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The Impact of Mathematics Coaching on Teacher Pedagogy and Student Understanding in Rural School Districts

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Instructional Coaching and Its Effect on Teacher Efficacy and Pedagogical Knowledge

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Abstract

This study collected perception data from teachers and math coaches in rural Maine schools to determine if working with a mathematics coach had an impact on teacher's pedagogy. Participants were also asked if they believed that coaching interactions impacted their students' understanding of mathematics. The design included interviews with four coaches who had been trained through the Maine Mathematics Coaching Project. Data from twenty-two teachers was collected through surveys that were emailed to all teachers who had worked with the four coaches. The conclusions indicate that most coaches and teachers do believe that working with a mathematics coach has a positive impact on both teacher pedagogy and student understanding, with the impact extending to subjects other than mathematics. Increased classroom discourse, persistence in problem solving, and stronger number sense due to increased use of research-based practices emerged as common trends in the findings from both sets of data.

Introduction

Instructional coaching is a tool used to assist teachers improve their professional practice. Literacy coaches are often employed by school districts, helping teachers to improve their efficacy and pedagogy, as well as their students' understanding. Recently there has been a shift, and schools have started to employ mathematics coaches as well. While some studies have focused on math coaching, a larger body of research exists for instructional coaching in general.

Numerous researchers have studied academic coaching and its effects on coaches, teachers, and students (Campbell, 2012; Hindman & Wasik, 2012; Ippolito, 2010; Kowal &

Steiner, 2007). Kowal and Steiner (2007) explained that coaches should demonstrate strong pedagogical knowledge, content expertise, and interpersonal capabilities. Ippolito (2010) conducted a study in an urban, mid-sized East Coast school district which identified ways of coaching that supported balanced relationships with teachers and collective learning. The coaching behaviors were described as responsive, which involves coaching for teacher self-reflection, or directive coaching for the implementation of particular practices. Ippolito (2010) claims that identifying and replicating these practices could be quite helpful in preparing and supporting coaches. All of these skills and practices are important for coaches to use when facilitating successful relationships with the teachers whom they coach.

Campbell (2012) reported on the complexity of the position of math coach and its impact on student achievement and teacher beliefs in grades 3-5. The greatest impact and effectiveness was found in cases where the teachers were highly engaged with the math coach. The researchers claimed that in order to be most successful, math coaches need to have time to establish, develop, and maintain collaborative relationships with the teachers in their schools (Campbell, 2012). These findings demonstrate the need for more research on the effectiveness of math coaching. This research supported my investigation of math coaching's effect on teacher efficacy and pedagogical practices by demonstrating that being well-trained and having the ability to establish and maintain collaborative relationships will allow math coaches to achieve greater success. This will be helpful to remember as I begin my work as a full-time math coach.

A qualitative study by Hartman (2016) is one of the only studies on academic coaching to have looked specifically at rural schools. Findings of this study showed that initial entry into classrooms was often easier for coaches in rural districts because they were often teachers that transitioned into leadership positions, so they already had established professional relationships

with teachers at their schools (Hartman, 2016). The study found that beyond the initial meeting, rural coaches face the same challenges in establishing ongoing coaching relationships as academic coaches in suburban or urban settings (Hartman, 2016).

Hindman and Wasik (2012) studied the impact of 2 years of a coaching-based language and literacy intervention at Head Start centers in an urban area in the Northeast. The researchers found that the first year of coaching was linked to gains, and a second year of coaching resulted in additional gains in the quality of instructional interactions. They also found that coaching was equally effective for all teachers, regardless of their initial skills. The coaching program also improved children's outcomes. The researchers claim that the findings imply that there are benefits of longer durations of high-quality professional development experiences. Findings such as these can be used to encourage school districts to continue funding math coach positions for more than just one or two years, in order to see the best results.

Literature Review

Effects of Coaching: Teacher Efficacy

Peer coaching in mathematics has also been used to change teachers' beliefs about their own teaching practices, which can lead to a change in their teaching strategies. Changing their teaching strategies can have a positive effect on their students' understanding. Various researchers have conducted teacher efficacy studies that focused on how teachers judge their own capacity to bring about student learning (Bruce & Ross, 2008; Charalambous, Philippou, & Kyriakides, 2008; Ross, 1992). Charalambous et al. (2008) aimed at addressing a research gap by

examining the development of prospective teachers' efficacy beliefs with respect to mathematics, during the period of fieldwork, instead of working with more experienced teachers.

