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An Interdisciplinary Coaching Approach to Data-Based Individualization: A Year-Long Partnership Between Mathematics Teachers and Special Education Researchers

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Abstract

This article describes a year-long partnership between a group of general education mathematics teachers and their special education researcher-coach counterparts, an experience we call interdisciplinary coaching. The purpose of this work was aimed at supporting teachers in adopting and implementing an evidence-based instructional practice intended to address the needs of students experiencing mathematics difficulty, including students with disabilities. Findings from this investigation indicate teachers had high rates of satisfaction with the coaching model and that, by some specific measures, this model demonstrates promise for improving teachers' assessment practice within a data-based individualization framework. We describe the unique tensions and affordances that arose from this type of partnership and share recommendations for how others might engage in interdisciplinary coaching work.

Introduction

More than ever, general education mathematics teachers are being tasked with supporting a range of students, including students experiencing mathematics difficulty or those with disabilities.[1] Most students with disabilities receive the majority of their instruction in the general education setting (Office of Special Education Programs, 2017), yet, general education mathematics teachers consistently report feeling unprepared to instructionally support these students (e.g., DeSimone & Parmar, 2006; Mackey 2014). One reason teachers might feel unprepared is because science, technology,

[1] We use the phrase students experiencing mathematics difficulty to include any student that may not be learning as expected within the general education classroom, including students with disabilities. In contrast, the phrase students with disabilities indicates only those students who have been labeled with one or more of the 13 disability categories as defined by the Individuals with Disabilities Education Act (2004). We intentionally use both phrases throughout this article.

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and mathematics teachers receive fewer hours of professional learning about supporting students with disabilities than other teachers (Li et al., 2015). As inclusive learning environments become the norm, professional learning opportunities to support general education teachers in addressing the needs of students experiencing mathematics difficulty is increasingly important (e.g., McLeskey & Waldron, 2002).

In addition to the need for high-quality professional learning opportunities, ongoing instructional coaching (Knight, 2007) is one catalyst for lasting instructional change (Bush, 1984) and has been demonstrated as beneficial for mathematics teachers (e.g., Neuberger, 2012). Historically, the instructional coaching relationship has existed between individuals with mathematics content expertise and mathematics teachers (e.g., Obara, 2010). This relational model is reflected in other disciplines, including when special education teachers have professional learning opportunities in mathematics (e.g., Gersten & Kelly, 1992). That is, coaches and teachers typically come from the same disciplinary background. While there is some evidence that special education teachers have received instructional support from mathematics instructional coaches (e.g., Louie et al., 2008), those instances are rare. Professional learning that crosses disciplinary boundaries typically involves engaging both general and special education teachers in a common professional development session (e.g., Bryant et al., 2001), but not necessarily in a coaching relationship.

One factor that may result in a reluctance to cross disciplinary boundaries might relate to the well-known theoretical divides between the fields of special education and mathematics education (van Garderen et al., 2009; Lambert & Tan, 2017). Despite these differences, fostering interdisciplinary collaborations has the potential to lead to improved access to and inclusion in the general education curriculum, particularly for students experiencing mathematics difficulty (e.g., Brusca-Vega et al., 2014). In order for interdisciplinary collaborations to be successful there must be sufficient time for the collaborating educators to share experiences, expertise, develop a shared vision, and move beyond simply learning about instructional approaches but towards designing instruction together (Bryant et al., 2001; van Garderen et al., 2012). Given the benefits of interdisciplinary collaborations, as well as the guidance for how to maximize such partnerships, interdisciplinary coaching might be an underutilized resource to support general education teachers in working with students with disabilities in the general education classroom.

While no formal definition of interdisciplinary coaching exists, in this article we draw on literature about interdisciplinarity (e.g., Collin, 2009) and define interdisciplinary coaching as a coaching relationship that consists of people with differing disciplinary expertise, working towards a common goal by integrating elements representative of their distinct disciplines. It has been well documented in the extant literature that discipline-specific knowledge related to mathematics instruction (Ball et al., 2008) and instructionally supporting students with disabilities (Simonsen et al., 2010) is not only different, but often times, positioned as disparate (e.g., Zigmond & Kloo, 2011). However, interdisciplinarity is increasingly recognized as a viable, and even necessary, approach to addressing and solving complex problems (Spelt et al., 2009), one of which surely includes the teaching and learning of mathematics.

