

Gaining Confidence: Increasing Elementary Mathematics Teaching Self-Efficacy Through Coaching

Stephanie B. Purington 
Marist University

Jesslyn R. Hollar 
University of Nebraska at Kearney

Abstract

Mathematics coaching is a professional development intervention being used to improve student learning. As student achievement has been linked to teacher self-efficacy, this study investigated whether an individual math coaching program for elementary teachers improved their mathematics teaching self-efficacy. Personal Mathematics Teaching Efficacy was improved in a statistically significant way over the ten-week intervention, but Mathematics Teaching Outcomes Expectancy did not increase significantly. Interviews indicated that teachers sought and received validation for their teaching from the coaches, likely contributing to the increase in self-efficacy. Schools and districts could consider implementing coaching to improve teacher self-efficacy.

Keywords: Instructional coaching, Math Teaching Efficacy, Elementary Mathematics, Teacher Professional Learning

Introduction

Beliefs about one's capability as a learner of mathematics influence math teacher learning and teaching (Bandura, 1986b). Teachers' self-efficacy around math instruction has been shown to positively impact students' achievement and confidence in mathematical learning (e.g. Chang, 2015). Improving teachers' self-efficacy and mathematics teaching efficacy has the potential to increase student achievement in mathematics. Consequently, districts have increased their investments in high-quality professional learning opportunities targeting teacher self-efficacy and mathematics teaching efficacy to improve teachers' self-efficacy in mathematics.

Instructional coaching is one form of professional learning designed to support teacher effectiveness in teaching literacy, and, increasingly, in mathematics teaching. Instructional coaching has been linked to improved teacher confidence and teacher self-efficacy (TSE). When implemented effectively, instructional coaching embeds professional learning into teachers' daily practice. Instructional coaching, when done well, is an opportunity to embed professional learning in educators' day-to-day work. With a minimal outlay of resources, effective instructional coaching models build the capacity of teachers, improve teacher retention, and raise student achievement.

While the benefits of instructional coaching have been explored as a school improvement strategy, fewer studies investigate instructional coaching related to mathematics instruction and elementary mathematics teachers' self-efficacy. This study connects these two bodies of research on instructional coaching with research on teacher self-efficacy and applies them in the context of mathematics teaching. More specifically, this study examines the impact of an instructional coaching cycle on elementary school teachers' reported mathematics teaching self-efficacy and their reported mathematics teaching outcomes expectations.

Theoretical and Conceptual Framework

The study uses Bandura's (1977) theory of self-efficacy as a theoretical pillar. As researchers, we adopted the following theory of action related to this study: High levels of teacher self-efficacy and mathematics teaching efficacy impact student learning. If math teachers engage in a cycle of intentional instructional coaching around mathematics instruction, math teachers' reported levels of mathematics teaching efficacy will improve. Improving educators' mathematics teaching efficacy through instructional coaching may positively influence students' mathematical learning.

Self-efficacy

For our study, we draw upon Bandura's (1977) theory of self-efficacy which highlights the power of belief in one's capabilities to shape behavior and achieve success. Bandura (1977) identifies four factors as contributing to self-efficacy: 1) prior performance – how one performed previously on a similar task; 2) vicarious performance – seeing how others perform at the same task; 3) verbal persuasion – encouragement from others; and 4) physiological cues – nervousness or excitement.

Bandura's theory of self-efficacy is an extension of Rotter's (1966) theory of locus of control. In this theory of locus of control, Rotter contends that individuals have different understandings and beliefs about their ability to influence outcomes: some believe outcomes are out of their control, while others believe themselves to be in control of outcomes. In this view, the locus of control describes a person's beliefs about their influence over outcomes. Rotter distinguishes between an *internal locus of control* and an *external locus of control* (Rotter, 1966). People with an internal locus of control believe their actions determine outcomes whereas those with an external locus of control attribute outcomes to external factors.

Bandura extends Rotter's work by theorizing that the extent to which one believes oneself to be in control of outcomes is a function of one's capabilities (1977, 1986a, 1997). When applied to education, if an intervention can increase a teacher's capacity to believe themselves capable and thus have the locus of control over some domain-specific tasks such as multiplying multi-digit numbers, then the teacher is more likely to also believe they are in control of individual student learning of that task. In essence, self-efficacy is a construct that represents a measure of teachers' beliefs about their ability to be in control of outcomes (Bandura, 1977, 1986a, 1997).

Teacher self-efficacy influences teachers' thoughts and emotions, which in turn enable or inhibit actions (Gavora, 2010). Gavora (2010) also notes that differences in teacher effectiveness may be largely the result of teaching self-efficacy. Greater self-efficacy catalyzes positive thoughts and emotions which enable actions: teachers with high levels of self-efficacy are more likely to persist in the face of challenges and be less fatalistic about their ability to overcome such challenges (Gibson & Dembo, 1984). Similarly, teachers with strong self-efficacy are more likely to persist when trying something new or when implementing new instructional strategies and pedagogical skills (Holzberger et al., 2013).

Under this construct, students would presumably benefit from teachers with higher levels of self-efficacy. That is, students would benefit from learning from teachers who believe themselves to be in control of their fates, who are more persistent in overcoming challenges, and who are more flexible in adapting new skills and strategies into their teaching practice (Tschannen-Moran & Woolfolk Hoy, 2001; Woolfolk Hoy et al., 2009; Zee & Koomen, 2016).

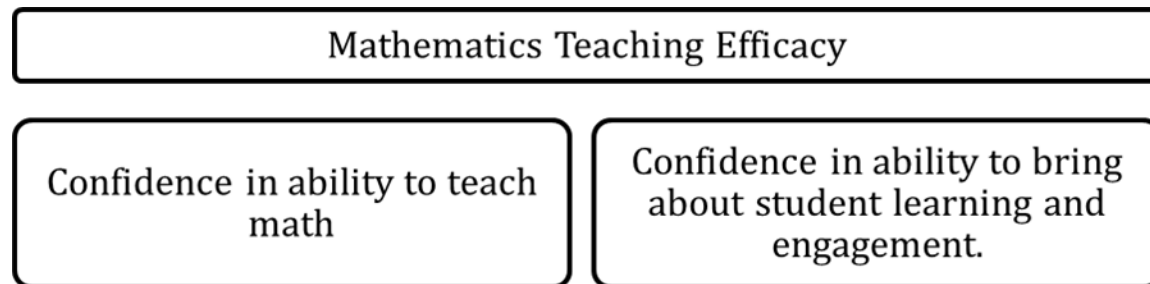
Teachers' Math Self-efficacy and Mathematics Teaching Efficacy

Educational researchers claim that a teacher's self-efficacy has a significant positive impact on student learning (e.g., Hickman & Sherman, 2019; Klassen & Tze, 2014). We turn now to address the research that examines self-efficacy and teaching efficacy through a lens of mathematics and mathematics instruction.