Ross (1992) concluded that student achievement was higher in classrooms of teachers who had more contact with their coaches and in classrooms of teachers with greater confidence in the effectiveness of education. The researcher found that all teachers, regardless of self-efficacy, were more effective with greater contact with their coaches. Although student achievement was higher in classrooms where teachers had greater self-efficacy, the researcher found no interaction between efficacy and coaching. Therefore it was concluded that there is need for further research in this area. Ross (1992) stated that a limitation of the study was the the small sample size. Creswell noted on p. 283 that inappropriate sampling is a common shortcoming of quantitative research studies.

The effects of peer coaching on mathematics teaching practices, as well as on teachers' beliefs about their capacity to have an impact on student learning was examined by Bruce and Ross (2008). It measured the effects of peer coaching and related mathematics in-service. Bruce and Ross (2008) used qualitative methods to conduct their research over several years, including teacher self-assessments, observations, peer interviews, and field notes of professional development sessions. After compiling the data, it was analyzed using a two-level qualitative coding strategy with multiple researchers interpreting the data. Their findings showed that peer coaching along with pedagogical training in mathematics moved teachers along a continuum of practices towards more effective teaching. Peer coaching increased the quality and value of teacher collaboration. The researchers concluded that interaction between peer coaching and effective mathematics teaching should be studied further (Bruce & Ross, 2008).

A study was conducted to measure the development of ninety-three preservice teachers' efficacy beliefs in math during fieldwork (Charalambous et al., 2008). The researchers used questionnaires and semi-structured interviews, and the findings of the study helped them to identify factors that contribute to the development of these beliefs. Charalambous et al. (2008) found that pre-service teachers' efficacy beliefs were mainly informed by experimentation with teaching and interaction with mentors, tutors, peers, and pupils. Based on the findings, they stated implications for mathematics preservice teacher education and provide suggestions for future research. These studies supported my investigation of math coaching's effect on teacher efficacy by demonstrating that teachers' beliefs about teaching mathematics can be changed, although it might take time and it could be challenging.

Effects of Coaching: Pedagogical Knowledge

Another effect of coaching is the change in effective teaching practices. As teachers work with instructional coaches, they begin to implement new pedagogy. Various researchers focused on the changes in teachers' pedagogical knowledge after working with coaches (Kupra & Confrey, 2012; Rudd, Lambert, Satterwhite, & Smith, 2009; White, 2013). As with teacher efficacy, these changes can lead to improved student understanding.

Kupra and Confrey (2012) conducted a case study on the use of instructional coaches in mathematics professional development. The researchers collected and analyzed data that showed that twelve teachers in their first 3 years of teaching showed noticeable changes in their practice after working with 2 coaches, especially in the areas of use of class time, pacing, formative assessment, and content delivery (Kupra & Confrey, 2012). DeChenne et al (2012) state that "research on coaching suggests that coaching can improve teacher quality and therefore student

achievement, but studies are needed to make that link clear (p.6).” These articles support the idea that coaching is an ongoing professional development activity that can improve teachers’ professional practices in math.

In 2013, White conducted a narrative study, as described in Table 15.5 of Creswell’s (2015) text (p. 518-519). At Burrus Elementary School in Houston, Texas, educators set a goal of placing a skilled teacher in every classroom with strong mathematics knowledge, supported by identified teacher leaders. School leaders worked to develop a professional learning community to strengthen the mathematics teachers' pedagogical skills, and to identify and train teacher leaders for the role of math coach. White (2013) described how the researcher collaborated with the participants in the study. Regular meetings with the school principal were also conducted during this process, to identify strengths and weaknesses of his teachers' pedagogical and mathematics content knowledge and progress teachers had made from previous coaching sessions. It was concluded that teachers’ practices are changed by working with a coach. Effective teachers can transition to the role of coach, but benefit from additional professional development of pedagogy and leadership skills. Support from administrators can facilitate the effectiveness of this process.

A study developed to determine the effect of side-by-side coaching as a means of improving the implementation of strategies taught in professional development seminars (Rudd, et al., 2009). The researchers concluded that there was a 56% increase of math mediated language following a professional development session. However, the greatest increase occurred after the coaching phase of the study. After coaching, there was an additional 39% increase of math mediated language compared to the improvement after professional development alone. A strength of this study was that researchers used a multiple-baseline design used in single-subject

research. On page 317, Creswell (2015) discussed how a multiple-baseline design allows researchers to introduce the intervention in a time-lagged fashion, so that the intervention is given to participants at different times. However, according to the authors, the variability found in the data analysis is a limitation to this study (Rudd, et al., 2009). They felt that the data displayed too much variability to conclude, with a high degree of confidence, that functional relationships exist specifically between math mediated language and professional development or side-by-side coaching. Their data does show that the combination of professional development and coaching made a significant difference in the teachers' practices (Rudd, et al., 2009). This study could impact coordinated planning of professional development and math coaching cycles for math coaches in school districts that are currently implementing math coaches.