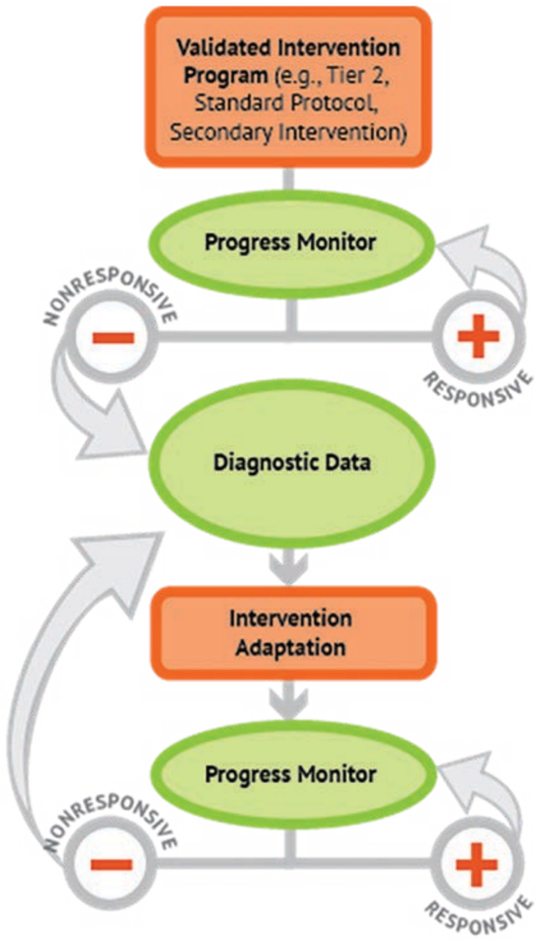
The purpose of this article is to describe an interdisciplinary coaching model that was used to support a group of general education mathematics teachers and special education researcher-coaches throughout a year-long partnership. In the following sections we situate this topic within the coaching and interdisciplinarity literatures, describe the methods used, share findings that demonstrate teachers' overall satisfaction with the coaching experience, and highlight some specific data that suggest preliminary model efficacy. Finally, we unpack some unique tensions and affordances that arose as a result of the interdisciplinary nature of this partnership. We share some reflections and lessons learned from this year-long collaboration, as well as some recommendations for how others might take up the work of interdisciplinary coaching.

Literature Review

Coaching

Research demonstrates that coaching can lead to improved teaching and student learning (Kraft et al., 2018). Coaching done well can dramatically improve performance, while coaching done poorly can be ineffective, wasteful, and sometimes even destructive (Knight et al., 2015). This would imply that a focus on differing approaches to coaching is an important area of research. While the benefits of providing coaching to in-service teachers are clear, we speculate that the coaching dynamic could be enhanced by introducing the perspectives and expertise of other related disciplines.

FIGURE 1.
Data-Base Individualization Framework (NCII, 2013)



Interdisciplinarity

Within mathematics education research that is focused on K–12 learning environments, interdisciplinarity is often framed in relationship to STEM education (e.g., Maass et al., 2019), while work about special education and students with disabilities is limited to investigations of co-teaching (e.g., Rexroat-Frazier & Chamberlin, 2019). In these instances, different disciplinary expertise is often acknowledged, but not leveraged to benefit either teachers or students. The current study attempted to move beyond acknowledgement and knit together the unique disciplinary expertise of the general education mathematics teachers and their special education researcher-coach counterparts.

Interdisciplinary Coaching

Combining the extant literatures, interdisciplinary coaching seems to leverage the strengths of ongoing support for in-service teachers in addition to using the expertise of all involved. Despite the potential benefits of this approach to coaching, interdisciplinary coaching is not, to our knowledge, a construct that has been studied to date. In the following sections, we describe the coaching partnerships that occurred across one school year between general education mathematics teachers and special education researcher-coaches. At no time during the larger study did we name this partnership as *interdisciplinary coaching*. It was only after the experience that we reflected on the distinct tensions and affordances that arose from our disciplinary differences and considered that our experience was something beyond *coaching*.

Methodology

As part of a multi-year, federally-funded project, research teams at three universities partnered with schools to support middle grade general and special education teachers to implement data-based individualization (DBI; see Powell et al., 2021, for an overview of the larger project).

