The Evolving Role of a Mathematics Coach During the Implementation of Performance Standards

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Abstract

The primary goal of this study was to investigate the role of the mathematics coach at Tabaka Middle School during the school's implementation of the Georgia Performance Standards through the utilization of Connected Mathematics Project materials. The study explores the coach's emergent understanding of her role as she provided teachers support through professional development, observation, and feedback in dealing with new content, adapting to new methods of teaching, working in collaborative groups, adapting to new ways of assessing students, and learning how to use new curriculum materials. The study suggests that in regards to teacher beliefs and practices, teachers benefit from a site-based long-term professional development program that targets content and pedagogical knowledge. The study underscores the importance of teamwork, collaboration, and having a mathematics coach on site in bringing to reality a new vision of a school's mathematics program.

Overview

The mathematics achievement of U.S. students is of great concern, as shown by a number of national and international studies (Beaton et al., 1997; Kilpatrick, 1992; 1997; National Council of Teachers of Mathematics, 1998; Wu, 1997), and efforts have been made through various professional development programs to provide resources to help teachers improve their instruction. The state of Georgia is in the process of replacing its Quality Core Curriculum with new Georgia Performance Standards[i]. In their efforts to successfully make this change, a number of school districts have employed an instructional or mathematics coach to provide in-school professional development (Richard, 2003). This article discusses the role of the mathematics coach at Tabaka Middle School[ii] during the school's implementation of the Georgia Performance Standards in 6th grade through the utilization of materials from the Connected Mathematics Project[iii].

Teachers are faced with a number of challenges when asked to implement a new curriculum. They are often mastering new content as well as adapting to new methods of teaching, assessing students in new ways, and learning how to use new curriculum materials. Site-based professional development coordinators can provide guidance for teachers as they come to grips with a new curriculum or seek to improve the teaching and learning of mathematics under an existing curriculum (Russo, 2004; West et al., 2003). These people are often referred to as "coaches," a term that includes generic instructional support specialists as well as content-specific specialists, such as literacy coaches and mathematics coaches. In some school districts, they teach full-time and work with other teachers after school, during common planning periods, or between lessons. In other districts, their role may be entirely supportive in nature, providing teaching staff with instructional materials, training, and professional development opportunities. Such specialists have similar roles in other areas; for example, the goal of a literacy coach is to increase the instructional capacity of teachers (Hall, 2004). Literacy coaching seems to hold great promise for the improvement of student achievement. As Richard (2003) points out:

> Coaching builds on a decade of research suggesting on-site, "job embedded" training is the best way to sharpen teaching skills and raise student achievement.... A primary goal of these on-site coaches is to help educators develop the habit of self-assessment—to learn to examine and improve their own professional work by reflecting on results, searching for more effective strategies, and calling upon their colleagues for ideas, feedback and support. (p. 2)

Mathematics coaches' roles may vary from one school or school district to another. They may serve one school or the whole district depending on the resources the school district has. For the coaches to be effective in their work, the following qualities are important: social leadership skills, content knowledge, pedagogical content knowledge, knowledge of curriculum, knowledge of gifted and special-needs students, and knowledge of research (Neufeld & Roper, 2003).

The following is an example of the use of academic coaches is the Pennsylvania school coaching initiative. The Annenberg Foundation funded this project to increase the instructional capacity of teachers as outlined in a report by Brown et al. (2006). This was a statewide project and was geared to the improvement of classroom instruction for high-need high school students. In the report, coaches were well received by teachers, but this did not happen by chance, and coaches had to earn that acceptance. The study found that coaches had to establish their credibility by building rapport and trust and establishing their role:

> We observed coaches working creatively, through considerable trial and error, to earn their colleagues' trust and receptivity to classroom visits. This is not to say that coaches made no missteps, but in general, coaches won the respect and high regard of most of their colleagues. (p. 19)

In the report, one principal pointed out that the teachers were receptive to the coaches because of the caliber of coaches—teachers expressed admiration of the coaches' content knowledge. The study suggests that coaching can change teachers, instruction, and students, but a coach's level of success depends on his or her ability to build rapport and trust, which is also dependent upon the intensity of contact between the coach and teachers and also upon the coach's interpersonal skills: "interpersonal skills of coaches are just as important as their content knowledge as they help teachers to take risks and apply new ideas in their classroom" (p. 20). In a report by Poglinco et al. (2003), the coaches' role was not explicitly defined, and teachers perceived them as informers for the administration rather than colleagues. The findings from that study indicate that this perception generated acute tension; however, those coaches who participated in joint planning or coteaching on a regular basis were viewed favorably by teachers and were not seen as informers for the administration. Similar findings to the Poglinco study were also noted by the Center for Strengthening the Teaching Profession (2007).

A review of research done by Richard (2003) indicates that well-trained on-site professional developers are having a significant impact on the quality of teaching, leading to improvements in student achievement. At the same time, it suggests that on-site personnel are faced with challenges in terms of what they need to advance their work, and, indeed, how they might define their work—a major concern is that their job descriptions are poorly developed. Poglinco (2003) found that "some coaches had never seen a written job description, or had seen an abbreviated one in the form of a job advertisement posted by the state, school district, or the school itself" (p. 9). Neufeld and Roper (2003) found that uncertain job descriptions often led to mistrust and confusion between the coach, teachers, and administrators.

Despite the early state of this professional evolution, the existence of high-stakes testing and the accountability systems required by No Child Left Behind create an immediate need for improvement in student achievement, and the data from this study suggest that school districts might be well advised to dedicate appropriate resources to promote this emerging and very promising on-site professional

development model. The remainder of this paper focuses on the utilization of a mathematics coach at a middle school in Georgia and explores her emergent understanding of her role as she oversees the implementation of a new curriculum, initiates an on-site professional development program, and supports the 6th grade mathematics teachers through the experience.

Framework

This study focuses on the mathematics coach as an on-site professional development provider working with three 6th grade teachers who attended a 1-week summer institute on the utilization of materials from the Connected Mathematics Project, a middle school mathematics curriculum that had been chosen during the subsequent school year at Tabaka Middle School for the implementation of the Georgia Performance Standards. The focus of the study was the evolving role of the mathematics coach as she and the teachers encountered new content, adapted to new methods of teaching, worked together in collaborative groups, adapted to new ways of assessing students, and learned how to use new curriculum materials. Specifically, the study focused on how the mathematics coach viewed her role and how the three teachers responded to the coach's efforts.

Case Study Method

The project follows a case study design (Stake, 1994; Yin, 2003), and the case presented in this article is part of a larger study examining the process and impact of implementing the Georgia Performance Standards in Mathematics using the Connected Mathematics Projects materials.

Participants and Site

This study focused on a mathematics coach, Bochere, and three 6th grade teachers—Nyanchoka, Moraa, and Kemuma—at Tabaka Middle School in Georgia. Middle schools in Georgia include grades 6 through 8, and students are generally 11 to 14 years of age. At the time of the study, Tabaka's school population was 21% Caucasian, 3% Asian, 49% Hispanic, 2% multi-racial, and 25% African American. Eighty percent of the students qualified for free or reduced lunch, an indication that the majority of the school's students were from lower socioeconomic circumstances. The site was chosen because the entire 6th grade teaching staff, as well as the mathematics coach, had participated in the Connected Mathematics Project summer institute, and the school, school district, and participants were willing to work with the researcher during the implementation of the new curriculum.

