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The Effects of a Coaching Cycle on Student Achievement in Math

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Abstract

This research study explored the effects a mathematics coach had on student achievement in math. The study analyzed the various interventions done by the math coach and teacher researcher in a second grade classroom and how those impacted students' learning as well as the test results. Data collection included a posttest from a previous unit compared to a post test of the current unit which used the implementation of the math coach. The data and analysis show that there was a slight increase in the average of student's test scores, but no change in the amount of students proficient when the math coach was utilized.

Effects of a Coaching Cycle on Student Achievement

With the changes in the Common Core State Standards for Mathematics, the demand for student's depth of knowledge in math has shifted from computational fluency to reasoning and sense making. As students learn the big Ideas in math, the kids use them as a foundation to build on each year. Improving students' mathematical achievements has become the ultimate focus. Polly, Mraz, and Algozzine (2013) comment on the recent Education Progress data saying,

> Although National Assessment of Education Progress data indicate modest achievement gains in mathematics over the last decade, students, in general, still struggle. While evidence about which instructional pedagogies contribute to the largest achievement gains is inconclusive, research indicates that teacher quality has a significant influence on students' achievement, and most professionals agree that it is the critical factor in bringing about improvement in America's schools. This idea of school-based support or coaching has been in education for decades, but little is known about the impact of coaching in the field of mathematics education. (p. 297)

With hopes of improving teacher quality and competence, "mathematics classroom coaching is being used across the United States as a means for improving instruction, with the ultimate goal of improving student learning" (Mudzimiri, Burroughs, Luebeck, Sutton, & Yopp, 2014, p. 1). "An instructional coach is an on-site professional developer working in one school offering on-the-spot, every day professional development" (Knight, 2004, p. 33).

Coaching is an opportunity to learn with another professional and is not meant to be long term, but rather a temporary approach to personal professional development. As coaches assist teachers in building understanding, it is crucial for the coach to be an expert in the standards and curriculum as well as instructional practices. Not only is it important for the coach to be an expert in the content area, a coach should also possess other qualities such as being organized, flexible, likable, a good communicator, and have a commitment to learning. Coaches can work with small groups of teachers or one on one to help promote professional growth. The relationship between the teacher and coach is a partnership. The partnership mainly consists of sharing, reflecting, analyzing, discussing, and reviewing. "In coaching, conversations are focused on specific goals with each participant listening and observing one another to gather information which will lead to a plan for accomplishing those specified goals" (Shidler, 2008, p. 454).

While the specific role and dynamics of an instructional coach may look different throughout various school districts, the coach is there to support classroom teachers and improve teacher learning. "The coaches often model lessons, observe teachers, provide constructive feedback, and share their experiences and expertise" (Thomas, Bell, Spelman, & Briody, 2015, p. 1). "A good instructional coach must be able to go into any classroom and provide a model lesson that responds to an individual teacher's needs" (Knight, 2004, p. 35). "One of the most critical responsibilities of the math coach is to assist teachers in building their own deep conceptual understanding of mathematics which, in turn, gives teachers the power to provide their students with a stimulating, logical, and coherent math program" (Silbey, 2015, p. 7).

Based on current information, student achievement is gained by improving the instructional practices of teachers. "Quality of teacher instruction seems to be the one factor that is within the locus of control of education systems and has proven to have a significant impact on student achievement" (Garcia, Jones, Holland, & Mundy, 2013, p. 2). Instructional coaches are just one research based way to improve teacher instruction. According to Polly, Mraz, and Algozzine (2013), "coaching models have been empirically linked to increases in recommended instructional practices as well as gains in student learning" (p. 298). Because of the constant push for an increase in student achievement, school districts continue allocating funds towards coaching. The teacher researcher's district currently provides money to provide instructional coaches within the district which led to the nature of the research. As a teacher researcher, the hypothesis that guided this research study is that following an instructional coaching model with an expert in the content area will increase student scores.