Mathematics self-efficacy is a person's belief about their ability to do, perform, or learn mathematics (Bandura, 1986b). Similarly, mathematics teaching efficacy is a teacher's belief about their ability to teach mathematics, and in particular, a belief in their ability to bring about student learning and engagement (Tschannen-Moran & Woolfolk Hoy, 2001). See Figure 1 for additional details. Importantly, mathematics teaching efficacy goes beyond teacher competence in that it encompasses not only knowledge and skills but the ability to enact knowledge and skills in practice (Zuya et al., 2016). Theoretically, an educator with high mathematics teaching efficacy would have an internal locus of control and should feel more in control of outcomes (i.e., student learning and engagement).

Figure 1

Components of Mathematics Teaching Efficacy



While this study focuses only on mathematics teaching efficacy, teachers' own math self-efficacy is positively correlated with teachers' mathematics teaching efficacy. Teachers who are confident in their own mathematical abilities are likely to believe they can directly impact students' mathematical learning (Bates et al., 2011). There is a strong relationship between mathematics self-efficacy and mathematics achievement (Siegle & McCoach, 2007). Similarly, in a study by Stevens et al. (2004), students assigned to teachers with high self-efficacy reported higher perceptions of mathematical ability in their final years of elementary school and middle school. Students paired with teachers with high self-efficacy perceived math as less difficult and expected to do better at math in the future than those students paired with teachers with lower self-efficacy (Stevens et al., 2004). In contrast, students who had been paired with high efficacious teachers in elementary school but who were paired with lower efficacious teachers in middle school, experienced declines in their perceived mathematical abilities; they judged the content as more difficult than their peers (Stevens et al., 2004). In general, lower achieving students were more sensitive to the efficacy level of their teachers. This suggests that pairing high efficacy teachers with lower achieving students in math instruction might result in improved math achievement for those students (Stevens et al., 2004). Additionally, teachers' teaching self-efficacy impacts teachers' choices of instructional strategies, pedagogical tools, and impacts the classroom climate, which in turn influences student learning (e.g., Siegle & McCoach, 2007). In an additional study, Xenofontos and Andrews (2020) use qualitative semi-structured interviews to probe teachers' understandings of self-efficacy around themes related to past experiences with mathematics, resilience, and mathematical competence. The authors highlight

the complexity of self-efficacy and its measurement. Thus, improving teachers' math self-efficacy and mathematics teaching efficacy is likely to improve students' math self-efficacy and overall achievement in mathematics.

Instructional Coaching

Schools have embraced instructional coaching as a model for professional learning. District leaders have recognized that one-off professional development days and professional learning workshops are ineffective models for sustaining improvement in teaching and learning (Ball & Cohen, 1999). Instead, investing in job-embedded interventions such as instructional coaching may produce more effective educators and stronger student outcomes. Investment in job-embedded interventions such as instructional coaching rather than standalone professional learning workshops may lead to more effective educators and increased outcomes for students. A meta-analysis by Kraft et al. (2018) finds causal evidence of the outsized impact of coaching on student achievement. Additionally, coaching is more economical when compared to traditional teacher development programs.

White et al. (2015) built on the work of Hanft et al. (2004) in identifying a conceptual framework for instructional coaching. They identified the following progression for successful coaching: joint planning between the coach and teacher; opportunity for the teacher to analyze or practice the new skills and strategies identified in the plan; the opportunity for the coach to observe the teacher, the teacher to observe the coach, or both; opportunity for the teacher to reflect; feedback from the coach; and reflective discussion between the coach and teacher. They argue that these stages provide the strongest opportunity for success with an instructional coaching program. While the progression should be followed for all teachers, the actual skills and strategies identified will be individualized for each teacher, based on their personal skills and needs (Wang, 2017).

A robust research base deems instructional coaching a high impact instrument for instructional change (e.g., Coburn & Woulfin, 2012; Desimone & Pak, 2017; Kraft et al., 2018; Russell et al., 2020; Woulfin & Rigby, 2017). In fact, Tschannen-Moran & McMaster (2009), found that instructional coaching designed to support mastery experiences had the strongest impact on teacher self-efficacy of four professional development models studied. Instructional coaching embeds professional learning opportunities into the day-to-day work of teachers (Heineke, 2013; Kraft et al., 2018). It also mediates the relationship between policy and classroom practice (Coburn & Woulfin, 2012). As coaches often work directly with teachers to support educator learning and shift classroom practice, instructional coaching can increase teacher efficacy to promote students' learning (Kraft et al., 2018; Russell et al., 2020; Woolfolk Hoy & Spero, 2005).

Districts approach coaching differently and with considerable variation (Hannan & Russell, 2020). Some districts view coaching as a lever for compliance (Coburn & Woulfin, 2012), or view coaches as thought partners, mentors, and collaborators (Sailors & Price, 2015). In addition to the function of coaching, the mode of coaching also varies considerably. Some coaching models embed coaches at one school and in teachers' classrooms, while other models envision coaching as an intervention for collective school improvement (Gibbons et al., 2017). Others have coaches travel throughout the district or approach coaching virtually. Still others prioritize coaching for teachers with a certain number of years of experience or in specific academic disciplines. Despite the variation in the model, using instructional coaching to build teacher efficacy; when the elements of a good coaching model are implemented, can cultivate success for teachers and students (Althausen, 2015; Marzano & Simms, 2014; Woolfolk Hoy & Spero, 2005).

When embarking on an instructional coaching cycle, there are critical elements to good instructional coaching models (Eastman, 2019). First, the coach/teacher relationship must be built on trust. Second, partners must develop confidence and identity as coaches and teachers. Third, the

collaborative model must scaffold experiences for the teacher based on the coach's ability to actively listen, ask reflective questions, and provide timely and appropriate feedback during the instructional coaching cycle. Additionally, in another study, three specific coaching actions - modeling, practice, and feedback - but especially practice during the coaching cycle, led to increased student achievement (Glover et al., 2023).

Similar to other instructional coaches, the role of mathematics coaches in instructional reform and institutional change continues to evolve (Hopkins et al., 2016). Mathematics coaches, and especially mathematics coaches with training and experience, positively affect student mathematics achievement over time (Campbell & Malkus, 2011). In Gibbons and Okun's (2023) study of a mathematics coaching routine termed *Teacher Time Out*, dedicated time to address complex pedagogical moves in-the-moment developed math teachers' collaborative inquiry into their teaching practice and enhanced equitable and ambitious teaching practices by facilitating mathematics discussions amongst students.