Bochere, the mathematics coach, had a doctorate in Mathematics Education and had several years of experience teaching at the middle and secondary levels. She was hired by the school district to initiate the implementation of the Georgia Performance Standards, guide the teaching staff, provide in-school professional development, construct tests and test rubrics, mentor teachers, and teach an 8th grade mathematics class. Bochere described her primary goal as "supporting teachers as they experienced new content and new methods of teaching, worked in collaborative groups, adapted to new ways of assessing students, and learned how to use new curriculum materials."

Data Collection

Data was collected from multiple sources, including observation and interviews. The first author videotaped in-school professional development and planning sessions, making detailed field notes, and interviewed Bochere four times concerning her role as a math coach. The first interview was at the beginning of the semester, two interviews were conducted during the course of the semester, and the fourth was at the end of the semester. Each of the three teachers was interviewed on the same schedule.

Data Analysis

Grounded theory (Glaser & Strauss, 1967) was the method of data analysis. Charmaz (2000) describes this method as consisting of "systematic inductive guidelines for collecting and analyzing data to build middle range theoretical frameworks that explain the collected data" (p. 509). The method

assumes that the processes of data collection, coding, and analysis are done simultaneously to generate or discover a general theory that is grounded in the data. As a result of the analysis of the data in this study, key ideas emerged: "comparing and contrasting them to identify the common features among them, in order to cluster them into conceptual categories" (Harry, Sturges, & Klingner, 2005, p. 5).

Summary

In the following section, we describe ways in which the math coach supported teachers during the implementation process of the Georgia Performance Standards as they experienced new content, new methods of teaching, working in collaborative groups, adapting to new ways of assessing students, and learning how to use the new curriculum materials.

Summer Institute

The math coach and the three 6th grade teachers attended a 5-day summer institute at Michigan State University to help them understand the Connected Mathematics Project materials. Bochere, the math coach, felt there was an expectation from the teachers that she should lead the process and that it was her responsibility to make the institute a great learning experience for all:

> Yeah, I was just afraid that something would happen and they would get turned off to it, or say this is not what I signed up for, or this is very overwhelming. I just wanted them to come back really excited about the curriculum…. It is kind of like with your own students—except they are adults and my friends.

The three teachers noted that Bochere helped them make sense of the institute's activities. They started building a sense of belonging during nightly gatherings, and all agreed that the experience would help them collaborate in their teaching. They all rated the math coach highly in terms of her support for them during this initial stage of the process.

In-School Professional Development Sessions

Throughout the implementation process, and even before it had begun, the coach worked with her colleagues during regularly scheduled in-school professional development sessions to address issues pertaining to the new curriculum materials as well as the new state standards. The three teachers met every week with the mathematics coach, and the researcher attended five sessions the coach had indicated were to be significant. The first meeting focused on the materials the teachers needed for the first week of class. It was important that each teacher understand the organization of student notebooks, an integral part of the Connected Mathematics Project program, and the mathematics coach gave guidelines about the organization of the students' notebooks, showing the teachers an example of a particularly well-organized notebook. She distributed copies of the Connected Mathematics Project student textbook to the teachers, and the group briefly looked at the content. The coach stressed the role of cooperative learning in the Connected Mathematics Project program, recalling the topics covered and activities shared when they attended the summer institute.

During the second session, which was the first meeting after their first day of class, the coach prompted the three teachers to share their experiences. They discussed how their students set up the notebooks and the initiation of and student response to the unit project—"my special number." Then the coach focused the group's attention on upcoming lessons—for example, she asked the teachers to review the "factor game investigation." She noted the importance of talking to students: "What is a factor? Good! So that will be the first vocabulary word we write." There was some discussion about terminology and whether the state assessment—Criterion Referenced Competency tests—would use "factor" or "proper factor." Bochere said, "I think it is okay. Just review with them what is a factor, what is a divisor. Those words will go to the glossary." The teachers were not sure of the difference between a factor and proper factor, and the coach took time to clarify the difference and reminded

them to refer to the glossary in their textbook for such information. Then the coach led the teachers in playing the factor game to make sure they were comfortable with it. Bochere outlined the winning strategies:

> After kids play the game, they will start to see the difference between prime and composite. That is, some numbers have only one proper factor and the others have lots of factors. So what they want to be able to say to you is: the best first move is the highest prime number. The students will also learn about terms like *abundant*, *deficient*, and *perfect numbers*, and these terms should go into students' vocabulary lists. This is a good opportunity for kids to work in groups.

During the third meeting, the teachers shared how things had gone in their classes, and Moraa noted that parents were beginning to get more involved with their children: "Parents are playing the factor game, and they are also playing the product game with their kids, and kids are playing among themselves in their free time." For this session, the coach had asked a school reading specialist to attend and share reading strategies that could be implemented to help those students who were struggling with reading Connected Mathematics Project materials. She explained how to get students to preread and suggested ways the teachers could identify words that might be difficult for the students. The reading specialist also suggested having a Spanish version of the Connected Mathematics Project to help those students for whom English was a second language.

The fourth and fifth meetings were focused on sharing strategies: how to work in groups, use the vocabulary quiz to increase students' vocabulary, and implement reading strategies. Additionally, the teachers and the mathematics coach spent time reviewing the mathematical concepts that would be included in upcoming lessons.

Most of the sessions were teacher-driven—teachers shared their struggles and the coach would step in to offer suggestions. Primarily, Bochere wanted to use these meetings to build mutual trust and develop collegial conversations based on the teachers' reflections about their teaching practice: "I would love to see the three teachers talk to each other more and support each other, and actually they have started. In our professional meetings, I let them talk and give feedback to each other without judging each other." The mathematics coach also wanted the teachers to observe one another's classes to gain further insights about the implementation process, but that did not happen due to scheduling difficulties.

In each meeting, Bochere talked about cooperative learning and incorporating manipulatives into instruction. For example, in one meeting she demonstrated to the three teachers how to use manipulatives to talk about dimensions of numbers and relate that concept to prime and composite numbers. She used the number 24 as an example and explained its dimension to be: 6×4, 4×6, 3×8, 8×3, 12×2, 2×12, 1×24, and 24×1. Other than conversations about mathematical concepts such as this, the meetings focused on planning and classroom management techniques.

Implementation Process

The three teachers, with the continual support of the mathematics coach, embarked on the implementation of the Georgia Performance Standards, using Connected Mathematics Project materials. The decision to use the Connected Mathematics Project had been made collectively by the 6th grade teachers and the mathematics coach after they were given the opportunity to examine four standards-based 6th grade textbooks. Bochere noted that the new standards-based curriculum was clearly going to be a departure from the skills-based curriculum of the past, and everyone realized their instructional methods would need some adjustment:

> We also had been unpacking standards all during last year. So we knew from looking at the GPS standards—before we ever looked at curriculum materials—that this was a big shift in the way that

> we were thinking about and teaching mathematics. So it was no surprise that this year the classrooms would be different, or teaching would be different.