Literature Review

According to Linda Shidler (2008), "teachers with a high level of instructional efficacy believe more whole-heartedly in children's ability to be successful" (p. 453). Shidler (2008) completed a three year study looking at the linkage between hours spent coaching nine head start teachers in the classroom for efficacy in content instruction and child achievements with each classroom having a specific coach. During each of the years, the amount of time spent in the classroom and outside of the classroom coaching was different. After each year, the results showed no significant correlation between the average gain in students' scores and the amount of hours coaching per classroom was found (Shidler, 2008). In Shidler's (2008) study, it was concluded "that

more time [with a coach in the classroom] is not always better. It is the type and quality of interaction that becomes a deciding factor (p. 459)."

A study done by Elish-Piper and L'Allier (2010) looked at the relationship between literacy coaching and student reading achievement in grades K-1. Five-literacy coaches spent time working with 26 different Kindergarten and first grade teachers throughout the year as the teachers were trying to implement guided reading. The result was that coaches spent the majority of the time with these teachers modeling, observing, and conferencing. Data was collected and analyzed. The researchers looked at the total coaching hours and interactions as well as the actions of observation and conferencing. The results showed that "these aspects of coaching did not account for a significant portion of the variance in student gain on the tests, but could mainly be because of the small number of coaches in the study, the relatively limited amount of documented coaching, and the inconsistency between the focus of coaching and the outcomes assessed on the test" (Elish-Piper & L'Allier, 2010, p. 169). Although Elish-Piper and L'Allier (2010) did note that there was a positive relationship between the number of coaching observation hours and total student gain. "As coaches spend more time observing teachers in the classroom, the teacher and coach may be engaging in a number of behaviors that positively impact the teacher's instruction and, as a result, the students' learning" (Elish-Piper & L'Allier, 2010, p. 170).

In a study done by Garcia, Jones, Holland, and Mundy (2013), the researchers looked at the influence the use of instructional coaches had on students' spring 2011 Texas Assessment of Knowledge and Skills Test (TAKS) scores. The TAKS show each student's proficiency in the core content areas. Two middle schools within the same

district in Texas were selected as the participants of this study. One school used instructional coaches throughout the year while the other did not. The coaches' primary duties were to "provide professional development, directly work with teachers to improve practice, and to lead instruction with curriculum alignment standards and assessment tools" (Garcia, et al, 2013, p. 9). When looking at the results, in all content areas except seventh grade writing, the school that did not utilize an instructional coach either had a higher student achievement mean score than the school that utilized a coach or the results were mixed. As the researchers analyzed the results, it was mentioned that there was not a clear understanding of the amount of coaching time per week, the pedagogical and educational background of the coach, or how the coaching time was utilized all of which could have an impact on the student achievement scores (Garcia, et al., 2013). Therefore, "as concluded by the researchers, the results of the study are not conclusive, but contribute additional evidence that supports the use of coaches to increase student achievement" (Garcia, et al., 2013 p. 9).

Another example comes from Knight (2004) as he reported on the Pathways to Success project in Topeka, Kansas which placed full-time instructional coaches in the school district. For four years, the instructional coaches were utilized in the middle school and high school classrooms of teachers who were interested. While there is not specific information on the amount of time coaches were in the classrooms, the researchers did find that coaches were accepted and welcomed by teachers when the teachers felt like there were choices, time was respected, and the relationship was a partnership. The Pathways to Success researchers also found that coaches had a significant impact on the school-wide instruction when they were available to provide

support and model instructional practices for the teachers. “The Pathways to Success staff engaged in ongoing formative and summative assessment through all stages of the project. Teachers and project staff use curriculum-based pretest and posttest measures (along with other measures) to assess the effectiveness of each intervention used” (Knight, 2004, p. 37). Looking at the results of the tests, the various interventions proved to be effective. For example, a self-questioning strategy was taught in three of the general education seventh grade science classes while the teacher’s traditional method of teaching was used in the other three classes. Each student was given a pretest and a posttest on the content. “Students who learned the strategy improved their posttest scores by 60%; students who didn't learn the strategy improved posttest scores by 40%” (Knight, 2004, p. 37).