Instructional Coaching and Self-Efficacy

When identifying coaching as the professional development model which most significantly affected self-efficacy, Tschannen-Moran & McMaster (2009) theorized how the coaching elements were related to Bandura's four elements of self-efficacy. Verbal persuasion from a coach could encourage a teacher to try new strategies or activities, despite the effort needed. By watching a coach model a lesson, a teacher could have the vicarious experience of success with a strategy. This was found most impactful if the teacher felt their capabilities to be similar to those of the coach. Having mastery experiences early in the coaching process was seen as critical to the growth of self-efficacy, and early failures were difficult to overcome. Having the opportunity to practice skills in a supportive setting allowed for a reduction in the fear of failure, which align with physiological cues of fear and nervousness.

Several studies showed an increase in self-efficacy when participants took part in either a coaching program or coaching training. In these studies, there was a focus on observation of modeled lessons, instructional support, and feedback (Goker, 2006; Panfillo-Padden, 2014; Entwistle & Rees-Davies, 2025). Pearson (2016) similarly found that the coaching activities of modeling instruction and classroom management strategies led to increases in teacher self-efficacy in student engagement and instructional practices. Walsh et al. (2020), mirroring the findings of Eastman (2019), note that the coaching process needs to be built on a collaborative model that builds trust between the coach and teacher and allows both parties to grow in their skills and confidence.

Few studies were found that addressed instructional coaching and self-efficacy in mathematics. Fewer still measured mathematics teaching self-efficacy in a quantitative manner. Bruce and Ross (2008) found that peer-coaching among elementary teachers improved their self-efficacy for teaching mathematics, but the data were qualitative in nature. Vicarious experiences, through observing other teachers, were noted to be a strong contributor to the increased self-efficacy; as they were able to more confidently implement new strategies after seeing them modeled. Participants also related that their students' enthusiasm and improvement contributed to increased self-efficacy.

Several recent dissertations have also examined the link between mathematics coaching and self-efficacy (Barnes, 2025; Rosato, 2019; Strong, 2021). In a study of high school mathematics teachers, Barnes (2025) did find a significant increase in self-efficacy after a coaching cycle. Strong (2021), who used a version of the Mathematics Teacher Efficacy Beliefs Instrument (MTEBI) that focused specifically on mathematical practices, reported increased self-efficacy for K-2 teachers after a six-week coaching cycle. This study did not, however, present quantitative data to support the

qualitative analysis of improved confidence. Rosato's study (2019) looked at coaching across multiple subjects, including mathematics, for elementary teachers. Using the Teachers' Sense of Efficacy Scale, she did not find a significant increase in self-efficacy, though coaching did impact teacher instructional practices. As so few studies have examined the impact of mathematics instructional coaching on mathematics teaching self-efficacy, this study may help to fill that gap.

Statement of the Problem

Strong mathematics self-efficacy and mathematics teaching efficacy are essential constructs that positively influence teachers' attitudes and behaviors toward mathematics teaching. Teachers with a high sense of mathematics self-efficacy and mathematics teaching efficacy are thought to be effective math educators. Instructional coaching, when done well, has been shown to be an effective form of job-embedded professional learning. As such, instructional coaching holds potential in supporting increases in teaching efficacy. Teachers need professional learning opportunities that enhance their capacity for effective mathematics instruction. This study seeks to answer the following research question: To what degree did a ten-week coaching cycle improve the mathematics teaching efficacy of elementary teachers?

Methodology

This study employed a convergent mixed-methods design which combined survey data with qualitative interviews (Creswell & Plano Clark, 2011). This allowed us to elicit contextualized insights from participants' experiences, perceptions of the coaching cycle, and offset some of the cautions from Xenofontos and Andrews (2020) related to quantitative analyses of self-efficacy. All methods and materials were submitted to the Institutional Review Board (IRB) prior to initiating any steps in the study. Additionally, our research was reviewed by the IRB and determined to be exempt (45 CFR 46). Since this research involved partners in a school district, the research team also received a letter of support for the research study from the school district. Informed consent/assent from all participants was obtained.

Participants

Individuals (n=17) were purposefully selected based on their participation in the coaching cycle. Participation in the study was entirely voluntary, and all participants were informed of their rights, including the right to withdraw from the study at any time without consequence.

Participants were classroom teachers in two K-6 elementary schools in a regional school district who participated in a required ten-week mathematics coaching cycle. Half participated during the second quarter of the school year and the other half during the third quarter. Although participation in the study was optional, all teachers in the two coaching cycles agreed to participate. The coaches were former teachers in the district who were identified as having strong mathematics skills and were hired into the coaching roles. In this document, all participants have been assigned pseudonyms.

Description and Format of the Coaching Cycle

After identifying weaknesses in their math program, the district had recently implemented a new mathematics curriculum and concurrently implemented this mathematics coaching program. One primary goal of the coaching program was to help teachers implement the program with fidelity. Each teacher worked either one-on-one with one of two math instructional coaches, or with

a co-teacher and one of the coaches. At the beginning of the coaching cycle, the coach and teacher(s) collectively surfaced one or more goals to work on over the next ten weeks. These goals are described in the findings.

The coach and teacher(s) were scheduled to meet at least once every six days for a common planning time. Weather, absence of the coach or teacher, and other professional development obligations sometimes impacted meeting times. Some teachers chose to meet more frequently with the coaches, as their schedules permitted.

During this dedicated planning time, the coaches and teachers collaboratively examined curriculum, developed lesson plans, or otherwise worked to further the goal(s) chosen by the teacher. In addition, coaches observed classes, taught portions of classes to model pedagogical strategies, and led group work to help address classroom needs. Elaboration on the coaching practices can be found in the findings.

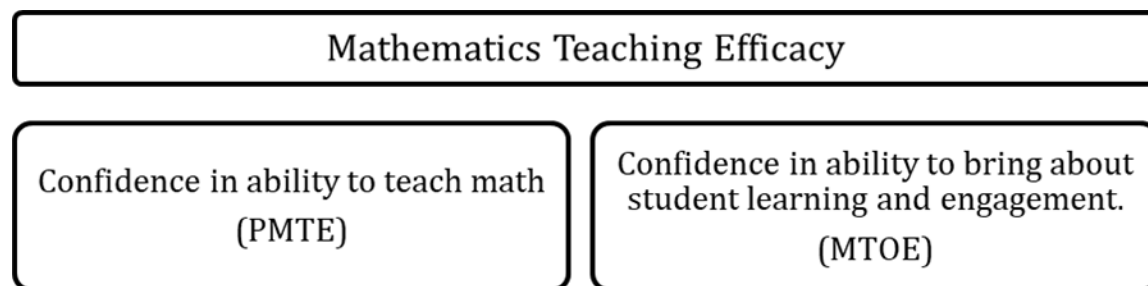
Data Collection

Pre/Post Survey Instrument

Prior to the beginning of the coaching cycle and at the end of the coaching cycle, each teacher completed the Mathematics Teacher Efficacy Beliefs Instrument (MTEBI), a twenty-one-item survey developed by Huinker and Enochs (1995), with a five-point Likert scale. The MTEBI has been shown to measure two constructs, Personal Mathematics Teaching Efficacy (PMTE), which indicates how capable the teachers feel about teaching mathematics at the elementary school level, and Mathematics Teaching Outcomes Expectations (MTOE). The MTOE indicates how much impact elementary teachers believe they have on the learning outcomes of their students (Huinker & Enochs, 1995; Enochs et al., 2000). Figure 2 illustrates how the two components relate to the earlier discussion of mathematics teaching self-efficacy.