While the teachers could look to the mathematics coach for guidance as they unpacked standards, selected curriculum materials, attended the summer institute, and embarked on the implementation process, the coach was not able to look to any specific person at the state or district level to support her in fulfilling her role or even defining what that role might be. Bochere described the uncertainty of her purpose and position:

> I have a boss who just took over in January, as the assistant superintendent, and he's working very hard to figure out what my job should be. And my principal is pretty supportive in what we think that we would like to try to do to help teachers. But the greatest support that I have is really from the literacy coaches because the four of us are trying to figure it out… and it's because it's a new kind of position and nobody knows, we're just doing the best we can.

Bochere continued, explaining that as an instructional support specialist, she did not have an administrative role, and her classroom observations were not officially evaluative but rather intended to provide collegial support:

> I wish that I knew how to describe my job, but the best way I know how to do it is to say I am here to support teachers as they strive to be better teachers, period. I think we should blur the lines between coach and teacher, and I love that my job is blurry and unbalanced and that I teach and coach. I think that any time we set up, you know, those binaries like coach and teacher, I think you're creating power systems that shouldn't be there, whether they're direct or just perceived. I really resist that.

Though the coach believed she did not have an administrative or evaluative role, the three teachers seemed to think otherwise. Nyanchoka reported that she was not comfortable having the coach in her classroom because she felt she was being evaluated. Moraa and Kemuma did not explicitly state that opinion, yet classroom observation data indicate that they changed the way they conducted their classes whenever the coach was present, using more cooperative groups in their instruction, changing the pace and direction of the lessons, and maintaining more control over their students.

The coach played a critical role in supporting the teachers as they dealt with the district's accountability system. The district's accountability system is part of a statewide initiative geared toward improving student performance; although every district must meet state requirements for mathematics achievement, each district is free to determine how its accountability system will be implemented locally. When Bochere was employed at Tabaka Middle School, the district initiative of accountability and the impending implementation of the Georgia Performance Standards were already established policies, and these realities comprised the culture in which the mathematics coach operated while performing her duties. At the time of this study, she had been working within the district for 2 years. When asked to describe the district accountability system, which includes the posting of the test scores for each teacher's class in the school hallway, Bochere explained that when she came to Tabaka Middle School, she found the reality somewhat different from the culture that had been explained to her:

> We implement a pre–post test system here in Tabaka City Schools that is recognized by the governor of our state as a model of what other schools should be doing. They say that we use it here to support instruction and celebrate excellence or achievement or something. Celebrate excellence. That is what we use it for. Not a "gotcha." Math teachers are not comfortable about the pre– and post–test thing... no matter how much they say it is only about celebrating, it is not

> celebrating when you post scores on the wall. People are walking down the hall comparing teachers. And teachers who had a 40% gain get an e-mail from the superintendent, and teachers who had a 20% gain don't, and that conveys a message. We are comparing.

Although the mathematics coach had tried to advocate for teachers by putting forth the argument that the graphs posted in the hallway are not valid indicators of any teacher's performance and do not really explain what goes on in the classroom, she believes that nothing can be done to change that system. She has focused her attention on aspects of the testing policy that can be used to guide instruction and has encouraged her teachers to do likewise.

Bochere acknowledged the challenges the teachers faced in using the new materials to prepare their students for the Criterion Referenced Competency tests for grades 1–8, an annual event that adds to the tension of the accountability system. They were still becoming familiar with the new materials; the reading level was above that of many of their students, making some of the materials difficult to use; and it was taking longer to cover the topics to meet standards-based expectations. The teachers were supposed to have received Spanish language materials for their English as a Second Language (ESL) students, and those materials had not been received. What they had planned to do in the first 9 weeks was not done, and their frustration was intensified because they were expected to cover a prescribed amount of material for the 9-weeks posttest—the results of which would be posted on the school walls:

> So we are feeling really stuck right now, because in order to get done what we said we were going to get done—the temptation is to chuck it, just bring in our old books to catch us back up with where we need to be and then go back to CMP. And part of the issue at the beginning had nothing to do with the investigations themselves but our lack of materials. We just got practice workbook things to run copies today from CMP. We had nothing. Finally after, what, 5 weeks, we were told, 'Oh, you can get some of that online.' That helped, but we were trying to use their curriculum, and we didn't have all of the pieces of it.

Bochere worried that because of the challenges they had encountered with the implementation, the teachers might develop a dislike of the Connected Mathematics Project materials, and she said that teachers were getting frustrated with the pacing at which they were covering topics. They were struggling to find strategies for teaching their students to read and write mathematically, and Bochere explained that the teachers often expressed concerns about the issue of reading in their meetings:

> We knew when we ordered the CMP, we knew the reading level is grade 6. We have students reading at grade level 1 and 2. Nyanchoka's 3rd period class is made up of students who are reading at grade levels 1, 2, and 3, and they are trying to read materials at a 6th grade level. So we got one of our reading specialists to come and meet with us. And she spent, I guess, a whole afternoon with our 6th grade teachers. Talking about how to get students to preread or things that we can do to identify in advance words that are going to be hard, and she gave us a lot of strategies.

During classroom observations, teachers were observed using strategies to help students learn to read and write mathematically. Teachers had their students read the assignments in class, and they answered questions the students had about what they were being asked to do. This strategy enabled some students to complete their homework, particularly students who previously could not understand the written instructions and information. All of the teachers had their classrooms arranged to facilitate group work, but Moraa and Kemuma, more often than Nyanchoka, had children work in groups of three, and they used these cooperative learning groupings to help those students who struggled to read. Nyanchoka usually arranged her students' seats in traditional rows, believing that groups fostered socializing instead of work doing mathematics. Moraa and Kemuma also used manipulatives more often, incorporating into their instruction ideas they had discussed in the in-school

professional development. All of the teachers made extensive use of the notebooks to foster learning and gave vocabulary quizzes every Friday to make sure students were learning those vocabulary words.

At the beginning of the semester, Bochere was trying to remain open to the teachers' needs; to be responsive to issues with the content, curriculum materials, and the new performance standards; and to create a cohesive professional development program. But things did not always go the way she had planned:

> I think what was really sad about that is that we all started out thinking that there would be time to talk about teaching strategies and looking at students' work and sharing what students are doing, you know, reading things that other people who have implemented CMP have experienced—I think we may have started it like that. All it has become now is planning. All it has become is, 'Oh, my God, how are we going to get this done?' And looking through investigations and trying to place value on them with respect to time. And that is what it has become. Probably the first 15 or 20 minutes just share what, you know—'How would your students react to this, or how did they do on this quiz? Or what units did they like; did they like this investigation?' And then it turns into, 'We've got to figure out where we are going from here.'

Although the group's focus during these meetings was often on pacing, from observation data, an important result of the weekly meetings was providing the teachers with a sense of "I am not alone" in the process. The meetings provided opportunities for them to reflect on good mathematical experiences from the summer institute and also look ahead as a group, as Bochere noted:

> I think we depend on being together. The first time you try anything, you know, it is just nice to have someone trying with you. It is their experiences that spark our conversations. What they need and what they ask for is what I want to provide for them. Right now we do not have any materials—but we will work it out! If they trust you, then they will try. I mean I really believe that if you foster relationships with people, then they know that I care about them and I care about kids and they're willing to try, and sometimes it's for no other reason than because I've asked them to. And then when they get really good results, then that's just amazing and they get excited but … why are you going to try something just because someone said to? I mean you have to trust that person, you know? It's about getting to know someone and their teaching and finding out what they need and supporting them. It's about trust.