Summary and Conclusion

Research exists on the effects of academic coaching on teacher efficacy, pedagogical knowledge, and its impact on student understanding. Instructional coaching has been studied across varied grade levels, including preschool. However, because math coaching is a relatively new field, less research has been done to study the effects of mathematics coaching. Much of the research has been conducted in urban areas, so research on math coaching in smaller, rural schools is also needed. This study will ask the research question: What is the effect of math coaching, if any, on kindergarten through eighth grade teachers' efficacy in a rural Maine school district, as perceived by mathematics coaches and the teachers themselves? Further, do teachers report changes in student math behaviors and understanding after their teachers work with a math coach?

Research Design

The purpose of the research

Mathematics coaching is a relatively new branch of education, and although there has been a good deal of research done on other types of academic coaching, the amount of research specific to the impact of mathematics coaching on teachers and students is relatively small. This research hopes to add to the data as other school districts begin to add mathematics coaches. Much of the research on academic coaching has also been conducted in urban areas with smaller sample sizes. This research has the potential to expand the sample size and geographic make-up due to including mathematics coaches and teachers from rural school districts throughout the state of Maine.

The research question

This project will ask the question: What is the influence of math coaching on teachers' efficacy in rural Maine school districts? Also, do teachers and coaches report that they perceive changes in student math behaviors and understanding after the teachers work with a math coach?

The central concepts related to the investigation

The central concepts related to this investigation are if math coaching has an affect on teachers' math teaching practices and in effect, teachers perceive this as having an impact on their students' understanding. Because Maine school districts have only recently started adding mathematics coaches to their staff at some K-8 schools, there has not been a lot of time to establish relationships between coaches and teachers. Different school districts have varied ways in which they are beginning to incorporate math coaches. Some districts have coaches working full-time with teachers with set expectations for amount of collaboration, while others have full-time coaches with no specific guidance about how often teachers need to work with them. Some schools have trained coaches still teaching in classrooms full-time, and limiting their coaching to

only four visits to other teachers' classrooms per year, when a mentor coach is on-site. Because mathematics coaching is in its early stages, not only in Maine but nationwide, studies are needed to determine its impact on both teachers and students.

The general approach of the investigation

In this investigation, data will be collected through the use of mixed-methods interviews given to mathematics coaches who were trained in the Maine Mathematics Coaching Project, and surveys given to the teachers that they coach in rural Maine school districts. This research study will generate data through interviews with the participating mathematics coaches about if they perceived changes in teachers' mathematics teaching strategies after coaching them, and if so, what shifts in practice were observed. Coaches will also be asked if they perceived any impact on the teachers' students.

Additionally, surveys will be distributed electronically to teachers who have worked with MMCP trained math coaches, to collect data on if they perceive changes to their own teaching practices after working with a math coach, and if so, in what specific areas. This investigation also intends to generate data about if these teachers perceive this to have had an effect on their students' understanding in mathematics. If needed, follow-up interviews will also be conducted with teachers to gather additional data.

A limitation of this study might be that much of the communication and recruitment of participants will be done electronically. Since they do not know me, it might be challenging to convince teachers to take the survey. I will need to create a personal subject line, perhaps including the name of their math coach, to make it appear less generic. Follow-up emails will also be sent to encourage participants who did not respond at first. A goal might be that for every

coach, at least one teacher will take the corresponding survey, which could be used for comparison and correlation with the coach's perceptions.

The method of inquiry

This research was conducted using mixed-methods study. The focus of this study was the perception of math coaches who participated in the Maine Mathematics Coaching Project at the University of Maine, Farmington, and teachers that worked with them. Participants will be recruited electronically. All participants were emailed by the researcher asking them to participate, and providing the Participant Informed Consent document. Interviews with the math coaches will be scheduled with the researcher, and will be conducted with math coaches in person or via a digital platform such as Google Hangouts, Facetime, or Zoom. Teachers were surveyed using a questionnaire which will be distributed using Google Forms via email. Follow-up emails were sent to teachers in cases where clarification was needed.

Research methods

Setting

This research was conducted at rural Maine school districts that have a math coach who was trained through the Maine Mathematics Coaching Program at University of Maine, Farmington. This includes Crescent Park School, Woodstock Elementary School, and Telstar Middle School in MSAD#44; Lisbon School Department; RSU#19; AOS 91; and Carrie Ricker School, RSU#4.