Data-Based Individualization

To understand the work we were inviting teachers to do, the following section describes the research base for DBI and briefly articulates the core tenants of the practice. DBI is a systematic process of analyzing student data to inform instruction. DBI was originally developed in the 1970s (Deno & Mirkin, 1977) but has since been further refined (National Center on Intensive Intervention [NCII], 2013). The DBI process (see Figure 1) is designed to support students who are not learning as expected in the general education curriculum. When students are not learning as expected, most teachers naturally engage in problem solving to improve instruction. The DBI process builds on teachers' proclivity to problem solve by providing a structure to the problem-solving process that integrates the use of student data.

The DBI components of assessment and instruction are carried out using five steps. *Step 1: Implement a standardized and validated intervention program with greater intensity* (e.g., smaller group size, more time). *Step 2: Collect progress monitoring data to determine the effectiveness of the intervention.* Data should be collected using valid and reliable tools and occur on a consistent schedule, ideally weekly. *Data* in this step typically refers to a global indicator, such as curriculum-based measurement (Deno, 1985). Curriculum-based measurement is one type of progress monitoring that typically measures discrete skills, such as computational fluency. While efforts have been made to develop measures that capture more complex constructs (e.g., Project AAIMS, 2007), the current study used the Algebra Readiness Progress Monitoring measures (Ketterlin-Geller et al., 2015) which asked students to compare expressions and select the correct symbol (greater than, less than, or equal). *Step 3: If the student continues to struggle, collect diagnostic information to determine the specific area of need.* This can be done through error analysis of the progress monitoring data, formative classroom assessments, or other precipitating factors like attendance or behavior challenges (Shumaker et al., 2017). *Step 4: Using pre-determined decision rules, make an adaptation to the intervention based on the diagnostic data.* This may include taking a new approach to instruction around specific content, providing additional practice with foundational skills, increasing instructional explicitness, or adjusting the group size or timing of the existing intervention (Shumaker et al., 2017). *Step 5: Continue to collect progress monitoring data to determine if the intervention adaptation is successful and the student is on track to meet the goal set.* Finally, continue Steps 1 through 5 until the student is making expected progress in the content.

School Partners

During the 2018–2019 school year, our university partnered with two schools in the Midwestern United States. Schools were recruited by a researcher from a local university who had previously provided professional development and consultative support to schools and teachers within each district. Southeast Middle School[2] was in a mid-sized suburban school district and consisted of approximately 700 students in Grades 6 through 8. The majority of students identified as white (62%) while others identified as Black (15.2%) or Latinx (7.3%). Center Middle School was in a mid-sized suburban school district. This middle school had approximately 750 students in Grades 7 and 8, with the majority of students identifying as Black (77.4%), followed by white students (13.1%) and then students who identified as two or more races (6.8%).

Teacher Partners

Our team worked with 13 middle school general education mathematics teachers who taught students in Grades 6, 7, and 8. Once school administrators agreed to participate, mathematics department chairs asked for teacher volunteers to participate in the study. Teachers had a range of teaching experience and educational backgrounds (see Table 1 for other relevant demographic information). More than half of the teachers had students with identified disabilities in one or more of their mathematics classes.

Researcher-Coaches

The four primary researcher-coaches were all doctoral-level graduate students in special education and had classroom teaching experience, with some having professional coaching experience (see Table 2 for other relevant demographic information). Three of the four coaches were part of a doctoral training program that specifically focused on special education and mathematics. Each coach worked with the same 2 to 4 teachers throughout the project.

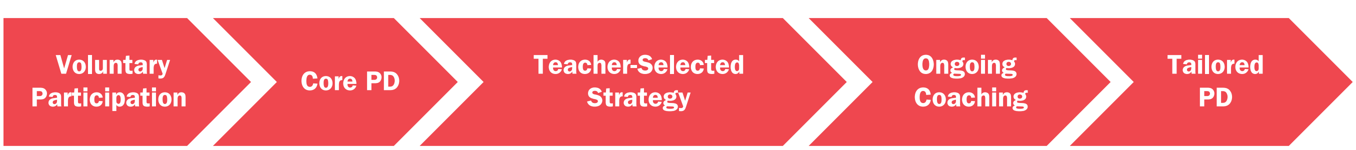
The Project

The interdisciplinary coaching model used in this project consisted of five main steps (see Figure 2).