Bochere added that the three teachers were supportive of one another and that collegiality had helped all of them cope with their frustrations. She said the three teachers valued the Connected Mathematics Project materials for what they could provide their students in terms of understanding mathematics, but she believed that it would take a while before she and the teachers could become comfortable with the materials:

> Every time we talk about that—they don't want to give up. This is the time their students are getting things conceptually, and they are seeing it. There isn't any one of the three teachers that would say that there is some other way of teaching that is better than that. Now, are they comfortable with it? No.

In their interviews, the three teachers said the mathematics coach provided the support and guidance they needed throughout the implementation process, but Bochere often felt she had not done a good job.

> It is because I want everyone to be happy. I want everyone to feel that their students are getting the best possible mathematical experiences that they could have. I feel a sense of responsibility to these three teachers to do everything I can to make sure that this year is … I guess it is not going to be smooth. I just have to give up on that idea and accept that we are learning as we go. That is what I am trying, and I am just trying to be there, trying… One thing I have done is try to help them understand that they can individualize this curriculum in their classes—that it doesn't have to look the same in everybody's room. We started out like that because we just wanted to. I think that has changed during the past 4 weeks. It is okay if your 1st period class takes a different kind of quiz or partner quiz than your 6th period class. It's okay. I mean we need to access students where they are and try to focus on that, not letting them compare. You know, I'm not as far along as someone else, or that teacher's quiz doesn't match with what my students are doing, or so-and-so's students had higher scores on the posttest.

The teachers agreed that this process of coming together and sharing ideas really helped them. As Moraa explained, the teachers took time to discuss how they each did different things with different students:

> That is the biggest thing…. We all get along well; we all listen to each other. We are all open to the ideas, and that is the best part. We learn from each other.

Overall, Moraa and Kemuma were influenced more by the mathematics coach than Nyanchoka. They used cooperative learning groups, utilized manipulatives, and involved students in classroom discourse on a regular basis. Both teachers tried to use strategies they learned in the professional development meetings to help their students learn mathematics conceptually, but all of the teachers agreed that their weekly meetings helped them during the implementation process. Their mathematics coach, according to Kemuma, had been "absolutely fabulous":

> When we have problems, when we don't know what else to do, we will go to her, and she will help us solve it; and, for example, if they are not quite getting it out of the textbook, you will go and say, "Can we pull from another place?" and she will say, "Yes, do what you need to do in order to get them to understand it." She understands that it is not going to be perfect and it is not going to be word by word, by the book each day. So she is very supportive, and she helps us with a lot of anything we need—resources, support—she's more than willing to help.

Discussion and Implications

This study echoed the findings of Cohen and Hill (2000), who found that receiving professional development in conjunction with a new curriculum enhanced the innovative practices of teachers and lessened their reliance on traditional practices—similar observations were also noted by Reys et al. (1997). Prior to the summer institute, the Tabaka Middle School teachers and their mathematics coach were involved in the selection process of the Connected Mathematics Project for their school's mathematics curriculum. Although the teachers' information about the new middle grades standards-based curriculum was based entirely on what they had learned from Bochere, they were given an opportunity to have input in the selection process. This gave the teachers a sense of ownership and an incentive to make the implementation successful. Ball (1994) asserts that "teacher development is especially productive when teachers are in charge of the agenda, determining the focus, nature, and kind of programming or opportunities" (p. 22).

There has been ample research indicating that teachers' entrenched beliefs can be a challenge to reform unless there is sustained long-term professional development and support for change. Research by Kent, Pligge, and Spence (2003) indicates that staff development targeting new content and how it can be taught enables teachers who are using standards-based curriculum materials to build necessary

pedagogical and content knowledge. The in-school professional development program at Tabaka Middle School played a significant role in supporting the teachers' change in instructional practice during the implementation of the new standards, and it encouraged the continued utilization of ideas they developed at the summer institute. The experience at the summer institute seems to have had a positive impact, but 5 days was clearly not enough time to address a new curriculum, materials, and management issues that the participants were going to encounter in the classroom. The teachers reported that they relied heavily on the support and advice from the mathematics coach once the school year began.

The fact that the mathematics coach was on site, meeting with teachers and discussing both content and pedagogical issues related to the materials, affected the teachers in positive ways. The data indicate that by having this support on site, with the mathematics coach planning the in-school professional development sessions and observing classes, the teachers had the opportunity to try strategies in their classrooms and receive immediate feedback on those strategies. The implementation of the Connected Mathematics Project went fairly well despite a number of challenges. The data suggest that the trust developed in the long-term relationship between this mathematics coach and her teacher colleagues was an important component in the teachers' willingness to continue in their efforts to change their instructional methods to align with standards-based curricular goals.

In research at another school in Georgia, Sloan (2006) found that a 6th grade mathematics teacher was unable to successfully implement the new Georgia Performance Standards at his school. In previous years, his students had made impressive gains in their scores under the Quality Core Curriculum standards, but without state or district support, this teacher did not have access to a professional development program in which to explore the new standards. He did not fully realize the nature of the new standards, nor did he anticipate the nature of the revamped state tests at year-end. He continued to work with his students as he did before, and his students' scores plummeted. Without access to professional development, guidance, or assistance in the implementation of the new standards, and with the previous year's textbook as his only resource material, this teacher's experience, as devastating as it was, is not surprising. Not only did this teacher have to cope with the new standards, but in order to provide effective instruction under the new standards, his entire philosophy of teaching mathematics—his instructional style, his beliefs, and his practices—would need to change (Sloan, 2006). Such change is unlikely without extensive and deliberate professional development. According to Borchers, Shroyer, and Enochs (1992), new knowledge acquired through long-term professional development improves teaching. "They must also identify or develop local expertise to provide on-site assistance for their teachers. Only through continuous assistance, training, support, and funding can those changes be made" (p. 390).

Where an on-site instructional specialist is utilized, professional development can develop that is responsive to the needs of the specific student population served by the teaching staff (Neufeld & Roper, 2003). Although statewide results in 2006 were disappointing, with a 50% increase in the number of 6th grade students who were unable to pass the mathematics portion of the Criterion Referenced Competency tests, the failure rate for the tests in the Sloan study (2006) doubled when the standards-inspired competency tests were given at year-end. In contrast, the percentage of 6th grade students at Tabaka Middle School who failed to pass the state-mandated Criterion Referenced Competency tests increased by just 15%. The current study suggests that sustained long-term on-site professional development was the key to the relative success of the implementation of the Georgia Performance Standards.