Sampling/Participants

The sampling includes four math coaches that were trained on math content, pedagogy, and coaching techniques by the Maine Mathematics Coaching Program at University of Maine, Farmington. All of these coaches work in rural Maine school districts, three of them full time, and one is working as classroom teachers and only coached part time during her training in MMCP. That district decided not to add a full time math coach to their staff. Participants also

include teachers from these school districts who have worked with the math coach at least one time. The researcher emailed all of the teachers who have worked with the math coaches in these school districts to see if they would be willing to participate in the research, and received responses from 22. Eighteen responses were included in this study. One was eliminated because the teacher did not respond to any questions other than demographic information. Three teacher were not included because their follow-up answers seemed to be in direct contrast to their responses on the scale of Strongly Agree, Agree, Disagree, and Strongly Disagree. The researcher reached out to all three of these teachers for clarification, but they did not respond to requests, therefore their responses were not included in the data.

Methodology

This mixed-methods study seeks to better understand if and how K-8 teachers from rural Maine school districts perceive their teaching pedagogy to have been impacted by working with a trained mathematics coach. It also examines the teachers' perceptions of any impact that their working with a math coach had on their students' mathematical understanding. This study also examines the perceptions of mathematics coaches working in these rural school districts, to see if there is any correlation between what teachers and coaches perceive as changes, if any, to teacher pedagogy and student understanding.

The use of mixed-methods allows for an analysis of the quantitative data collected from some questions using numerical information and graphs, while the interviews and open-ended questions provide qualitative data to support the information. A more in-depth narrative about the specific pedagogical shifts that are being perceived by teachers and coaches, and the impact that these changes have on students was created using the qualitative data.

Perception data was collected between January-March 2018 by the researcher through

interviews with coaches that were conducted and recorded using Zoom and teacher surveys that were emailed through Google Forms. Participants included four mathematics coaches from rural school districts in Maine where coaching was implemented beginning in the 2015-16 school year. All coaches were members of Cohort 1 of the Maine Mathematics Coaching Project at the University of Maine, Farmington. Additional participants included nineteen teachers who have worked with these mathematics coaches at least one time during the past three years.

Teachers were asked to rate the following questions on a scale of Strongly Agree, Agree, Disagree, Strongly Disagree, and then to explain their answer.

1. Working with a math coach resulted in changes to my mathematics teaching practices.
2. My work with a math coach impacted my teaching practices in subject areas other than mathematics.
3. My students' understanding in mathematics was impacted by my work with a math coach.

Operational Measures

Participating teachers were provided with an electronic link to a questionnaire where they were asked a series of questions about their age, grade level, teaching experience, amount of time that they have worked with a math coach, and in what capacity they have worked with the coach. They will then asked if they perceive that working with a math coach had an impact on their teaching practices in mathematics, or if it had an impact on their teaching practices in other academic subjects, and if they believe it had an impact on their students' mathematics behaviors and understanding. Regardless of if they answered yes or no to the perception questions, teachers were asked to follow-up with an explanation for the answer. When additional clarification was needed, the researcher sent follow-up questions to the teachers. Four requests for clarification from teacher participants were sent, and only one response was received. That response was counted in the data, but in the three cases where no clarification was received, the original responses were not counted in the data.

Mathematics coaches were interviewed by the researcher either using Zoom, which is an electronic format which allowed the interviews to be recorded. Coaches answered a series of questions about their school districts, amount of time in the districts, coaching experience (including length of time and grade level), and if they were a participant in MMCP. They were then asked if they perceive that math coaching has had an impact on teachers pedagogy. If so, they were asked to describe evidence of this impact, and if not, they were asked to give their perception of why they did not see any impact. Coaches were also asked if they believe that mathematics coaching has impacted students' understanding. Again, further explanation was asked for regardless of their answer.

Data Collection

Data was collected and recorded from math coaches through interviews with the researcher, using a virtual format, Zoom. Additionally, a Google Form was created by the researcher, and these questionnaires were distributed to teachers who has worked with the MMCP math coaches that agreed to be interviewed. If follow-up data was needed, additional follow-up emails were sent to teachers as well.

Personal emails were sent to each mathematics coach trained through the MMCP, explaining the study, and asking if they would like to participate in an interview with the researcher. If they agree dto an interview, the consent form was shared with them and their superintendent, and an interview was scheduled with the researcher once consent was received. Personal emails were also sent to potential teacher participants, which included a description of the study, adult consent forms, and the link to the survey using Google Forms.