CORE PROFESSIONAL DEVELOPMENT (PD)

Core Professional Development (PD) consisted of three sessions, each of which lasted approximately 6 hours. The first session described the DBI framework (see Figure 1) and the details of the project. The second session focused on the role of assessment within the project, specifically introducing teachers to the weekly progress monitoring tool. Finally, the third session introduced teachers to evidence-based instructional strategies specifically designed to support students experiencing struggle in mathematics. All three sessions were delivered by members of the research team and were delivered using a strategic combination of lecture, hands-on applied activities, discussion, critical thinking, and reflection.

FIGURE 2. *Interdisciplinary Coaching Model*



2 All school names are pseudonyms.

Table 1: General Education Mathematics Teacher Demographics

Teacher	School	Years of Teaching Experience	Grade Level Currently Teaching	Highest Degree Earned	Degree Area	Students with Disabilities Enrolled
1	Southeast	16	7	MEd	Curric. & Instruct.	No
2	Southeast	16	7	MEd	Curric. & Instruct.	No
3	Southeast	6	7	EdS	Ed. Leadership	No
4	Southeast	20	8	MS	Counseling	No
5	Southeast	6	8	BS	Math. & Sci. Ed.	No
6	Southeast	19	6	EdS	Ed. Leadership	Yes
7	Southeast	8	6	MA	Teaching	Yes
8	Center	2	8	BA	Mathematics	Yes
9	Center	5	7	BS, BA	Math. Ed.	Yes
10	Center	20	7	MA	Curric. & Instruct.	Yes
11	Center	7	8	BS	Education	Yes
12	Center	19	7	BS	Mathematics	No
13	Center	25	7	MA	Teaching, Admin.	Yes

Table 2: Researcher-Coach Demographics

Coach	Years of Teaching Experience	Teaching Experience	Grade Levels Taught	Years of Coaching Experience	Doctoral Program Math Focus
1	15	SpEd	K–12	6	Yes
2	2	SpEd	pre-K–5	0	No
3	4	SpEd	6–12	2	Yes
4	6	GenEd	K–8	0	Yes

TEACHER-SELECTED STRATEGY

During the third professional development session, teachers chose one of two evidence-based instructional strategies to implement for the remainder of the project: reasoning with multiple representations or teaching with explicitness. Both of these instructional strategies have a solid evidence base in both mathematics education (e.g., National Council of Teachers of Mathematics, 2014) and special education (e.g., Powell & Fuchs, 2015). It should be acknowledged that, because this project was designed and implemented by special education researchers, the manifestation of these instructional practices aligned more closely with special education interpretations.

ONGOING COACHING

Special education researcher-coaches supported teachers in implementing DBI over the course of 7 months. To select students for this project, teachers examined class-wide mathematics screening data and identified 3 to 5 students who were experiencing mathematics difficulty (as indicated by the universal screening measure used by each school) or who had a disability (as indicated by an individualized education plan).

Following professional development sessions, teachers collected weekly progress monitoring data for consented students throughout the duration of the study. Concurrently, researcher-coaches met with teachers in person once per month, during which coaches conducted a classroom observation of the teacher implementing the teacher-selected instructional strategy. Following each observation, the coach and teacher would debrief the observation and plan for additional learning opportunities (Tailored Professional Development). In addition to in-person coaching, coaches and teachers met once per month via videoconference or phone call. These coaching sessions were intended to provide teachers with an opportunity to troubleshoot their implementation of the instructional strategy and plan for the next in-person observation and coaching session.

TAILORED PROFESSIONAL DEVELOPMENT (PD)

In addition to Core PD, each coach tailored their support to the individual teacher with whom they were working. Tailored PD consisted of access to more than 70 brief (3–10 minute) videos that were housed on a researcher-created YouTube channel. Coaches would assess their teacher's need and determine what tailored learning opportunity was appropriate. This support is described as tailored because different teachers across the project had different areas of need related to assessment practices, instructional strategies, and data use.

Data Collection

During the first professional development session and again at the conclusion of the study, teachers took a series of assessments (see Powell et al., 2021, for a complete description), two of which specifically relate to coaching: The Coaching Satisfaction survey and The Teacher Instructional Practices survey.