In a case study by Jim Neuberger (2012), Neuberger studied a third/fourth grade teacher and instructional coach for two months. While Neuberger (2012) does not comment on quantitative data, the data that is described on the research is done in a qualitative manner. The instructional coach and teacher worked together as an intervention to see if it would affect the teacher’s classroom practices specifically in math. In order to gather data, Neuberger (2012) conducted a series of interviews with both the teacher and coach individually. In the interviews, the teacher noted that the coach really got the teacher to look at and analyze the students’ work. This would guide the discussion as well as lead to questions the teacher would ask. In response, the coach gave ideas for follow up activities. Between the beginning interviews and the end, Neuberger (2012) commented on some of the most noticeable differences after the coaching cycle occurred. It was evident that the teacher gained pedagogical and

mathematical knowledge, had emerging and changing beliefs and practices, and an increase in self-confidence in teaching math. "When a teacher has the opportunity to observe and discuss the impact of the beliefs and practices of an excellent coach, the experience can be profound" (Neuberger, 2012, p. 309). In conclusion, Neuberger's (2012) case showed that coaching can be a successful teaching tool but also takes into consideration that the principal and teacher's colleagues, atmosphere of the school, willingness of the teacher, and the skills of the coach play a vital part in whether the coaching cycle process is likely to be successful.

While the other articles looked at interventions and support given by instructional coaches and the effects on student achievement, Polly, Mraz, and Algozzine (2013) discuss a logical model based on Vygotsky's Zone of Proximal Development "for preparing elementary school mathematics coaches in their efforts to provide instructional support and professional development to teachers who, in turn, influence a student learning" (p. 301). The model begins with coaches assisting teachers through co-teaching, model teaching, or observing a lesson and providing feedback after. In the second stage, the teachers start to become self-supported and the coach is used more as a support for planning. As a teacher moves to stage three, the practices and pedagogies learned from the coach are internalized. The coach provides experiences to help the teacher reflect and internalize. Finally, the teacher self modifies and self reflects while utilizing the coach as a support as needed. Ultimately, "coaches serve as the more knowledgeable other that helps teachers refine their instruction to maximize the impact on their students' learning" (Polly, Mraz, & Algozzine, 2013, p. 306).

Methods

Participants

This action research project was implemented in a second grade general education classroom. In the class, there are 22 students, eight females and fourteen males. All of the students range from 7-8 years old. The student's demographics consist of 19 white students, one African American student, one Hispanic student, and one Asian student. Within the class, four of the students fall below the free and reduced lunch socio-economic status while the other 18 are above. Of the 22 students in the researcher's class, one receives special education services in math and reading, one receives Title 1 reading assistance, and one is on a behavior Instructional Education Plan (IEP).

Data Collection

The focus of this action research was to look at the effect an instructional coach has on second grade student achievement in math. Quantitative data was collected by looking at the percentage of correct answers on the unit four posttest compared to the percentage of correct answers on the unit five posttest. The dependent variable was the student achievement measured by the posttest, and the independent variable was the presence or absence of the instructional coach in each unit. The teacher researcher and instructional coach followed a coaching cycle where time was spent planning lessons, asking questions, teaching the lessons, pulling small groups of students, and analyzing students' work.

Before the unit began, the instructional coach and teacher researcher met to talk about the format of the math class as well as look at the content that was going to be

taught in unit five, which was three digit addition and subtraction. For the first couple of days, the instructional coach came to observe the teacher researcher's students and instruction. During the lesson, the coach walked around talking to students about their math thinking helping to avoid misconceptions when needed. The coach and teacher researcher had also agreed on the instructional coach co-teaching when it was applicable. After the observations, the coach and teacher researcher met to discuss specific student needs as well as aspects that went well and others to consider for improvement. The partnership also looked at and analyzed student work, discussed and planned the next couple of upcoming lessons, and talked about specific students to pull for small group instruction based upon student work.