Figure 2

Relationship of MTEBI constructs to Mathematics Teaching Efficacy



The MTEBI was initially designed to study the self-efficacy of pre-service teachers but, as the types of questions asked addressed the beliefs we were interested in exploring; we adapted some questions to make them more applicable to in-service teachers (Figure 3).

Figure 3*MTEBI Items (Adapted)*

1. When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort. (MTOE)
2. I continually find better ways to teach mathematics. (PMTE)
3. Even if I try very hard, I will not teach mathematics as well as I will most subjects. (PMTE)*
4. When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach. (MTOE)
5. I know how to teach mathematics concepts effectively. (PMTE)
6. I am not very effective in monitoring mathematics activities. (PMTE)*
7. If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching. (MTOE)
8. I generally teach mathematics ineffectively. (PMTE)*
9. The inadequacy of a student's mathematics background can be overcome by good teaching. (MTOE)
10. When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher. (MTOE)
11. I understand mathematics concepts well enough to be effective in teaching elementary mathematics. (PMTE)
12. The teacher is generally responsible for the achievement of students in mathematics. (MTOE)
13. Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching. (MTOE)
14. If parents comment that their child is showing more interest in mathematics at school, it is probably due to the performance of the child's teacher. (MTOE)
15. I find it difficult to use manipulatives to explain to students why mathematics works. (PMTE)*
16. I am typically able to answer students' questions. (PMTE)
17. I wonder if I have the necessary skills to teach mathematics. (PMTE)*
18. Given a choice, I would prefer not to invite the principal to evaluate my mathematics teaching. (PMTE)*
19. When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better. (PMTE)*
20. When teaching mathematics, I usually welcome student questions. (PMTE)
21. I do not know what to do to turn students on to mathematics. (PMTE)*

* Indicates that the item is reverse-coded.

Semi-Structured Teacher Interviews

In addition, each teacher was interviewed at the end of the coaching cycle, using a semi-structured interview protocol, co-designed by the researchers and the coaching team (Figure 4). The goal was to better understand teachers' perspectives of the coaching process. Interviews were conducted using video technology and recorded with participant permission. When recording was not possible, the interviewer took detailed notes. All interviews were transcribed and verified for accuracy.

Figure 4

Semi-Structured Interview Questions

COACHING

1. Please share a bit about how you approach math instruction in your classroom.
2. Can you talk about how you engaged with the recent cycle of math instructional coaching?
3. In what ways do you think your approach to teaching mathematics has changed after the math instructional coaching cycle? Can you talk about specific changes you've made to your math instruction based on the coaching you received?
4. Can you talk a bit about the goal you set with your instructional coaches in this coaching cycle? Do you feel as though you made progress toward the goal you established with your coaches?

TEACHING

5. What are your goals for your students when it comes to mathematics?
6. What types of instructional strategies do you find to be particularly effective for teaching mathematics?

SELF

7. Now, would you mind speaking a bit about yourself as a learner:
 - a. How did you engage with math instruction as a learner?
 - b. What did "learning" and "success" in mathematics look and feel like for you as a student?
8. How confident are you in your ability to teach mathematics in ways that might be different from the ways you learned?

Data Analysis

To look for any significant changes in teacher self-efficacy, one-tailed, paired sample *t*-tests were run on the MTEBI data to compare the pre- and post-item scores for PMTE, MTOE, and each individual item.

To explore how the coaching process might be linked to any changes in teacher self-efficacy, the research team, consisting of three primary researchers, manually coded the interview transcripts using thematic coding (Braun & Clark, 2006). Both coaching goals and the coaching process were examined to identify how the coaching program was implemented for each participant. The interviews were further analyzed to identify salient patterns and recurring themes in the responses that might offer insight as to why changes in self-efficacy were or were not found.

Findings

The evaluation of the data from this instructional coaching cycle revealed a range of insights. Survey findings indicate significant increases in Personal Mathematics Teaching Efficacy (PMTE), but not

in Mathematics Teaching Outcomes Expectancy (MTOE). What follows is a more detailed description of these findings along with supporting evidence from the interviews.

MTEBI Survey Findings

Personal Mathematics Teaching Efficacy

From the analysis of the MTEBI data, PMTE increased by a statistically significant amount (Table 1). Within the PMTE construct, six of the thirteen indicators increased significantly. These items included items numbered 6, 11, 16, 16, 19, and 20.

Table 1

Personal Mathematics Teaching Efficacy Results

Personal Mathematics Teaching Efficacy (PMTE)	Pre-Coaching Mean	Post-Coaching Mean	Δ	p-Value
Overall PMTE (Range is 13-65)	54.15	57.09	2.94	0.004*
For questions below, 5=strongly agree				
2. I continually find better ways to teach mathematics.	4.21	4.53	0.32	0.06
5. I know how to teach mathematics concepts effectively.	4.00	4.24	0.24	0.08
11. I understand mathematics concepts well enough to be effective in teaching elementary mathematics.	4.06	4.74	0.68	0.0004*
16. I am typically able to answer students' questions.	4.41	4.62	0.21	0.02*
20. When teaching mathematics, I usually welcome student questions.	4.59	4.76	0.18	0.04*
For questions below, 5=strongly disagree				
3. Even if I try very hard, I will not teach mathematics as well as I will most subjects.	4.35	4.12	-0.24	0.15
6. I am not very effective in monitoring mathematics activities.	4.00	4.29	0.29	0.03*
8. I generally teach mathematics ineffectively.	4.29	4.41	0.12	0.29
15. I find it difficult to use manipulatives to explain to students why mathematics works.	4.29	4.35	0.06	0.36
17. I wonder if I have the necessary skills to teach mathematics.	3.88	4.41	0.53	0.01*
18. Given a choice, I would prefer not to invite the principal to evaluate my mathematics teaching.	4.06	4.12	0.06	0.41
19. When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better.	4.12	4.44	0.32	0.03*
21. I do not know what to do to turn students on to mathematics.	3.88	4.06	0.18	0.21

* $p < 0.05$

Mathematics Teaching Outcomes Expectancy

Overall Mathematics Teaching Outcomes Expectancy (MTOE) did not change significantly (Table 2). Only one of the eight items that comprised the MTOE construct, item number 1, changed significantly.