Measures

The researcher-created Coaching Satisfaction survey was administered to a subset of participating teachers as part of a secondary analysis. Eight teachers from three coaches completed the survey. The Coaching Satisfaction survey measured teachers' satisfaction of coaching using nine Likert scale items (1 = strongly disagree; 4 strongly agree) and two open-response items. Likert scale items addressed the following coaching domains: knowledge of the needs and characteristics of diverse learners, content knowledge, knowledge of research-based practices, responsiveness, the provision of resources, identification of teaching strategies, coach's comfort, coach's professionalism, and an overall rating of the teacher's perception of benefit. The open-response items included the following prompts: "Based on this experience, what would you consider this coach's greatest strengths?" and "Please describe any impacts on your professional practice or other benefits that have resulted from working with this coach."

The Teacher Instructional Practices survey (Powell et al., 2021), which measured teachers' perceptions of the importance of a practice (0 = not very, 4 = very), their understanding of the practice (0 = not very, 4 = very), their confidence in implementing the practice (0 = not very, 4 = very), and frequency with which they currently used the practice (0 = less than once per month, 5 = daily). Survey items consisted of practices related to DBI content knowledge (3 items), instructional practices (16 items), and assessment practices (8 items). The Teacher Instructional Practices survey was administered at the beginning of the first Core PD and at posttest. Internal consistency measures for each section of this survey were well above accepted thresholds (Powell et al., 2021; see Gersten et al., 2005 for accepted thresholds).

Results

Coaching Satisfaction Survey

Overall, teachers *agreed* or *strongly agreed* with all items on the coaching survey (see Table 3 for detailed results). Five of the 8 respondents completed the open-response items. In response to the item "Based on this experience, what would you consider this coach's greatest strengths?", teachers described their coach as "knowledgeable," "helpful," "understanding," "[eager] to help," "supportive," and as having "suggestions on how to incorporate different strategies into [lessons]." In response to the item "Please describe any impacts on your professional practice or other benefits that have resulted from working with this coach.", teachers identified the benefits as "resources," "the graphing tool," and a deliberate focus on "using math specific vocabulary with [struggling] students." Two teachers described relational benefits they received from the experience. One teacher acknowledged the coach's classroom experience as a way to relate to the teacher and a factor that helped the teacher "buy into the research and the opportunities presented

Table 3: Researcher-Coach Demographics

Survey Item	Rating (*n* - 8)	
	M	*SD*
Demonstrated knowledge of the needs and characteristics of diverse learners.	4	0
Demonstrated needed content knowledge.	3.88	0.35
Demonstrated knowledge of research-based practices.	4	0
Was responsive to my needs and concerns.	3.88	0.35
Provided me with useful teaching resources.	3.5	0.53
Helped me identify teaching strategies to better meet the needs of students.	3.63	0.52
Seemed comfortable in their coaching role.	3.75	0.46
Demonstrated professionalism in our interactions.	3.89	0.35
Overall, my ability to meet student needs has increased as a result of my interaction with this coach.	3.75	0.71

Note: Likert scale, 1 = strongly disagree, 4 = strongly agree

for [students]." Another teacher said their coach "opened my eyes to some additional things I could be doing in my classroom to help my students."

Teacher Instructional Practices Survey

When comparing teachers' pre- and post-test mean scores on the Teacher Instructional Practices survey, increases occurred across all Assessment Practice items, with minimal areas of growth in either Data-Based Individualization or Instructional Practices (see Table 4 for detailed results across items).

Discussion

All results should be interpreted with caution given the construct *interdisciplinary coaching* was implicitly measured, but not explicitly named. While the small sample included in these analyses reflect the applied nature of this project, the sample is not representative of the general education mathematics teacher population and should therefore be interpreted in light of school, district, and study contexts.

Findings from the Coaching Satisfaction survey indicate that overall, teachers had high rates of satisfaction with the coaching model used in this project. Answers to the open-response items indicated an additional layer of teachers' satisfaction, naming not only the positive qualities of their coaches but also articulating specific and tangible benefits gained from the coaching experience. These findings suggest promise in using this interdisciplinary coaching model and should be empirically tested to refine the model. Further, the Coaching Satisfaction survey was created by researchers for use in this project and should be further tested for psychometric properties.

The Teacher Instructional Practices survey revealed increased mean scores between pre- and post-test in the domain of Assessment Practices. This was not surprising given the project's intense focus on weekly formative assessment and the use of data to drive instructional decision making. Additionally, gains within this domain reflect the disciplinary expertise of special educators and researchers, including items such as, "Use data from a variety of sources to identify which concepts students are struggling to grasp," "Use screening data to determine which students may be at risk for failure," and "Use progress monitoring data to determine effectiveness of instructional approaches for meeting students' needs." This finding points to one possible benefit of an interdisciplinary partnership that goes beyond discipline-specific knowledge and skills.

