\_\_\_\_ collaborative planning with teachers
- \_\_\_\_\_ sharing and modeling effective teaching strategies
- \_\_\_\_\_ observing and providing feedback on teachers' instruction
- \_\_\_\_\_ working on administrative tasks assigned to you
- \_\_\_\_\_ supporting teachers' classroom management

End of Block: Block 9

---

Start of Block: Block 10

The March 2020 school closures due to the Covid-19 health pandemic changed the way schools operated as districts shifted to online instruction. Please explain how your work as an instructional coach of mathematics has been modified in the following areas.

---

Q51 How has your mathematics coaching changed since the onset of Covid-19?

---

---

---

---

---

Q52 How has the content of the mathematics professional development you provide changed since the onset of Covid-19?

---

Q53 What have been the most challenging aspects of mathematics coaching during the Covid-19 pandemic?

---

End of Block: Block 10

---

### Appendix C: Self-Efficacy Scores by Item

CSI Mean and Standard Deviation by Item

| Item: How effective/confident do you feel coaching teachers on... | <i>M</i> | <i>SD</i> |
|---|----------|-----------|
| mathematics content   | 3.96     | .727      |
| mathematics pedagogy  | 3.86     | .775      |
| the mathematics taught at the grade levels coached                | 4.20     | .800      |
| the mathematical reasoning behind the mathematics                 | 3.96     | .799      |
| number sense and computation                                      | 4.29     | .729      |
| creating and using mathematical applications/connections          | 3.98     | .787      |
| incorporating mathematics conceptual understanding                | 4.02     | .905      |
| incorporating genuine mathematical problem solving                | 4.04     | .662      |
| incorporating investigative, inquiry or discover-based math       | 3.65     | .844      |
| engaging students in math abstraction or sense-making             | 3.71     | .756      |
| general (not necessarily mathematics-specific) pedagogy           | 4.42     | .702      |
| encouraging student participation in mathematics                  | 4.43     | .700      |
| using strategies to increase student collaboration/dialogue       | 4.27     | .750      |
| creating an environment where students listen to one another      | 4.16     | .857      |
| the use of cooperative learning in mathematics                    | 4.22     | .832      |
| classroom management in mathematics                               | 4.41     | .669      |
| observing lessons and giving teachers feedback in math            | 4.27     | .723      |
| creating environments where teachers reflect on instruction       | 4.02     | .905      |
| helping teachers set goals and objectives in improving            | 3.80     | .800      |
| creating an environment of open discussion and criticism          | 3.76     | .764      |