As an example of the kind of support critical to the success of such implementation, consider the reading issue at Tabaka Middle School and its ramifications. The school had a large population of Hispanic immigrants, most of whom had limited reading ability in any language. The Connected Mathematics Project materials had "more words than numbers," as one of the teachers described it—much different from the traditional way in which mathematics books have been written for U.S. schools. Additionally, the delivery of Spanish language materials was delayed by several months. The

students who had limited reading ability struggled with the materials as their teachers struggled to find strategies to help them. The in-school professional development meetings, under the leadership of the mathematics coach, provided an opportunity for the teachers to discuss the issues of language and reading, meet with a reading specialist, develop and share strategies, and address the difficulties head-on.

The position of mathematics coach is a new phenomenon in this school district, and the results of this study suggest that having a mathematics coach had a positive effect on the teaching staff. However, it seemed that the role of the mathematics coach was not well defined, nor were her duties clearly prioritized. In addition to providing long-term instructional planning for the mathematics program, conducting professional development sessions, and attending to the needs of the teaching staff, she had the responsibility of constructing pre- and posttests, coteaching with other teachers, and teaching a class of her own. The job description of the mathematics coach needs to be carefully developed to provide a structure within which such a professional can effectively support, guide, and influence the teachers and their instructional efficacy.

This study provides further evidence that "helping teachers to understand more deeply the content they teach and the ways students learn that content appears to be a vital dimension of effective professional development" (Guskey, 2003, p. 749). Having somebody on-site who is knowledgeable in the content area seems to have a positive effect on teachers (Smith, 1995). Additionally, according to Borchers, Shroyer, and Enochs (1992), new knowledge acquired through long-term professional development improves teaching, and school district leaders should provide resources to support on-site professional development initiatives that create ongoing opportunities for improvement in teaching and student learning. "They must also identify or develop local expertise to provide on-site assistance for their teachers. Only through continuous assistance, training, support, and funding can those changes be made" (p. 390).

Innovators often "failed to appreciate teachers' need to learn in order to use new materials" (Ball & Cohen, 1996a, p. 6), and providing the opportunity for teachers to learn how to use new curriculum materials is a critical component of professional development. Working together in groups promotes collegiality, reflection, and collaboration, which, in turn, promotes sharing of instructional materials and provides opportunities to discuss instructional strategies (Garet et al., 2001). Collaboration and reflection can also promote change by enabling other teachers to see events from different perspectives (Smith, 1995). Kazemi and Franke (2003) found that collaborative teachers created a network in which they learned mathematics deeply and examined their own practices, and that such work groups helped teachers learn how to examine and analyze student work.

Implication for Curriculum Coach Preparation

Coaching is an emerging and complicated role, and those tapped to fill these positions need professional development. In general, those filling these positions are either taken from classroom teaching or hired because of their advanced degrees, but in either case, they face professional challenges as they transition to being a resource for teachers. In order for coaches to be successful in their work, they need the following set of skills: content knowledge, pedagogical content knowledge, knowledge of the curriculum, knowledge of gifted and special-needs students, knowledge of research, and social leadership skills. In this study, although the mathematics coach was knowledgeable in the curriculum that was being used, she still struggled with many aspects of the implementation process. As districts plan to utilize this new professional development idea, they also need to consider ways and means of giving support to this new position.

Suggestions for Further Research

Mathematics coaches who have had training or experience with collaborative work groups, new methods of instruction, standards-based activities and materials, and technology can assist teachers who may be struggling with change. This study suggests that the presence of the mathematics coach who possessed these attributes was a driving force behind the teachers' efforts, collectively and

individually, to improve their practice and create a strong mathematics program. Further research is needed to determine if there are professional or graduate programs specifically designed to prepare mathematics coaches, and if so, how that preparation stacks up against the realities of the job. Research centered on mathematics coaches who have held these positions over a period of several years would be enlightening as such professionals could shed some light on the most effective use of their time and resources.

Clearly, mathematical content knowledge is a critical requirement for a mathematics coach, but further research is needed to determine how mathematics coaches are using their mathematical knowledge to support teachers' efforts to strengthen their instructional practice. The mathematics coach in this study mentioned that she has to "point out more things about discipline than I do about mathematics." There was an unrelenting problem with reading. In what ways should mathematics coaches, or other instructional support specialists, be trained in matters of discipline, cultural diversity, language or reading difficulties, or student motivation? Can the mathematics education community borrow from other disciplines to develop comprehensive programs to prepare these coaches to provide support in such a multitude of ways? Additional research, focused perhaps on nonmathematical as well as mathematical issues with which mathematics coaches must contend, would be useful to help the mathematics education community in their efforts to prepare professionals for these positions.

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Notes

[i] For additional information about the Georgia Performance Standards for mathematics, visit the Georgia Department of Education at http://www.georgiastandards.org/math.aspx

[ii] All names of persons, schools, districts, and locations are pseudonyms.

[iii] The Connected Math Curriculum for grades 6–8 is a standards-based curriculum developed by the Connected Mathematics Project at Michigan State University.

General Educators' In-Service Training and Their Self-Perceived Ability to Adapt Instruction for Students With IEPs

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Abstract

Recent research has suggested that the professional development general educators receive is not adequately preparing them to properly implement inclusion-based practices. In this study, data from the Study of Personnel Needs in Special Education was used to investigate the relationship among teachers' years of experience teaching students with Individualized Education Programs (IEPs), the amount of professional development received over the past 3 years, and teachers' self-perceived ability to adapt instruction for students with IEPs. Results indicate that any amount of professional development in a 3-year period significantly predicts teachers' perceived ability to adapt instruction; however, at least 8 hours of professional development in a 3-year time frame was related to an increase in teachers' perceived ability to adapt instruction, more than twice the effect of less than 8 hours. Additionally, professional development was found to be a better predictor for increasing perceived ability to adapt instruction than was teacher experience with instructing students who have IEPs.

Introduction

Teachers who have little or no professional development in teaching students with special needs have significantly less positive attitudes concerning inclusion than those with extensive professional development (Avramidis & Kalyva, 2007). College coursework is often seen as ineffective or of little value in instruction, and teachers have relatively few hours in professional development workshops on inclusion (DeSimone & Parmar, 2006b). The resulting effect is teachers who do not believe they are adequately prepared to instruct students with disabilities (DeSimone & Parmar, 2006b; Maccini & Gagnon, 2006). Teachers' teaching efficacies, or their belief about themselves as teachers, has been shown to be a strong predictor of their actions in the classroom (Jerald, 2007). Teachers with high self-efficacies are more likely to meet the needs of their students. Therefore, a teacher with a low teaching efficacy is not likely to have teaching behaviors that positively impact students (Allinder, 1995; Berman, McLaughlin, Bass, Pauly, & Zellman, 1977; Bogler & Somech, 2004; Guskey, 1988; Stein & Wang, 1988). As the number of students with learning disabilities (LD) in general education classrooms increases, we must ask ourselves if there is progress in teachers' preparedness to teach students with LD. The current study seeks to answer this question: In what way does the amount of training and experience relate to general education teachers' self-perceived skills in adapting instruction for students with Individualized Education Programs (IEPs)?