Table 2

Mathematics Teaching Outcomes Expectancy Results

Mathematics Teaching Outcomes Expectancy (MTOE)	Pre-Coaching Mean	Post-Coaching Mean	Δ	p-Value
Overall MTOE (Range is 8-40)	25.91	26.24	0.32	0.36
5=Strongly Agree				
1. When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.	3.00	3.53	0.53	0.04*
4. When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.	3.85	3.65	-0.21	0.18
7. If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching	2.09	2.06	-0.03	0.46
9. The inadequacy of a student's mathematics background can be overcome by good teaching.	3.71	3.59	-0.12	0.29
10. When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher.	3.09	3.35	0.26	0.08
12. The teacher is generally responsible for the achievement of students in mathematics.	3.76	3.71	-0.06	0.37
13. Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.	3.06	3.18	0.12	0.25
14. If parents comment that their child is showing more interest in mathematics at school, it is probably due to the performance of the child's teacher.	3.35	3.18	-0.18	0.24

* $p < 0.05$

Coaching Goals and Activities

Each participant reported setting at least one goal with their mathematics coach and some noted more than one goal. In a few cases, the goal changed during the process, as either the participant or coach noted a new need. Coaching activities were well-aligned to the goals, as shown in Table 3.

Table 3*Coaching Goals and Activities*

Participant	Coaching Goal(s)	Coaching Activities
Ms. Adams	Differentiation	Coach gave assistance modifying materials for special education students.
Ms. Brown	Technology for differentiation and reteaching; understanding strategies and expectation	Used coach as a reference for both student concerns and for understanding content and strategies.
Ms. Carey	Technology for differentiation and reteaching	Coach helped with understanding the curriculum; learning to use the technology for differentiation and reteaching, including using data.
Ms. Dalton	Pacing	Coach pushed into classroom - observed, took notes, met to discuss. Gave strategies for how to fit it all in, provided some resources to help.
Ms. Evans	Unit planning; differentiation; fostering student independence	Coach provided guidance on differentiation and scaffolding, which fostered student independence.
Ms. Franklin	Differentiation; fostering student independence	Coach provided support on differentiation, provided access to activities and technology that supported differentiation and student independence.
Ms. Gonzalez	Fostering student independence; use of fact fluency sprints	Coach provided support and encouragement for promoting independence and use of the sprints. Coach split class so they could work with smaller groups.
Ms. Hanson	Pacing and differentiation	Helped break down the curriculum. Co-taught and modeled lessons to help with strategies and content.
Ms. Jones	Examining data to determine student needs; enrichment activities	Coach provided/modeled enrichment opportunities for students, helped teacher analyze student data. Coach observed teaching and gave feedback.
Ms. Kim	Pacing	Planning together. Observation and feedback on teaching. Some model teaching by the coach, allowing observation of methods and observation of students.
Mr. Larson	Analyzing student data for differentiation; effective use of intervention time	Coach taught participant how to analyze student data to plan for differentiation. Worked on effective use of intervention time. Coach was another adult for small group work.
Mr. Mitchell	Working with word problems	Coach provided strategies, resources, and materials. Coach observed a few lessons and provided feedback.
Ms. Quigley	Pacing	Coach helped plan lessons for pacing and provided resources and materials to help with lessons.
Ms. Riley	Student independence	Coach provided support and strategies for student independence Observed lessons, gave verbal praise.
Ms. Smith	Differentiation; modifying assessments	Coach assisted with setting up structures for differentiation and worked with a small group in class and for intervention time. Coach helped them to modify assessments and how to think about them going forward. Provided resources and materials.
Ms. Taylor	Pacing; using assessment data to help plan lessons for differentiation and intervention	Coach created calendar and structure for assessments Observed lessons and gave feedback.
Ms. Vasilli	Differentiation; pacing	Coach helped differentiate assignments. Provided positive feedback on teaching and pacing. Modeled questioning strategies and provided information about student thinking during independent work.

Ten of the 17 participants (59%) mentioned differentiation as a goal. While the teachers were trying to implement the new curriculum with fidelity, they were also trying to meet a wide variety of student needs. Differentiation took on different meanings, depending on the needs of the participants. Some were looking for strategies to modify assessments; some were looking for technology resources to aid with differentiation. Working on pacing was another frequently identified goal, named by six of the participants (35%). Participants were grappling with fitting expected lessons in the time frame allotted to mathematics in the school day. By working with the coaches, they hoped to develop strategies for addressing all relevant objectives and activities within the given time.

Four participants (24%) had a goal of fostering independence in their students. These teachers recognized that they struggled to have their students work independently on math activities and wanted to develop strategies for offering independence while minimizing unproductive student struggle.

Learning how to examine and use data to determine student performance levels and needs was a goal identified by three participants (18%). These teachers felt comfortable with differentiation, pacing, and the mathematical content of the curriculum but were not familiar with accessing and using data to help structure differentiation.

Other goals identified by just one participant were: understanding mathematical strategies, unit planning, incorporating fluency practice, structuring enrichment activities, effective use of intervention time, and working with word problems. This wide variety of goals seems to indicate that, while the coaches had some overall curricular goals, the coaching was personalized to the needs and wants of each participant.

The coaching activities described by the participants seemed well-aligned with the coaching goals. When differentiation was a goal, the coach provided materials, advice, or modeled strategies for differentiating the curriculum, instruction, or assessments. At times, the coaches acted as another classroom teacher, providing an extra person to do small group work when differentiating instruction. The coaches also modeled lessons or sections of lessons, giving the participants the opportunity to see a strategy in action and to see how their students engaged with those strategies. In several cases, the coach observed the teacher and offered feedback and validation.

Several participants noted that their coach provided assistance by creating or curating materials that were needed for implementing a new strategy or a component of the curriculum. This reduced or removed a barrier that the participants had perceived as preventing them from fully implementing the curriculum.

Support for Increased Self-Efficacy

Data from the teacher interviews support the increases in self-efficacy shown in the PMTE section of the MTEBI. Analyzing the tasks found in Table 2, it is seen that the coaches provided opportunities for the participants to experience all four of the components identified to develop and improve their teaching self-efficacy.