For the next lesson, the coach pulled the lowest six students to teach the concept at a slower pace while the teacher researcher taught the other 16 students the same concept. While the small group instruction with the coach was not successful due to behaviors and students' poor number sense, the teacher researcher was able to teach the lesson at an accelerated pace in the classroom to the remaining students. The following lesson was taught by the teacher researcher to all of the students with the instructional coach aiding the teacher researcher when necessary as well as working with individual students. After analyzing the students' work, the instructional coach and teacher researcher decided that co-teaching the next couple of lessons and then pulling students in small groups or individually to fill in the gaps would be the best way to cover the materials as most of the students already understood the concept of three digit addition from those lessons.

The remaining lessons shifted from three digit addition to three digit subtraction. As the instructional coach and teacher researcher met to plan for the rest of the lessons left in the unit, it was decided to co-teach the lessons with careful consideration in the number choices, amount of examples, and activities done in each lesson. The partnership recognized that a handful of the students were bored while another group was losing focus because the lessons were difficult and long. As the co-teaching occurred, the team worked to focus on the struggling students while capitalizing on the knowledge of the students who understood the concepts by having them present and explain their work during guided practice. After teaching the lesson, the teacher researcher and instructional coach would work with individual students, who still had some misconceptions, on their individual practice. After school, the partnership would meet to look at students' work and make any adjustments for the next day's lesson. This was the process that was followed for the remainder of the unit.

Beyond working with individual students during the normal 75 minute math block, the teacher researcher and instructional coach each pulled small groups of 3-4 students during a 30 minute intervention block three days a week. The groups were determined based on student's work. If there were misconceptions based on prior knowledge, then either the teacher researcher or coach would plan activities and use various teaching strategies to help backfill. Otherwise if the misunderstandings were based on the current standard being taught, the teacher researcher or coach would provide additional activities and opportunities for practice. Often times, it was the same 6-7 students who would be pulled for the math interventions with the exception of an additional student or two. Three students struggled with general number sense, so those students were

almost always in the backfilling group to try and help them catch up to their grade-level peers. Overall, having two professionals in the classroom during the lessons and extra intervention time allowed for helping twice the amount of students compared to if the teacher researcher had been alone. The partnership could work together to cover more struggling students, provide extra assistance to the average students, and challenge the gifted students.

Findings

Data Analysis

As the research was conducted, very little bias was included. The teacher researcher was the teacher of the students for both of the math units, and the instructional coach is the district math coach. The instructional math coach is an expert in the math content, and the district recommends that teachers utilize the coach whenever possible. The math curriculum was new this school year, so the teacher researcher was encouraged to go through a coaching cycle which led to the nature of this research. As the teacher researcher taught the previous math units, the teacher researcher was looking for ways to help increase student achievement. Quantitative data was collected to try and answer the question of what effects a coaching cycle has on student achievement in math.

Quantitative data analysis. In order to collect the quantitative data, the teacher researcher gave two different posttests covering material from two different units. The first posttest was given at the end of unit 4 which the teacher researcher taught her second grade students without utilizing the instructional coach. The second posttest

was given after unit 5 during which the teacher researcher took part in a coaching cycle. The table below shows each student's percentage correct and whether their percentage increased or decreased from unit four to unit five.