Definitions

There are varying definitions of *inclusion*, but teachers generally agree that inclusion deals with educating students with disabilities in the general education classroom (Keefe & Davis, 1998; Snyder, Garriot, & Ayler, 2001). After a student is identified with a disability, he or she is given an IEP. IEPs are developed by a team of teachers and the parents of the student. The primary purpose of an IEP is to determine what types of services the student will receive, when he or she will receive them, and how the program's effectiveness will be evaluated (Kupper, 2000). Special needs are any disability, such as a

speech or hearing impairment, a cognitive disability, a physical impairment, or a specific LD (see Evans, 2007, for further description). An LD is a type of special need where the student has a specific cognitive disability in one or more subject areas (Avramidis & Kalyva, 2007; Evans, 2007). An LD can also be described as "a condition that makes it hard for someone of otherwise normal intelligence to read, write, speak or work with numbers" (Jost, 1993, p. 1081). However, what an LD is can be hard to define. As Jost (1993) describes it, it is an "umbrella term" and therefore is general in and of itself. As the definitions written here are given with practicality in mind, a more in-depth description of the meaning of LD is beyond the scope of this study. Additionally, providing further in-depth reviews of what IEP and LD should mean would detract from the focus of this study. Because teachers themselves view these terms in a general context, it is within this context that we wish to use them here. If we were to narrow the definitions further, then we might interpret the self-perceptions of teachers in ways that we should not, and these definitions are not meant to imply anything beyond the terms generally used in the schools and classroom.

Teacher Self-Efficacy

Self-efficacy can be described as the perceived level of ability, capability, or behaviors one possesses (Bandura, 1994). Peoples' beliefs about what they are capable of and what their abilities are help to define their actions as individuals. Thus, they will usually commit to doing something only if they believe they can do it (Bandura, 1994; Schunk & Pajares, 2005). Teachers' self-efficacies have consistently been found to predict their choices and effort in the classroom (Bogler & Somech, 2004; Jerald, 2007). In his review of research on teacher efficacy, Jerald (2007) found that teachers who had higher degrees of self-efficacy were more open to new ideas, more actively engaged in planning, less likely to be critical of students, and less likely to refer students to special education.

The current study investigated the relationship between teachers' level of training in inclusion-based instruction and their perceived ability to teach students with special needs in their classrooms. Since teacher efficacy has been shown to be a reliable predictor of teacher actions, an analysis of teachers' efficacy concerning inclusion may inform teacher training efforts that could potentially impact teachers' actions toward students with special needs in their classrooms.

Teacher Beliefs About Inclusion

We (Kosko and Wilkins) could find little current research focusing on general education teachers' beliefs related to students with IEPs. Additionally, the majority of the research dealing with teachers' perceptions of teaching students with LD focuses specifically on mathematics teachers (e.g., DeSimone & Parmar, 2006a; DeSimone & Parmar, 2006b; Gagnon & Maccini, 2007; Maccini & Gagnon, 2006). Though it is true there may be specific differences in the teacher beliefs of mathematics teachers and other general education teachers about students with LD and/or special needs, it is believed that lessons can be learned from this research that may have inferences for general education teachers as a whole.

The majority of secondary mathematics teachers surveyed in three recent state and national studies believe students with LD should be given every opportunity to learn mathematics (Barco, 2007; DeSimone & Parmar, 2006b; Snyder et al., 2001), but in all of these studies, less than half of teachers surveyed believe the mathematics classroom is the best environment for them to do so (DeSimone & Parmar, 2006b). During interviews, DeSimone and Parmar (2006a) found that these teachers had interacted very little with students with LD. According to Jordan and Stanovich (2001), students with LD who interact less with their teachers have lower achievement scores. This is one possible explanation for the conflicting beliefs of inclusion but not in the mathematics classroom (DeSimone & Parmar, 2006b).

Another possible explanation for this may be how unprepared teachers are to teach their subject to students with LD. Gagnon and Maccini (2007) found that math teachers in their study felt somewhat unprepared to teach students with LD, while DeSimone and Parmar (2006b) cited only a slightly higher

comfort level in mathematics teachers' ability to adapt instruction for LD. However, the belief that the general mathematics classroom is not the best place for students with LD to learn may stem from teacher beliefs about the true causes of academic failure of students with LD. In examining dyslexic and bilingual students' academic failure, Spiridon-Georgios and Touroutoglou (2007) found that general education teachers often attributed academic failure to student- and parent-related factors. Similar to the findings of DeSimone and Parmar, Spiridon-Georgios and Touroutoglou found that general education teachers were more likely to focus on referral practices rather than instruction modification to aid their students with disabilities in academic shortcomings.

Adding to the list of conflicts, DeSimone and Parmar (2006b) found that even though math teachers on average felt able to adapt instruction, well over one-third of these teachers disagreed with the notion that their teacher education program helped them in developing philosophies, gave information on the learners' needs, or provided instructional strategies for teaching mathematics to students with LD. In fact, only a portion of teachers took coursework that focused on how to teach students with disabilities. deBettencourt (1999) found that only 41.5% of 71 surveyed general educators had taken such coursework, while Maccini and Gagnon (2006) found that just half of 77 surveyed secondary mathematics teachers had taken any coursework related to teaching mathematics to students with IEPs. Some teachers do take a course in special education, but it rarely includes information on specific strategies in teaching content (DeSimone & Parmar, 2006b).

Although teachers may not think they are fully prepared to teach students with LD (Gagnon & Maccini, 2007), they generally strongly support the ideas behind inclusion, which would lead one to believe that their opinions about inclusion are wholly positive (Barco, 2007; DeSimone & Parmar, 2006b; Snyder et al., 2001). Yet, in interviews conducted by DeSimone and Parmar (2006a), some teachers reported that what they taught was too advanced for students with LD. Further, 2 out of 3 of the teachers who had little interaction with students with LD had more positive outlooks on the effectiveness of inclusion, whereas 3 out of 4 teachers with more interaction had less positive outlooks (DeSimone & Parmar, 2006a). A portion of these negative outlooks may be associated with the disposition of students with LD who reach the secondary level. In a study concerning the effect of teacher attitudes on students with LD, Lapointe, Legault, and Batiste (2005) found that teachers' negative attitudes affect average and gifted students but not students with LD. They attributed this finding to the assumption that these students already believed they would fail; thus, negative attitudes did not affect their achievement. This seemed to be confirmed in part by the results of the study conducted by DeSimone and Parmar (2006a) in which one interviewee stated she observed these students as having expectations of failure. However, the same interviewee stated that these attitudes changed because of the inclusion program at their school.

In a dissertation looking at secondary teacher beliefs concerning inclusion, Barco (2007) found that teachers felt inclusion works for some students but not others. DeSimone and Parmar (2006a) confirm this in an interview with one of their participants. Barco gave examples of several interviewees who held this belief. These teachers had varying years of experience and were from different disciplines, but all believed that certain students currently included in regular classrooms should be in special classrooms to learn the material. One of the teachers interviewed in the study expressed that even though not all the students included would benefit academically, all would benefit socially.

Studies discussing secondary teachers' beliefs concerning the social benefits of inclusion are hard to come by. However, there are studies that look at preservice teachers' beliefs in this regard. Rademacher, Wilhelm, Hildreth, Bridges, and Cowart (1998) found that preservice teachers identify social benefits as the most positive reason for inclusion. Cook (2002) suggests that personal characteristics (e.g., patience, love of children) are more significant in implementing inclusion than knowledge, skills, or training experiences. Perhaps this is related to the finding that while preservice teachers may learn about the characteristics of students with LD, they do not think they learn how to teach students with LD (Rademacher et al., 1998). In recalling the finding that in-service teachers do not think their preservice education prepared them to teach students with LD (DeSimone & Parmar, 2006b)

but that these same teachers support inclusion (Barco, 2007; DeSimone & Parmar, 2006b; Snyder et al., 2001), a possible trend emerges.