Physiological cues. As the teachers were working with a new curriculum, many expressed that, prior to the coaching cycle, they felt nervousness over using the representations expected in the curriculum, fitting in all of the components, and teaching the lessons with fidelity. Ms. Kim noted that her goal was “to fit everything in the whole lesson in one hour. Because the whole lesson, including the fluency and the debrief, all of that was taking over an hour.” Ms. Riley stated that “I know we're supposed to be teaching the program with fidelity, but the 60 [minutes required of the lessons] doesn't fit in the 45 [minute slot I have].” Ms. Hanson mentioned that she was not fully confident in teaching the new strategies used throughout the curriculum, and that becoming comfortable with the new strategies was like going through math class again and took her a lot of

effort. The coaches were able to address these issues with the participants so that they became more confident with their teaching. Several participants noted that the coaches encouraged them to try new strategies or components with the coach available as a backup, which made them feel supported and that they were sharing responsibility with the coach. As Ms. Gonzales noted, “Sometimes, when you're in one mode of teaching for so long, you don't really think outside the box [...]. So, it was nice to have that person say, ‘Let's try this’. I've actually gained more confidence.” Having the coach supervise and take responsibility for the outcome of trying a new strategy helped to reduce the nervousness felt by the teachers, which could have helped to improve their self-efficacy.

Verbal persuasion. Adding to the curriculum competencies they supported, the coaches also provided positive feedback on teachers’ lessons and interactions with students. Ms. Riley said that her coach gave her a lot of verbal praise, which was appreciated. Ms. Vasilli, who was concerned about her lesson pacing, noted that her coach timed a lesson and gave her very positive feedback on the pacing, which allowed her to feel more secure and to focus on other goals. By providing this positive feedback, the coaches alleviated teacher anxiety and promoted deeper engagement with the curriculum. This seems to have improved the participants’ confidence in engaging with students around mathematical concepts.

The persuasions offered by the coaches mentioned with physiological cues also can be thought of as verbal persuasion. Referring to trying math sprints in her class, Ms. Gonzales said, “I felt like it was too much pressure to do this. So [the coach] said, you know what, there's two of us here. Let's try it. and we did.” By expressing confidence that the teacher could successfully implement the strategy, the coach essentially loaned confidence to the participant and helped to bolster self-efficacy.

Vicarious experiences. The coaches worked with many of the teachers on their pacing of the curriculum and the inclusion of all required components. They also modeled lessons or portions of lessons, allowing the participants to observe the teaching of new strategies and pacing of a lesson. Ms. Hanson noted that the modeling of specific strategies by her coach, such as bar models and open number lines, has made her feel more confident in teaching those topics. Similarly, one of the coaches modeled some enrichment strategies for Ms. Franklin, who expressed that she now felt more comfortable with providing enrichment activities for her students.

Mastery experiences. As teachers incorporated more components of the curriculum, they felt that they were able to differentiate better for their students and address individual needs better. The coaches encouraged the participants to analyze student data and use the curricular resources to plan activities and individualized technology usage. Once she had success with the sprints, aided by the coach, Ms. Gonzales felt comfortable incorporating them on her own on a regular basis. Mr. Mitchell felt that his work with the coach on word problems was successful and “it's something that we can take into the future and hopefully tweak but use again, and again, and again.” In Mr. Larson’s class, “we decided to focus on the [software program] because that's tied directly to our [progress] testing, and I think it was really effective. You know, I'm seeing growth. Most of the students have gone up a level in their testing in that area.” By building in opportunities for mastery experiences, the coaching program helped the teachers gain confidence in their ability to work with the mathematics curriculum.

Outcomes expectancy. Some of the participants did note student improvement with the changes that were made during the coaching cycle, such as Mr. Larson noting the increase in progress test scores. What is surprising is that related items, such as “When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach,” did not increase significantly, and in fact decreased. The lack of increase in MTOE will be further discussed below.

Discussion

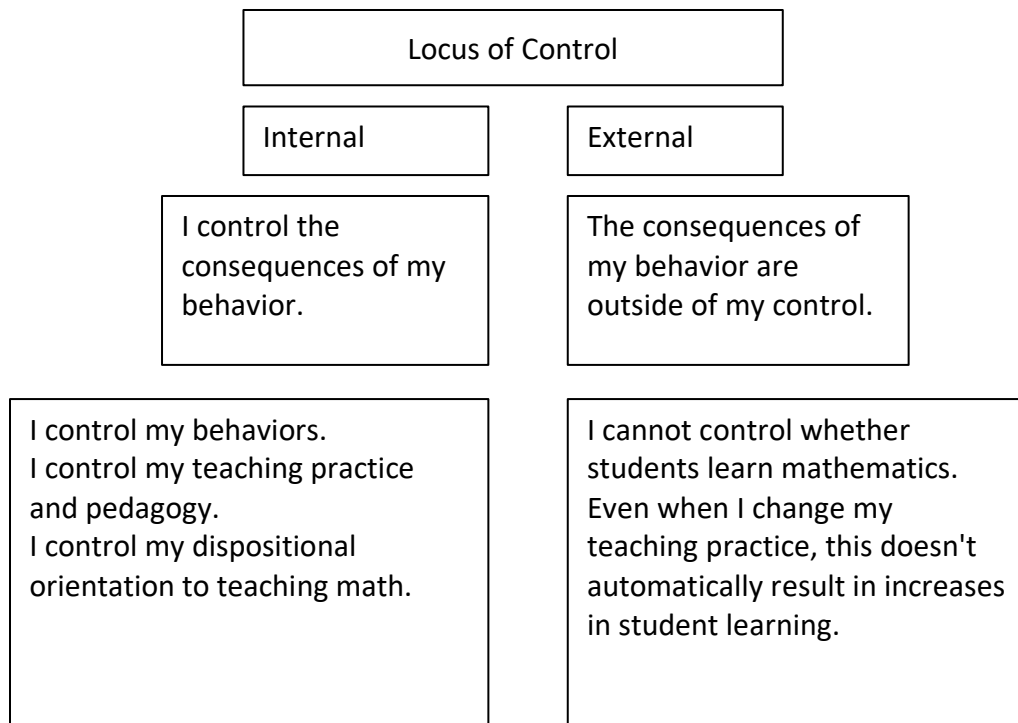
Personal Mathematics Teaching Efficacy (PMTE) increased significantly over the course of the coaching cycle. The components of the program - setting individualized goals, allowing for opportunities to practice new skills and strategies, observation by both the coach and participant, feedback, and reflection – were well-aligned with the progression suggested by White et al. (2015) and Hanft et al. (2004). Modeling, practicing, and feedback were found throughout the coaching process. These have been identified as the components most likely to lead to increased student achievement which is, ultimately, the goal of teacher professional development (Glover et al., 2023).

The types of support given to the participating teachers aligned well with the four factors that Bandura (1977) identified as contributing to self-efficacy, and also with the components of coaching Tschannen-Moran & McMaster (2009) theorized as building that self-efficacy. The coaches provided vicarious learning by teaching parts of lessons and leading small group learning with the classroom teacher observing them. When the coaches gave participants positive feedback, it allowed them to feel successful and assume mastery in their ability to enact the curriculum and teach effectively (Zuya et al., 2016). The coaches also provided encouragement to the participants to try new strategies and resources, which align with verbal persuasion. Also, through the feedback given to participants, the coaches were able to help alleviate some of the anxiety the teachers were feeling about enacting the curriculum with fidelity and fitting it within the time allotted for mathematics in the classroom.