Table 1

Student Math Scores

Student	Unit 4 Test	Unit 5 Test	% Difference from Test 4 to Test 5
1	63%	62%	1%
2	94%	100%	6%
3	83%	89%	6%
4	80%	95%	15%
5	94%	89%	5%
6	86%	78%	8%
7	69%	67%	2%
8	89%	100%	11%
9	86%	95%	9%
10	74%	84%	10%
11	83%	84%	1%
12	89%	100%	11%
13	91%	100%	9%
14	89%	100%	11%
15	94%	100%	6%
16	83%	95%	12%
17	63%	45%	18%

18	94%	100%	6%
19	69%	62%	7%
20	97%	95%	2%
21	77%	78%	1%
22	86%	100%	14%

The data from the unit four posttest showed a class average of an 83% on the test with 73% (16 out of 22 students) of the class being proficient. Proficient means the individual's score was on or above an 80%. Data from the unit five posttest showed an increase in the class average with a score of 87%, but the percentage of student's proficient remained the same with 16 out of 22 students or 73% of the second graders. Overall, 68% of the student's test scores increased after the coaching cycle while 32% of the class's test scores decreased.

Looking at individual scores, the highest score on the unit four posttest was a 97% while multiple students scored a 100% on the unit five posttest. On the contrary, the lowest score actually occurred on the unit five posttest at a 45% while the lowest score on the unit four posttest was a 63%.

Student 17 had the lowest score on both of the posttests, and also had the largest decrease between test scores. This was a student that was always a part of the extra pull out intervention time, and received extra assistance during individual work time. The student struggles with number sense, but also has a difficult time paying attention and staying on task.

When looking at the other students who had a decrease in test scores, Student 1, 6, 7, and 19 were also a part of the extra assistance during the normal math block. Students 1 and 7 struggle in math and often had many misconceptions, so those students were regularly pulled during the extra intervention time. Students 6 and 19 often made calculation mistakes which was the reason for the decrease on the individual test score as well. Because the teacher researcher and coach knew that, the professionals would check in with those students frequently throughout the regular math time. Often times all that was needed was for those students to slow down and check the work as well as a need for those students to work on math facts. Student 6 went from proficient in unit four to not proficient in unit five. Students 5 and 20 also showed a decrease, but remained above the 80% or proficient level.

While five of the students, who the teacher researcher and instructional coach worked with more than other students throughout the coaching cycle, showed a decrease in test scores, four of the students showed an increase. Students 3, 4, 10, and 21 all made growth while the instructional coach was present. Student 4 was on a math IEP. Student 10 went from not proficient in unit 4 to proficient in unit 5. All four of those students worked hard during the math block.

Discussion

Summary of Major Findings

Throughout this research study, the findings show that while there was not a large growth, the student test average did increase when the instructional coach was involved. The effect of the coaching cycle on student achievement did not change the

amount of students proficient at the end of each unit. The largest quantitative difference seen is the amount of students that mastered the concepts. In unit 4 posttest, zero students received a 100% while on the unit 5 posttest, eight students scored a 100%. While the findings do not show large quantitative gains in student achievement as an effect of the coaching cycle, the teacher researcher noticed a huge increase in the amount of student and teacher time. With both the teacher researcher and instructional coach teaching, analyzing, planning, and providing interventions, the amount of students that benefited increased. The partnership could double the small group and one-on-one instruction both during the math block and extra intervention time. Also, as the teacher researcher and instructional coach worked through the coaching cycle, there were two professionals with knowledge and ideas on how to best capitalize on this group of second graders' strengths and find ways to improve the students' weaknesses.

Limitations of Study

The limitations of this research study include that the content in unit five may have been easier than unit four. Unit four was focused on strategies for double digit addition and subtraction which was a new concept to second graders. Three digit addition and subtraction strategies were the focus of unit five. Similar strategies were taught, so students had to apply them to numbers above one hundred rather than below one hundred. Because of the knowledge from the previous unit, students had a foundation already started. Other factors that may have influenced the findings of this research are natural maturation as well as continued classroom activities and practice.