Burke and Sutherland (2004) conducted a study comparing attitudes and beliefs of preservice and in-service teachers. Their results cited significant differences in beliefs about preparedness and confidence in the ability to properly implement inclusion. Preservice teachers in the study were cited as thinking they were more knowledgeable and prepared than in-service teachers. Additionally, preservice teachers were found to believe inclusion held academic benefits for students with special needs. The same cannot be said of the in-service teachers in the survey (Burke & Sutherland, 2004). According to Soodak, Podell, and Lehman (1998), as teachers spend more years in the classroom, they have less enthusiasm and lower expectations for students with LD. Although DeSimone and Parmar (2006b) found that, over time, teachers become more comfortable in their ability to adapt instruction.

The above literature illustrates a number of conflicts in teacher beliefs concerning inclusion. The common themes seem to show, however, a general belief that inclusion should be implemented. Two studies surveying general educators have found they do not have a strong belief in academic benefits of inclusion (Barco, 2007; Soodak et al., 1998), and research on preservice teachers indicates a belief that academic benefits lessen over time (Burke & Sutherland, 2004; Soodak et al., 1998). The strong support of inclusion for social reasons by preservice teachers (Cook, 2002; Rademacher et al., 1998) and the continued support of inclusion by general education teachers (Barco, 2007; DeSimone & Parmar, 2006b; Snyder et al., 2001) suggest that as beliefs in academic benefits lessen, support of inclusion is based mainly on social aspects. However, no research at this point has clearly outlined such a conclusion.

Training Teachers to Teach Students With IEPs

Research indicates that general education teachers take few courses on teaching students with special needs (deBettencourt, 1999; DeSimone & Parmar, 2006b; Maccini & Gagnon, 2006). Some teachers take a single course on special education in college, but the vast majority of these courses do not provide instructional strategies. These courses typically focus on the legal responsibilities of teachers with students who have IEPs and the legal rights of such students (DeSimone & Parmar, 2006b).

Professional development workshops positively impact teachers' perceived ability to teach students with LD (DeSimone & Parmar, 2006b; Miller, Wienke, & Savage, 2000); however, these workshops are offered and taken infrequently. Examining results from 228 teachers surveyed across the country, DeSimone and Parmar (2006b) found that 43% of middle school mathematics teachers had taken less than three workshops on working with students who have LD. Of the workshops that teachers did participate in, the majority of these were seen as unfruitful because they did not focus on instructional strategies that could be used in teaching their students. Miller et al. (2000) found that workshops that focus on specific strategies for teaching students with LD significantly increased general educators' perceptions of their ability to teach students with LD.

When general education teachers were asked what types of professional development they and their colleagues need most, they identified teaching and collaboration strategies as two of their top three needs (Pindiprolu, Peterson, & Bergloff, 2007). In the same assessment, administrators and special education teachers ranked behavioral assessments and inclusion strategies in the top three areas needed for professional development. Both groups identified behavior intervention as their top need in training. Administrators and special educators do not appear to perceive teaching strategies as a high priority for professional development related to special needs, which may explain why such professional development opportunity is seldom offered to general education teachers (DeSimone & Parmar, 2006b).

The literature above suggests that general educators want to learn more effective strategies for teaching students with LD as they did not study this in their college coursework (DeSimone & Parmar, 2006b; Maccini & Gagnon, 2006); yet, they are not offered professional development opportunities in this area (DeSimone & Parmar, 2006b; Pindiprolu et al., 2007). Further, the lack of in-depth in-service

training limits the effectiveness of teaching strategies discussed in such professional development (Cook & Schirmer, 2003).

Research Question

Previous research suggests that teachers are not given enough opportunities for professional development on inclusion-based practices, but the research does not provide information on how much training general educators need. In order to address this issue, the current study asks the following question: In what way does the amount of training and experience relate to general education teachers' self-perceived skill in adapting instruction for students with IEPs?

Methods

Data

Data from the Study of Personnel Needs in Special Education (SPeNSE) were used in this study (Carlson et al., 2002). Data were gathered through interviews over the phone from teachers, administrators, and paraprofessionals during the 1999–2000 school year. SPeNSE was funded by the U.S. Department of Education and Office of Special Education Programs. SPeNSE was designed to address shortages in personnel providing services to students with special needs and to investigate factors contributing to the training these personnel receive.

There was a two-phase sample design used in the SPeNSE study. During the first phase, three sampling units were randomly selected from the Quality Education Data (QED), an education marketing service firm. Local education agencies (e.g., locally operated school districts) were stratified by geographical region and district size. Intermediate education units (e.g., state-operated school districts) were also stratified by geographic region. Seventy-six state schools for students with sensory impairments were selected from the QED, and all were included (Carlson et al., 2002).

The second phase of the sample design used a simple random sample of service providers (e.g., teachers, administrators, paraprofessionals) from the personnel rosters of the sampling units listed above. Only 46% of the agencies sampled participated, and of these, 69% of the sampled service providers participated (Carlson et al., 2002). Therefore, the low participation in this study should be considered a limitation.

The current study used data collected from general education teachers who participated in the SPeNSE study. For the purposes of this study, general education teachers were defined as those identifying themselves as teaching early childhood education, kindergarten, elementary education, social sciences, language arts, mathematics, and science. The final sample size of 1,126 was approximately 14% of the total sample in the study. The distribution of the sample can be seen in Table 1.

Table 1
Sample Distribution

Teaching assignment	n	%
Early childhood	226	20.1
K–5	383	34.0
Social sciences	101	9.0
Language arts	237	21.0
Mathematics	114	10.1
Science	65	5.8
Total	1126	100

Measures

Teachers' self-perceived ability to adapt instruction for students with IEPs was measured based on the answer to the following: "To what extent do you agree with the following statements? …I am skillful in…adapting instruction for students with IEPs" (Office of Special Education Programs, 2000, p. 13). The teachers rated their level of agreement using a Likert scale (1 = not at all; 2 = small extent; 3 = moderate extent; 4 = great extent). Immediately following the question regarding skill in adapting instruction, teachers were asked whether they received preservice preparation in adapting instruction for IEP students, to which they replied "yes" or "no" (coded 1 = yes, 0 = no). Responses to this question were used as an indicator of preservice preparation related to inclusion. Interviewers also asked the number of hours of professional development teachers had received in the past 3 years on adapting instruction for IEP students. The available choices were "none," "less than 8 hours," and "8 or more hours." Professional development was dummy coded to create three groups: "None," "less than 8 hours," and "8 hours or more." Additionally, the number of years a teacher has taught students with IEPs was included in the analysis as a continuous variable.