Several participants noted that, due to the coaching, they had made material changes in their classroom instruction. These changes included differentiating instruction and assessment, changing the pacing of lessons, using data to inform their lesson planning, and incorporating new strategies or elements to their lessons. The coaching that leads to these changes in classroom practice has been linked to the increased teacher efficacy seen in the study (Kraft et al., 2018; Russell et al., 2020; Woolfolk Hoy & Spero, 2005).

The increase in Personal Mathematics Teaching Efficacy (PMTE) was heartening, but there was not a similar increase in Mathematics Teaching Outcomes Expectancy (MTOE). This indicates that, while teachers feel more confident in their mathematics teaching abilities, they do not feel more confident in their ability to impact students' understanding of mathematics. Affecting change in student outcomes is a tertiary effect of changing instructional strategies and methods, which indicates distance from what the teacher can control. Many aspects of student learning and achievement are removed from instructional interventions and hence may be perceived as outside of a teacher's control. An educator might be more confident that they can change their instructional strategies and methods but less confident that these will result in changes to student outcomes because changes to student outcomes rely upon other extraneous variables unrelated to what the teacher can control.

Returning to our operational theory using Rotter's Locus of Control (1966), instructional coaching interventions did improve teachers' internal locus of control for the consequences of their behaviors related to internal consequences to behavior changes. For instance, changed behaviors led to positive consequences in teachers' pedagogy, practice, and dispositional orientations to mathematics. However, additional changes – removed from the teachers themselves (i.e., student learning and student achievement) – remained in the external locus of control. This suggests coaching interventions can shift the locus of control toward an internal locus of control for consequences related to teaching pedagogy, practice, and dispositional orientation. Coaching interventions were less effective in shifting the locus of control from external to internal when focusing on student learning and achievement (see Figure 5).

Figure 5*Two Aspects of Locus of Control***Conclusion**

Mathematics coaching appears to be a strategy for improving teachers' Personal Mathematics Teaching Efficacy and supporting teachers as they work to enact curriculum. This coaching program allowed for individualized goals and strategies, which gave teachers voice and agency in the process. The coaches were able to incorporate the factors for self-efficacy improvement, such as mastery, vicarious learning, encouragement, and managing emotions (Bandura, 1977; Tschannen-Moran & McMaster, 2009), leading to greater teacher confidence.

That Mathematics Teaching Outcomes Expectancy did not change indicates that teachers are not convinced that their teaching has the greatest impact on student learning. Further research should be undertaken to explore why this facet of self-efficacy did not improve and what changes to the coaching process might be needed to help teachers increase their confidence in their ability to affect student achievement.

Funding

The authors received no financial support for the research, authorship, and/or publication of this manuscript.

Stephanie B. Purington (stephanie.purington@marist.edu) is a Lecturer of STEM Education at Marist University. She is interested in helping current and future teachers develop their math and science pedagogy and improve their confidence.

Jesslyn R. Hollar (hollarj2@unk.edu) is an Associate Professor and Dean of the College of Education at the University of Nebraska at Kearney. Her work focuses on teacher education, educational policy, and community-forward educational partnerships.

References

- Althausen, K. (2015). Job-embedded professional development: Its impact on teacher self-efficacy and student performance. *Teacher Development*, 19(2), 210 – 225.
<https://doi.org/10.1080/13664530.2015.1011346>
- Ball, D. L. & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In G. Sykes and L. Darling-Hammond (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (3-32). Jossey Bass
- 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. (1986a). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.
- Bandura, A. (1986b). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, 4(3), 359-373. <https://doi.org/10.1521/jscp.1986.4.3.359>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.
- Barnes, N. (2025). *Exploring the effectiveness of instructional coaching: A qualitative meta-analysis of high school mathematics education in urban schools* [Doctoral dissertation, South College].
- Bates, A. B., Latham, N., & Kim, J. A. (2011). Linking preservice teachers' mathematics self-efficacy and mathematics teaching efficacy to their mathematical performance. *School Science and Mathematics*, 111(7), 325-333. <https://doi.org/10.1111/j.1949-8594.2011.00095.x>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Bruce, C. D. & Ross, J. A. (2008). A model for increasing reform implementation and teacher efficacy: teacher peer coaching in grades 3 and 6. *Canadian Journal of Education* 31(2), 346-370.
- 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>
- Coburn, C. E., & Woulfin, S. L. (2012). Reading coaches and the relationship between policy and practice. *Reading Research Quarterly*, 47(1), 5-30. <https://doi.org/10.1002/rrq.008>
- Chang, Y. L. (2015). Examining relationships among elementary mathematics teacher efficacy and their students' mathematics self-efficacy and achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, 11(6), 1307-1320. <https://doi.org/10.12973/eurasia.2015.1387a>
- Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research*. Sage publications.
- Desimone, L. M. & Pak, K. (2017). Instructional coaching as high-quality professional development. *Theory Into Practice*, 56(3), 3-12. <https://doi.org/10.1080/00405841.2016.1241947>