Table 4: Teacher Instructional Practices Pre- and Post-Test

Teachers' Instructional Practices		Pre (n - 8)		Post (n - 13)	
		M	*SD*	*M*	*SD*
Data-Based Individualization	Importance of practice	2.59	0.64	2.28	0.72
	Understanding of the practice	2.26	0.88	2.31	0.66
	Confidence in implementing the practice	2.21	0.83	2.23	0.90
	Frequency of implementing the practice	2.44	1.47	2.46	1.47
Instructional Practices	Importance of practice	2.89	0.37	2.82	0.39
	Understanding of the practice	2.89	0.31	2.87	0.34
	Confidence in implementing the practice	2.87	0.40	2.80	0.40
	Frequency of implementing the practice	4.5	0.71	4.51	0.68
Assessment Practices	Importance of practice	2.44	0.72	2.59	0.75
	Understanding of the practice	2.47	0.64	2.75	0.46
	Confidence in implementing the practice	2.41	0.75	2.77	0.42
	Frequency of implementing the practice	2.38	1.50	2.61	1.50

Note: Likert scale for importance, understanding, confidence, 0 = not very, 4 = very; Likert scale for frequency, 0 = less than once per month, 5 = daily

The minimal or negative ratings in the Data-Based Individualization domain suggest teachers did not gain an understanding or use of this practice. One reason for this finding could have been the diminished use of the term *Data-Based Individualization* beyond Core PD sessions. That is, day-to-day, as teachers and coaches interacted, perhaps the formalized term was not embedded in coaching sessions or other communication. Minimal or negative gains in the Instructional Practices domain could be explained by several factors. First, teachers may have not seen the practices introduced in this study (e.g., reasoning with manipulatives, increasing instructional explicitness) as new and therefore, did not experience increased understanding or use throughout the project. Another reason for this finding could be that teachers focused on different instructional practices and that differences based on the practice they chose were obscured by considering them under the larger umbrella of instructional practices. Future investigations should recruit a larger sample in order to both generalize findings and to allow for additional statistical comparisons between pre- and post-test scores.

Taken together, teachers in this project articulated positive feelings about the coaching experience and, in relation to their assessment practices, demonstrated measurable gains.

Implications for Practice

It is not surprising the general education mathematics teachers and special education researcher-coaches in this study experienced tensions when working towards the common goal of supporting students with mathematics difficulty in the general education setting. In the following section, we share these tensions and describe our attempts to integrate both groups' distinct disciplinary expertise. In addition, we reflect on what we could have done differently in response to these tensions.

Tension: Logistics of Data Collection

The special education researcher-coaches' previous classroom experience was primarily in small group settings in which data collection was a main priority in order to support students with disabilities in reaching their individualized education plan goals. However, in middle school mathematics classrooms of 20 or more students, the teachers in this study felt less able to take time out of whole-group instruction to ensure 3 to 5 students were assessed using the progress monitoring measures. For teachers at Southeast, administering the progress monitoring measure during class time did not make sense. Instead, they believed administration could only happen during a designated school-wide intervention time. This concern reflected the attitude that teachers viewed the DBI process as separate from mathematics instruction and should therefore occur elsewhere. This tension was both an issue of perception and logistics.

REFLECTION: In an effort to support mathematics teachers without discounting the usefulness of progress monitoring in the DBI process, coaches could have framed progress monitoring as another type of formative assessment. Instead of thinking about progress monitoring data collection as something *additional*, the process could have been framed as something *aligned* with what teachers were already doing. In addition, coaches could have planned for ways to streamline progress monitoring efforts, such as supporting teachers in integrating progress monitoring into existing classroom routines (e.g., during a daily warm up).

Tension: Social Implications of Data Collection

A related concern was teachers found it difficult to collect progress monitoring data from a few students and not all students in one class. In a special education classroom, each student is typically working on individual goals and tasks, while in a general education classroom all students are typically engaged in the same activities. In this setting the general education mathematics teachers were reluctant to "single out" students for fear of drawing negative peer attention or having those few students miss out on what the rest of the class was doing. When teachers attempted to address this challenge, their concerns were, in some ways, addressed, yet new tensions arose. At Center Middle, an interventionist administered the progress monitoring measures weekly. While this partial solution alleviated teachers' concerns about integrating progress monitoring into their instructional routine, this arrangement left teachers feeling disconnected from the data and students missing their advisory period. At Southeast Middle, in response to teachers' concern about singling out students, progress monitoring measures were administered during a school-wide intervention time. This approach led to inconsistent data collection, as students often switched intervention class placements.