Analysis

Correlation and multiple regression techniques were used to analyze the relationship among the amount of professional development, preservice preparation, number of years teaching students with IEPs, and teachers' self-perceived skill level in adapting instruction for students with IEPs. In the regression model, teachers' ability to adapt instruction was regressed on professional development and teaching experience, and "None" was used as the comparison group. Some teachers had more years experience than others in the sample, and this experience may have influenced their perceived skill in adapting instruction. Including this variable in the regression model helped to control for this possible influence. Because of the reduced response rate for the question related to preservice preparation, this variable was not included in the model, but the relationship between teachers' ability to adapt instruction and preservice preparation was investigated separately using Pearson correlations.

Results

Means, standard deviations, and intercorrelations for the study variables can be found in Table 2. On average, teachers' reported belief in their ability to adapt instruction indicated that they felt a little more than moderately comfortable adapting instruction for students with IEPs (M = 3.25, SD = 0.91). The number of responses to the preservice question was much lower than the other items (n =104). For this reason, the variable was not included in the regression model. However, a moderate but statistically significant correlation (r = .25, p < .01) was found between preservice preparation and teachers' perceived ability to adapt instruction.

Table 2
Means, Standard Deviations, and Intercorrelations for Variables

	Preservice	PD (none)	PD (<8 hrs)	PD (≥8 hrs)	Years teaching IEP	Adapt instruction
Preservice	--					
PD (none)	-.54**	--				
PD (<8 hrs)	.41**	-.65**	--			
PD (≥8 hrs)	.14	-.33**	-.50**	--		
Years teaching IEP	.14	-.02	.03	-.02	--	
Adapt instruction	.25**	-.25**	-.02	.30**	.15**	--

Table 2 (continued)

	Preservice	PD (none)	PD (<8 hrs)	PD (≥8 hrs)	Years teaching IEP	Adapt instruction
M	.51	.30	.50	.20	9.72	3.25
N	104	475	475	475	559	648
SD	.50	.46	.50	.40	6.8	.91

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

Teachers' self-perceived ability to adapt instruction was regressed on hours of professional development and years of teaching experience. Note that the correlation between the level of professional development and teaching experience was not different from 0 (see Table 2). This suggests noncolinearity, or no overlap, in explained variance for these variables. Standardized and unstandardized coefficient estimates for the model are presented in Table 3. The model was found to explain 14.5% of the variance in a teacher's self-perceived ability to adapt instruction. Additionally, the regression model was found to have a medium effect size ($f^2 = .17$; see Cohen, 1992). The amount of professional development was found to be statistically significant and positively related to teachers' perceived ability to adapt instruction. In particular, when comparing standardized coefficients, 8 hours or more of professional development was found to have a stronger relationship ($\beta = 0.39$, $p < .01$) with teachers' perceived ability to adapt instruction than either professional development of less than 8 hours ($\beta = .16$, $p < .01$) or the number of years teaching students with IEPs ($\beta = 0.19$, $p < .01$). The effect of "more than 8 hours" of professional development was twice that of the other two variables in the model. IEP teaching experience was also found to be statistically significant and positively related to teachers self-perceived ability to adapt instruction ($\beta = 0.19$, $p < .01$).

Table 3
Regression of Teachers' Self-Perceived Ability to Adapt Instruction on Professional Development and Years Teaching Students With IEPs

	Unstandardized coefficients		Standardized coefficients	
	β	*SD*	β	*t*
Professional development (8 hours or more)	0.64***	.083	0.39	7.67
Professional development (less than 8 hours)	0.22**	.067	0.16	3.24
Number of years teaching IEP	0.02***	.004	0.19	4.28

*$p < .05$, ** $p < .01$, *** $p < .001$; $R^2 = .145$, $n = 475$

Discussion and Implications

The focus of this study was to investigate the relationship among teachers' number of professional development hours, years teaching students with IEPS, and self-perceived ability to adapt instruction for students with IEPs. The analyses showed that the more hours of professional development teachers have the more able they believe they are to adapt instruction for students with IEPs. In particular, although some professional development is better than none, having 8 hours or more of professional

development is more than twice as effective as less than 8 hours in improving teachers' self-perceived ability to adapt instruction.

Further, the results of the current study suggest that it may take large amounts of training to have a meaningful influence. As this study used a categorical variable to describe the amount of professional development teachers had received, the results cannot discern a specific threshold for the amount of professional development needed to increase teachers' perceived ability to adapt instruction. While any amount of professional development seems to increase teachers' perceived ability to adapt instruction, larger amounts (e.g., 8 or more hours) more than doubles the effect. In other words, a 1-hour session every year may not be very effective. Although teachers, on average, feel moderately comfortable adapting instruction, we must ask ourselves if this comfort level is good enough. Recent studies suggest teachers do not believe it is (DeSimone & Parmar, 2006b; Pindiprolu et al., 2007).

Teachers have been found to have limited hours of in-service training on inclusion-based practices (DeSimone & Parmar, 2006b). Therefore, a clear implication of this study is for administrators to offer extensive workshops on specific teaching strategies for students with IEPs. The implications from this study and suggestions from other researchers (Cook & Schirmer, 2003; DeSimone & Parmar, 2006b) imply these workshops should be conducted periodically and more than once a year. It may also be beneficial to receive teacher feedback in order to evaluate the effectiveness of such training sessions.

Huffman, Thomas, and Lawrenz (2003) evaluated the effectiveness of different types of professional development for mathematics and science teachers. Although the study did not focus on teacher training in regard to inclusion, the findings do provide information on the types of professional development that effectively changed teachers' instructional practices. Specifically, Huffman et al. found that professional development was more effective when teachers developed curriculum materials or when they evaluated classroom scenarios or real classroom situations. Research suggests teachers want more practical inclusion training (DeSimone & Parmar, 2006b; Miller et al., 2000); thus, the use of professional development as discussed by Huffman et al. may improve inclusive teaching practices. Teachers may think their training is worthwhile if they are provided opportunities to develop curriculum materials for teaching in an inclusive classroom, as well as opportunities to evaluate inclusion classroom scenarios. Additionally, the findings from the current study suggest that such training should be offered and provided often.

Professional development was found to be a better predictor of teachers' improved perceptions of their ability to adapt instruction for students with IEPs than years of experience teaching such students. Roll-Pettersson (2008) found similar results when examining teacher beliefs about students with dyslexia or mild mental retardation. Such results do not suggest teaching experience should be discounted—quite the contrary. It only suggests that experience is not the only means by which teachers improve their skills in working with students with IEPs.

The implications from the review of literature and the results of this study cannot be understated. Teachers do not feel they have been prepared to teach students with disabilities (DeSimone & Parmar, 2006b; Maccini & Gagnon, 2006). What they want is more training on specific teaching strategies (Pindiprolu et al., 2007). However, DeSimone and Parmar (2006b) and Maccini and Gagnon (2006) suggest this training is not taking place. From here there are several objectives worth pursuing: One is to identify inclusion-based teaching strategies that general educators can apply to their specific content areas; another is to find the best ways to teach these strategies to teachers so that they can properly implement them. The current study found that teachers who had more professional development in adapting instruction for students with IEPs felt more skillful in adapting instruction. Therefore, the findings of this study suggest that one major objective should be to provide extended professional development on adapting instruction for students with IEPs. However, further research is necessary to know how much professional development is enough.

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