Data Analysis

The data that is collected from teachers and mathematics coaches was analyzed using mixed methods. Some of the questions posed to participating teachers are quantitative in nature because they had a set amount of choices. Data from quantitative questions was analyzed for each question, and graphs were created as a visual representation of the results.

A qualitative analysis was completed with the open-ended questions on surveys to teachers and interviews with coaches. The researcher analyzed the data looking for common themes that emerge in the participants answers.

Expected Findings

The researcher expected to find that coaches who work with teachers on a regular basis would perceive that teachers' math pedagogy has changed over time. The expectation was the same for teachers' perceptions after they have worked with a math coach on an ongoing basis.

The researcher believes that the findings of this study would also show that both coaches and teachers believe that math coaching has an impact on students' understanding of mathematics and on their mathematics behaviors. Because there was a goal focused on on increasing mathematical discourse for all schools with MMCP math coaches in the 2016-2017 school year, the research anticipated that increased mathematics communication in the classrooms would emerge as a theme.

In the cases of coaches who only have the opportunity to work with teachers in a coaching capacity four times a year because the coach is still teaching full time, it was expected that coaches and teachers will perceive less of an impact of these coaching relationships. This could be due to less time to support the teachers in developing these practices, but it could also be due to lack of time to follow-up with the teachers or to return to their classrooms and see evidence of pedagogical shifts. In related situation where teachers have only worked with a math coach once, or less than three times per year, the researcher would expect that these teachers might not perceive as much of an impact on their teaching pedagogy. However, even with limited coaching interaction, finding some impact on both teachers and students is possible if teachers followed through with suggestions from the coach on their own without much additional support.

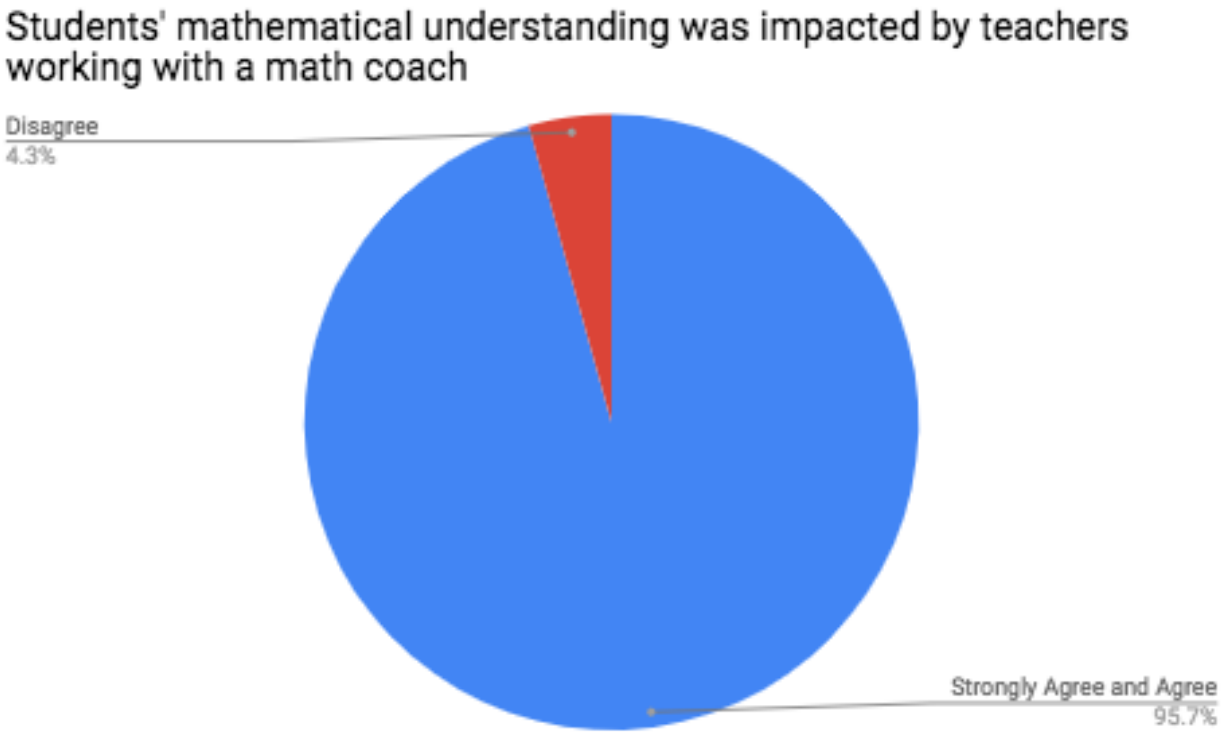
Potential Issues & Weaknesses

The sample size of this study is small because the research was conducted in rural, Maine schools. Only four math coaches who agreed to participate, and of the teachers who have worked with these math coaches, only 22 teachers responded to the survey that was distributed by the researcher. This could be due to the fact that they do not know the researcher and might not perceive the electronic correspondence about the study to be of importance or personal impact to