- Eastman, C. A. (2019). The developmental needs of coaches and coachees: A metasynthesis of IJMCE Volumes 1-7. *International Journal of Mentoring and Coaching in Education*, 8(3), 217-227. <https://doi.org/10.1108/IJMCE-03-2019-0044>
- Enochs, L. G., Smith, P. L., & Huinker, D. (2000). Establishing factorial validity of the mathematics teaching efficacy beliefs instrument. *School Science and Mathematics*, 100(4), 194-202. <https://doi.org/10.1111/j.1949-8594.2000.tb17256.x>
- Entwistle, L. L., & Rees-Davies, L. (2025). Teachers' perceptions of cognitive coaching: impacts on self-efficacy, improvement and growth. *Coaching: An International Journal of Theory, Research and Practice*, 1-23. <https://doi.org/10.1080/17521882.2025.2570687>
- Gavora, P. (2010). Slovak pre-service teacher self-efficacy: Theoretical and research considerations. *The New Educational Review*, 21(2), 17-30. <https://doi.org/10.15804/ner.10.21.2.01>
- Gibbons, L., Kazemi, E., & Lewis, R. (2017). Developing collective capacity to improve mathematics instruction: Coaching as lever for school-wide improvement. *The Journal of Mathematical Behavior*, 46, 231-250. <https://doi.org/10.1016/j.jmathb.2016.12.002>
- Gibbons, L. & Okun, A. (2023). Examining a coaching routine to support teacher learning, *Investigations in Mathematics Learning*, 15(1), 11-28. <https://doi.org/10.1080/19477503.2022.2139094>
- Gibson, S., & Dembo, M. H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology*, 76(4), 569-582. <https://doi.org/10.1037/0022-0663.76.4.569>
- Glover, T., Reddy, L. & Crouse, K. (2023). Instructional coaching actions that predict teacher classroom practices and student achievement. *Journal of School Psychology*, 96, 1-11. <https://doi.org/10.1016/j.jsp.2022.10.006>
- Goker, S. D. (2006). Impact of peer coaching on self-efficacy and instructional skills in TEFL teacher education. *System*, 34(2), 239-254. <https://doi.org/10.1016/j.system.2005.12.002>
- Hanft, B. E., Rush, D. D., & Shelden, M. L. L. (2004). *Coaching families and colleagues in early childhood*. Brookes Publishing Company.
- Hannan, M. & Russell, J. (2020). Coaching in context: Exploring conditions that shape instructional coaching practice. *Teachers College Record*, 122(10), 1-40. <https://doi.org/10.1177/016146812012201002>
- Heineke, S. F. (2013). Coaching discourse: Supporting teachers' professional learning. *The Elementary School Journal*, 113(3), 409-433. <https://doi.org/10.1086/668767>
- Hickman, C. J., & Sherman, H. J. (2019). *Learning mathematics successfully: Raising self-efficacy in students, teachers, and parents*. Information Age Publishing, Inc.
- Holzberger, D., Philipp, A., & Kunter, M. (2013). How teachers' self-efficacy is related to instructional quality: A longitudinal analysis. *Journal of Educational Psychology*, 105(3), 774-786. <https://doi.org/10.1037/a0032198>
- Hopkins, M., Ozimek, D., & Sweet, T. (2016). Mathematics coaching and instructional reform: Individual and collective change. *The Journal of Mathematical Behavior*, 46, 215-230. <http://dx.doi.org/10.1016/j.jmathb.2016.11.003>
- Huinker, D., & Enoch, L. (1995). Mathematics teaching efficacy beliefs instrument (MTEBI). *Milwaukee: University of Wisconsin, Center for Mathematics and Science Education Research*.
- Klassen, R. M., & Tze, V. (2014). Teachers' self-efficacy, personality, and teaching effectiveness: A meta-analysis. *Educational Research Review*, 12, 59-76. <https://doi.org/10.1016/j.edurev.2014.06.001>
- Kraft, M. A., Blazar, D. & Hogan, D. (2018). The effect of teacher coaching on instruction and achievement: A meta-analysis of the causal evidence. *Review of Educational Research*, 88(4), 547-588. <https://doi.org/10.3102/0034654318759268>
- Marzano, R. J. & Simms, J. A. (2014). *Questioning sequences in the classroom*. Marzano Resources. <https://www.marzanoresources.com/questioning-sequences-in-the-classroom>
- Panfilio-Padden, S. (2014). *The effect of instructional coaching on teacher efficacy and on student achievement*. Northwest Nazarene University.

- Pearson, S. (2016). 'Teachers' use of an instructional coach and teachers' perceived sense of self-efficacy: A correlational study. *ProQuest LLC*.
- Rosato, J. (2019). *The effect of instructional coaching on teachers' sense of self-efficacy* (Doctoral dissertation, University of Alabama Libraries).
- Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80(1), 1–28. <https://doi.org/10.1037/h0092976>
- Russell, J. L., Correnti, R., Stein, M. K., Thomas, A., Bill, V., & Speranzo, L. (2020). Mathematics coaching for conceptual understanding: Promising evidence regarding the Tennessee math coaching model. *Educational Evaluation and Policy Analysis*, 42(3), 439-466. <https://doi.org/10.3102/0162373720940699>
- Sailors, M., & Price, L. (2015). Support for the improvement of practices through intensive coaching (SIPIIC): A model of coaching for improving reading instruction and reading achievement. *Teaching and Teacher Education*, 45, 115–127. <https://doi.org/10.1016/j.tate.2014.09.008>
- Siegle, D., & McCoach, D. B. (2007). Increasing student mathematics self-efficacy through teacher training. *Journal of Advanced Academics*, 18(2), 278-312. <https://doi.org/10.4219/jaa-2007-353>
- Stevens, T., Olivarez, A., Lan, W. Y., & Tallent-Runnels, M. K. (2004). Role of mathematics self-efficacy and motivation in mathematics performance across ethnicity. *The Journal of Educational Research* 97(4), 208–222. <https://doi.org/10.3200/JOER.97.4.208-222>
- Strong, J. (2021). *Teacher perceptions of self-efficacy and instructional practices through instructional coaching in mathematics: an action research study*. The College of William and Mary.
- Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a new teaching strategy. *The Elementary School Journal*, 110(2), 228-245. <https://doi.org/10.1086/605771>
- Tschannen-Moran, M. & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education*, 17(7), 783-805. [https://doi.org/10.1016/S0742-051X\(01\)00036-1](https://doi.org/10.1016/S0742-051X(01)00036-1)
- Walsh, N. R., Ginger, K., & Akhavan, N. (2020). Benefits of instructional coaching for teacher efficacy: A mixed methods study with PreK-6 teachers in California. *Issues in Educational Research*, 30(3), pp. 1143-1161.
- Wang, S. (2017). "Teacher centered coaching": An instructional coaching model. *Mid-Western Educational Researcher*, 29(1), 3.
- White, A. S., Howell Smith, M., Kunz, G. M., & Nugent, G. C. (2015). Active ingredients of instructional coaching: developing a conceptual framework. R2Ed Working Paper 2015-3. National Center for Research on Rural Education.
- Woolfolk Hoy, A. & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education*, 21(4), 343- 356. <https://doi.org/10.1016/j.tate.2005.01.007>
- Woolfolk Hoy, A., Hoy, W. K., & Davis, H. A. (2009). Teachers' self-efficacy beliefs. In K. Wentzel& A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 627–653). Routledge.
- Woulfin, S. L., & Rigby, J. G. (2017). Coaching for coherence: How instructional coaches lead change in the evaluation era. *Educational Researcher*, 46(6), 323-328.
- Xenofontos, C., & Andrews, P. (2020). The discursive construction of mathematics teacher self-efficacy. *Educational Studies in Mathematics*, 105(2), 261 – 283. <https://doi.org/10.1007/s10649-020-09990-z>
- Zee, M., & Koomen, H. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research*, 86(4), 981–1015. <https://doi.org/10.3102/0034654315626801>
- Zuya, H. E., Kwalat, S. K., & Attah, B. G. (2016). Pre-service teachers' mathematics self-efficacy and mathematics teaching self-efficacy. *Journal of Education and Practice*, 7(14), 93 – 98. <https://eric.ed.gov/?id=EJ1102977>