Further Study

Implications for future research include looking at multiple units of data. This research was done over a three month period where two units were completed. More research needs to look at multiple units over the course of a year both with and without utilizing a coaching cycle. In addition, implementing a pretest into each unit and then looking at the percentage increase or decrease between the pre and posttest would give more specific data to analyze. Finally, more research could be done looking into teacher's classrooms who utilize coaching cycles compared to classrooms where coaching cycles are not integrated.

Conclusion

"Mathematics coaches are needed in schools to provide instructional support to classroom teachers and students into the teaching and learning of mathematics" (Polly, Mraz, & Algozzine, 2013, p. 306). Throughout this research, the instructional coach directed a coaching cycle with the teacher researcher with the goal of impacting student achievement in math. The quantitative data of this research showed an increase in the average of student test scores, but the amount of students proficient remained the same. "The increased focus on teaching mathematics in elementary school in a conceptual, reform-oriented manner requires teachers to possess adequate knowledge of content, pedagogy and of how students best learn mathematics. Elementary school mathematics coaches can provide the necessary on-site support to help teachers adapt the way they teach mathematics" (Polly, Mraz, & Algozzine, 2013, p. 306). Although the data was not an overwhelming increase, throughout the coaching cycle, the teacher researcher was better able to meet the needs of the students. Finally, the assistance of the mathematics instructional coach allowed the teacher researcher to change and

improve the mathematics teaching which helped to develop students' mathematical proficiency.

References

Elish-Piper, L., & L'Allier, S., K. (2010). Exploring the relationship between literacy coaching and student reading achievement in grades K-1. *Literacy Research and Instruction, 49*(2), 162-174. https://ezproxy.nwciowa.edu/login?url=https://search-proquest-com.ezproxy.nwciowa.edu/docview/89199054?accountid=28306

Garcia, S. G., Jones, D., Holland, G., & Mundy, M. (2013). Instructional coaching at selected middle schools in south Texas and effects on student achievement. *Journal of Instructional Pedagogies, 11*(11). https://ezproxy.nwciowa.edu/login?url=https://search-proquest-com.ezproxy.nwciowa.edu/docview/1826537569?accountid=28306

Knight, J. (2004). Progress through partnership. *Journal of Staff Development, 25*(2), 32-37. https://ezproxy.nwciowa.edu/login?url=https://search-proquest-com.ezproxy.nwciowa.edu/docview/211508949?accountid=28306

Mudzimiri, R., Burroughs, E. A., Luebeck, J., Sutton, J., & Yopp, D. (2014). A look inside mathematics coaching: Roles, content, and dynamics. *Education Policy Analysis Archives, 22*(53), 32. https://ezproxy.nwciowa.edu/login?url=https://search-proquest-com.ezproxy.nwciowa.edu/docview/1697487633?accountid=28306)

Neuberger, J. (2012). Benefits of a teacher and coach collaboration: A case study. *The Journal of Mathematical Behavior, 31*(2), 290-311. http://dx.doi.org.ezproxy.nwciowa.edu/10.1016/j.jmathb.2011.12.004

Polly, D., Mraz, M., & Algozzine, R. (2013). Implications for developing and researching elementary school mathematics coaches. *School Science and Mathematics, 113*(6), 297-307. https://ezproxy.nwciowa.edu/login?url=https://search-proquest-com.ezproxy.nwciowa.edu/docview/1441696725?accountid=28306

Shidler, L. (2009). The impact of time spent coaching for teacher efficacy on student achievement. *Early Childhood Education Journal, 36*(5), 453-460. doi:http://dx.doi.org.ezproxy.nwciowa.edu/10.1007/s10643-008-0298-4

Thomas, E. E., Bell, D. L., Spelman, M., & Briody, J. (2015). The growth of instructional coaching partner conversations in a PreK-3rd grade teacher professional development experience. *Journal of Adult Education, 44*(2), 1-6. https://ezproxy.nwciowa.edu/login?url=https://search-proquest-com.ezproxy.nwciowa.edu/docview/1750418316?accountid=28306