themselves. Another weakness could be that the researcher was a math coach for one of these school districts, but is no longer coaching there. Teachers in that district might be weary of responding in ways that the researcher might be affected negatively by as a former coach, due to personal relationships. Creswell (2015) suggests that is is extremely difficult for qualitative research to be completely objective. No matter how hard the researcher may try to avoid them, some of their own biases and perceptions may influence this research because the researcher is a MMCP trained mathematics coach who worked with some of the teachers and coaches that participated in this study. The data might also be impacted because some of the coaches can only work with teachers four times a year, while others are working full time. The amount of time that teachers work with even full-time coaches also varies. Each school district involved in the study has determined different expectations for the ways that mathematics coaching has been implemented at their schools.

Results

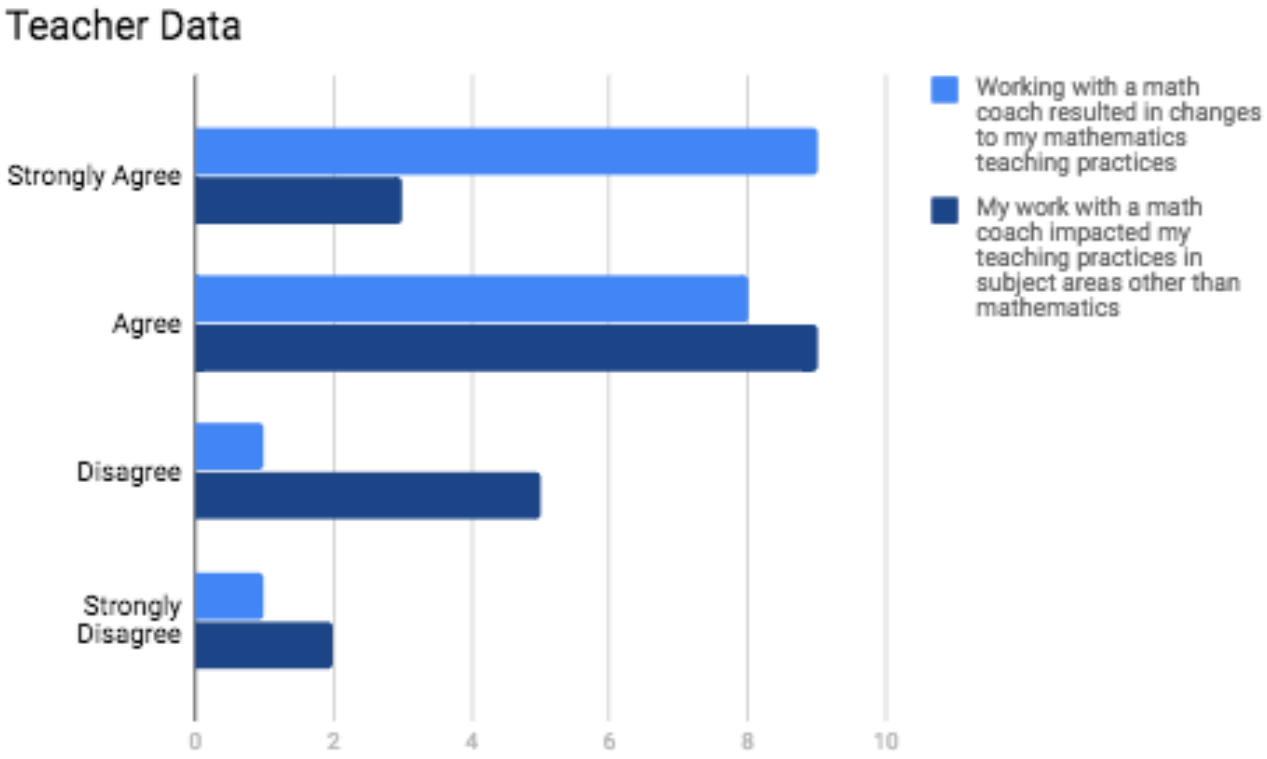
Using the answers from four math teachers and nineteen teachers, it was shown that



22 strongly agreed and agreed, 1 disagreed

18 teachers and 4 coaches believed that students were positively affected by their teachers working with math coaches.

1 teacher disagreed, and said that she felt the coach's suggestions resulted in less time for students to do independent work.