### Appendix D: Raw Data Table

#### Percentage by Responses for Survey Items

| Item # | Item description                           | Responses (%)                         |                         |                                   |  |                 |
|--------|--|---------------------------------------|-------------------------|-----------------------------------|--|-----------------|
| 21     | Highest degree                             | PhD/EdD<br>(11.0)                     | Specialist<br>(47.1)    | MA/Med<br>(37.3)                  |  | BA/BS<br>(2.0)  |
| 22     | Mathematics content courses (bachelor's)   | 4+<br>(29.4)                          | 3<br>(35.3)             | 2<br>(21.6)                       | 1<br>(5.9)                               | 0<br>(5.9)      |
| 23     | Mathematics content courses (master's)     | 4+<br>(9.8)                           | 3<br>(9.8)              | 2<br>(25.5)                       | 1<br>(21.6)                              | 0<br>(25.5)     |
| 24     | Field of study for bachelor's              | Math<br>(27.5)                        | Math intensive (3.9)    | Secondary mathematics<br>(13.7)   | Elementary ed (52.9)                     | Other<br>(2.0)  |
| 25     | Field of study for graduate degree         | Math<br>(5.9)                         | Math intensive<br>(7.8) | Secondary mathematics<br>(13.7)   | Elementary ed<br>(35.3)                  | Other<br>(29.4) |
| 26     | Years taught in grades K–5                 | 21+<br>(5.9)                          | 16–20<br>(11.8)         | 11–15<br>(37.3)                   | 6-10 (23.5)                              | 1-5<br>(19.6)   |
| 27     | Years taught mathematics in grades K–5     | 21+<br>(2.0)                          | 16–20<br>(13.7)         | 11–15<br>(29.4)                   | 6-10 (31.4)                              | 1-5<br>(21.6)   |
| 28     | Description of your current assignment     | Coach working with teachers<br>(76.5) |                         | Teacher who also coaches<br>(2.0) | Multiple roles including coach<br>(17.6) |                 |
| 29     | Years coaching (any subject) K–5           | 21+                                   | 16–20<br>(3.9)          | 11–15<br>(3.9)                    | 6-10 (19.6)                              | 0-5<br>(70.6)   |
| 30     | Years coaching mathematics K–5             | 21+                                   | 16–20<br>(7.8)          | 11–15                             | 6-10 (17.6)                              | 1-5<br>(70.6)   |
| 31     | K–5 Mathematics Endorsement or certificate |                                       | Yes<br>(29.4)           |                                   | No<br>(68.6)                             |                 |
| 32     | Coaching Endorsement or certificate        |                                       | Yes<br>(33.3)           |                                   | No<br>(64.7)                             |                 |
| 33     | Ethnic background                          | Black/African American<br>(72.5)      |                         | White/Caucasian<br>(19.6)         | Hispanic (may be any race)<br>(5.9)      |                 |

Table continues

| Item # | Item description                                | Responses (%)             |                                    |                             |                           |                      |
|--------|---|---------------------------|------------------------------------|-----------------------------|---------------------------|----------------------|
|        |   | Male (11.8)               |                                    | Female (86.3)               |                           |                      |
| 34     | Gender  |                           |                                    |                             |                           |                      |
| 35     | Number of teachers coaching                     | 1–5 (33.3)                | 6–10 (17.6)                        | 11–15 (29.4)                | 16+                       | (13.7)               |
| 36     | Number of subject areas coaching                | 1 (15.7)                  | 2 (21.6)                           | 3 (7.8)                     | 4 (29.4)                  | 5+ (17.6)            |
| 37     | School administrator(s) support                 | Extremely effective (3.9) | Very effective (7.8)               | Moderately effective (23.5) | Slightly effective (41.2) | Not effective (17.6) |
| 38     | PD hours in mathematics in 12 months            | 41+ (13.7)                | 31–40 (11.8)                       | 21–30 (15.7)                | 11–20 (29.4)              | 0–10 (23.5)          |
| 39     | % of work day coaching mathematics              | 76–100 (5.9)              | 51–75 (19.6)                       | 26–50 (37.3)                | 0–25 (29.4)               |                      |
| 40     | % of work day coaching new mathematics teachers | 76–100                    | 51–75 (3.9)                        | 26–50 (27.5)                | 0–25 (62.7)               |                      |
| 41     | % of work day serving students in mathematics   | 76–100                    | 51–75 (19.6)                       | 26–50 (19.6)                | 0–25 (68.6)               |                      |
| 42     | % of work day allocated to administrative tasks | 0–25 (2.0)                | 26–50 (9.8)                        | 51–75 (39.2)                | 76–100 (43.1)             |                      |
| 43     | Mathematics coaching sessions weekly            |                           | 6+                                 | 3–5 (27.5)                  | 0–2 (66.7)                |                      |
| 44     | School math curriculum                          | STEM (25.4)               | International Baccalaureate (13.4) | Eureka Math (29.9)          | Other (31.3)              |                      |
| 46     | Number of teachers I coach                      |                           | Too many (31.3)                    | Not enough (41.2)           | Right amount (64.6)       |                      |
| 48     | Number of subjects I coach                      |                           | Too many (41.7)                    | Not enough                  | Right amount (58.3)       |                      |