Strongly Agree: Q 1: 9

Q2: 3

Agree: Q 1: 8

Q2: 9

Disagree: Q 1:1

Q2: 5

Strongly Disagree: Q 1: 1

Q2: 2

Common trends were seen in the findings of both sets of data:

Coaches and teachers both felt that mathematical discourse, increased student talk, and greater sharing of ideas and strategies occurred in these classrooms due to math coaching.

Using student work and assessment data for planning and differentiation is being used by more teachers.

Teachers reported finding it helpful to have someone to support them, provide resources, and to bounce ideas off of.

Both teachers and coaches reported mathematics classes becoming more student-centered.

Recommendations

School districts should consider adding math coaches to their staff to positively impact teachers and students. Teachers find value in the resources that are shared by coaches in professional development, professional learning groups, and from interactions during coaching cycles.

The collaborative relationship between coaches and teachers can benefit both new and experienced teachers, as well as teachers of subjects other than mathematics.

Further research on the effectiveness of specific coaching models and techniques is necessary.

Implications

This research implies that mathematics coaching has a positive impact on both teachers and students, according to the perceptions of mathematics coaches and teachers in rural Maine school districts.

It does not appear that years of teaching experience has an effect on if teaching practices are impacted by mathematics coaching, which implies that both new teachers and experienced teachers may benefit from working with a mathematics coach. The positive impact that

mathematics coaching has on their students is another reason for teachers to consider working with a mathematics coach. Even for teachers nearing the end of their own teaching careers, allowing students to have this exposure to the effective mathematics teaching techniques will allow their students to develop deeper mathematical understanding, which will carry over even as the students move on to other grades and different teaches.

The amount of time spent working together, relationship building, and prior experience with academic coaches could impact the effectiveness of mathematics coaching. Even one or two sessions, either in the teacher's own classroom or during professional development sessions led by the coach may positively impact teachers and students. The research also implies that even teachers of other academic subjects can be positively impacted by working with mathematics coaches, since these effective teaching methods also carry over into the teaching of other subjects.

Implications for future research would be to look more deeply at the data to determine the way mathematics coaching impacts teachers and students dependent on the amount of time spent working with the coach and the types of coaching interactions.

Another implication for future research would be to examine the effects of mathematics coaching on teachers and students in cases where the coaches had not received training as the coaches in this study had during their participation in the Maine Mathematics Coaching Project. In many other cases, teachers transition into a coaching role with no additional instruction on mathematics content, pedagogy, or effective coaching techniques for working with adult learners. Additional research would need to be done to determine if mathematics coaching is as effective without this additional training.

Personal Learning Reflection

I found this experience to be very informative as someone who works as a mathematics coach and who facilitates mathematics professional development for teachers. My training as a mathematics coach had a major impact on my understanding of mathematics concepts, as well as the way I teach mathematics to young students and how I work with adult learners. While I knew the impact on my own understanding, I found it disappointing as a professional to have limited research to back up something that I felt was extremely beneficial to both teachers and students. It gives me a sense of satisfaction to have been able to determine a solution to this dilemma that myself and other mathematics coaches in rural areas had. I feel like this study has the potential to be used as an example of the effectiveness of mathematics coaching.

This process has sparked a potential interest for me in conducting future educational research. For many years, I have had a strong interest in educational research, and I have read many studies on various topics. But until going through the various courses in the Educational Leadership program at the University of Maine Farmington that led me through the process of doing a literature study, and then conducting and analyzing my own research, I had never put much thought into how many different steps and considerations there are in doing a research study. Now I have experienced the entire process myself, what I was most surprised to discover is that completing this research project does not necessarily mean I have come to an end. On the contrary, the findings have led to new implications and ideas for future research on this topic, so I am already thinking about where to go next. While I determined some answers to the questions in this study, I have also been left with additional questions about the efficacy of mathematics coaching under different circumstances. Perhaps another research study is in my future, to help

to answer these questions that I, and others that are interested in mathematics coaching, would still like to learn more about.

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Appendices

Appendix A

ADULT INFORMED CONSENT FORM

You are invited to participate in a research project being conducted by Renee Charette, a student at the University of Maine at Farmington. The purpose of the research is to learn if teachers in rural Maine school districts believe that math coaching has had an impact on their teaching practices and their students' understanding. I am also interested in learning if math coaches have similar perceptions about the effect of math coaching on these teachers and students.

What Will You Be Asked to Do?

If you decide to participate as a teacher, you will be asked to fill out one questionnaire on Google Forms between January-March 2018. This should take approximately 15 minutes of your time. If you decide to participate as a coach, then you will be asked to do an interview with the researcher over Zoom, Facetime, or another electronic method. The interview should take approximately 15 minutes of your time.

Risks

- There is the possibility that you may be uncomfortable with some of the questions, but you can skip any questions that you do not wish to answer.
- The time and inconvenience of the questionnaire or interview may be risks of

participating in the study.

Benefits

There are no direct benefits to you from participating in the study. However, as a participant you may enjoy contributing to current research on the impact of mathematics coaching on teachers and students in rural Maine school districts. Aside from this benefit to the participant, this research will help those in the mathematics and university communities learn more about the effectiveness of mathematics coaching through the perceptions of math coaches and teachers that they work with.

Confidentiality

Subjects' identities will remain confidential. The paper documents and files from this study will all be kept in a filing cabinet in Renee Charette's home. All electronic information including survey data and interviews will be stored on Renee Charette's password-protected employer-owned laptop, in her Google Drive which is linked to her UMF account. She is the only one who has the password to this account. Some data may be shared with Dr. Christopher Strople. All data from the study, including the participant key, will be kept for two years and then destroyed.

Voluntary

Participation is voluntary. If you choose to take part in this study, you may stop at any time. You may skip any questions you do not wish to answer.

I, _____, fully understand the purpose of this research and the procedures to be followed. I understand that my records will be kept

confidential, my participation is voluntary, and that I may withdraw at any time without penalty. I also recognize that I may skip any questions I don't wish to respond to. Results of this research will be shared in the form of one or more publications and verbal presentations. If you have any questions about this study, please contact me, Renee Charette at renee.charette@maine.edu or 508-380-5327. You may also reach the faculty advisor, Dr. Christopher Strople on this study at christopher.strople@maine.edu or (207) 778-7015. You may also contact the Chair of the IRB Karol Maybury at karol.maybury@maine.edu. By signing below, I assert that I fully understand the above and give my consent to serve as a subject in this research. (If you would like a summary of the results, please make the request of the researcher at the contact given above).

_____

_____

(Date) (Signature)

Appendix B

SUPERINTENDENT CONSENT FORM

Dear _____,

My name is Renee Charette and I am a student at the University of Maine Farmington. I am interested in conducting a research study in February-March of 2018. I am interested in learning if teachers in rural Maine school districts believe that math coaching has had an impact on their teaching practices and their students' understanding. I am also interested in learning if math coaches have similar perceptions about the effect of math coaching on these teachers and students.

I would like to learn if teachers in rural Maine school districts believe that math coaching has had an impact on their teaching practices and their students' understanding. I am also interested in learning if math coaches have similar perceptions about the effect of math coaching on these teachers and students.

- Qualitative
  - I will interview the district's math coach and send questionnaires to teachers that have worked with the math coach. This will occur between February-March 2018.
  - I will use the interviews and questionnaires to determine if there is a perceived effect of math coaching by coaches and teachers on both the teachers and the students, and if so, what areas of teaching pedagogy and math understanding were impacted.
  - The questionnaires will be sent to teachers via email using Google Forms. The interviews will be done with coaches over a virtual meeting format such as Zoom or Facetime.
  - I will send consent forms via email when I ask if teachers and coaches are willing to participate. Teachers who complete the Google Form will give their consent by completing the Google Form. I will get oral assent from the math coaches at the time of our interviews.
  - Participation is voluntary and participants can leave the study at any time.

- Quantitative
  - I will be working with math coaches and teachers in their school districts, gathering perception data about if they think teacher's practices and student understanding was affected by math coaching, and if so, in what ways. I will also gather demographic data about the coaches and teachers, such as age, years teaching, and grade level taught.

- Data will be de-identified and subjects will be not identified by name or school district. I will compare subjects' answers to look for commonalities between their perceptions about math coaching and its effects on teachers and students.

I will not share identifiable data about specific students, parents or others involved in the study. If I have any questions about the research, you may contact the principal investigator. If you have any questions about this study, please contact me, Renee Charette at renee.charette@maine.edu or (508) 380-5327. You may also reach the faculty advisor, You may also contact the Chair of the IRB, Karol Mayberry at karol.maybury@maine.edu or (207) 778-7067.

Thank you for considering my request to conduct research,
Renee Charette

I have reviewed Renee Charette's research plan for "The Impact of Mathematics Coaching on Teacher's Pedagogy and Student Understanding in Rural School Districts." I give my consent to conduct this research in _____. I am aware that I may also ask to view the report at the end of the study.

_____	_____	_____
Date	Name	Position in District/Site