REFLECTION: While DBI was designed with students who are struggling in mind, all students can benefit from progress monitoring. Coaches could have recommended making progress monitoring a class-wide instructional routine. For students who demonstrated grade-level skills, progress monitoring could aid in goal setting and could encourage ongoing growth. Again, coaches could have engaged teachers around the idea that these types of data were informative about students' learning and therefore, having all students participate in this instructional routine could have minimized logistical difficulties. To avoid students missing out on instruction, coaches could have supported teachers in establishing a regular day and time during which progress monitoring measures could be administered to the whole group.

Tension: Using Assessment Data

The general education mathematics teachers reported collecting both formal and informal assessment data throughout different phases of instruction. When it came to using those data to make instructional decisions, teachers expressed that regular data analysis was not part of their instructional routine, but rather, data were used to justify students' grades. When data were used to drive instruction, they were used to determine whether students learned as expected (and whether it was time to move on to the next instructional unit), but rarely to inform specific instructional moves, like diversifying instructional approaches.

REFLECTION: This tension is not unique to general education teachers, as many teachers experience difficulty regularly and systematically using data to inform instruction (e.g., Schildkamp et al., 2017). Teachers have become proficient at collecting student data, yet one of the biggest challenges teachers face is making the data collection process meaningful by analyzing the data with an instructional lens. Consulting a range of data sources can reveal students' content area learning, but also suggest to what degree a particular instructional strategy either is or is not facilitating that learning.

A practice the study could have incorporated to make this process more meaningful and sustainable for teachers is collaborating with colleagues in order to use data to inform instruction. In future iterations of this process coaches might schedule time with groups of teachers to analyze data and support each other in instructional decision making. In addition to accountability for data analysis, this collaboration could reveal insights about data patterns or instructional adjustments that may be overlooked if analyzed alone. An example from our project involved two teachers who taught different sections of the same course and typically planned together. In thinking ahead to the next instructional unit, graphing on coordinate planes, the teachers considered how students would access this content. Progress monitoring data collected through the project showed that incorporating multiple representations into instruction supported students in learning content in the current unit. Based on those data, the teachers decided to continue using multiple representations and started brainstorming ways this would take shape in the unit. They reported this experience to be beneficial and in the focus group other teachers suggested that more time to collaborate with teachers in the study would be a welcome addition.

Tension: Applying the Instructional Strategy

When thinking about lesson logistics, mathematics general education teachers in our project felt intimidated by the idea of implementing an instructional strategy that was originally designed for students experiencing mathematics difficulty. This perception was likely based on observation of special education classes and traditional intervention approaches. However, the project had intentionally selected instructional strategies that, while effective for students experiencing mathematics difficulty or disabilities, would be beneficial to all students. The mathematics general education teachers were encouraged and supported by their researcher-coaches to utilize the practice during whole-group instruction and not limit the use of the strategy to small groups or individuals.

REFLECTION: To address teachers' concern that they had to create an entirely separate lesson in order to implement an instructional strategy, we encouraged teachers to consider that a robust instructional strategy, like making concepts explicit or reasoning with multiple representations, would support a range of students and could be integrated into existing whole-group instruction. During professional learning, researcher-coaches could have taken a clearer stance about for whom these evidence-based instructional strategies were for. While many instructional adjustments or interventions are designed to support students who are experiencing a particular kind of mathematics difficulty, a range of students can benefit from having access to those adjustments or interventions. For example, using multiple representations has been demonstrated to support students with disabilities in developing procedural and conceptual knowledge (e.g., Strickland, 2017). A teacher might plan to introduce multiple representations with a particular group of students in mind but make the use of those representations available to all students in the class.

Tension: Including Students in the DBI Process

One component the researcher-coaches did not incorporate into the study design was a way for students to be meaningfully included in the DBI process, so that it became something the teacher did *with* students and not *to* students. At the conclusion of the study, teachers speculated about the benefits they thought could have come from including students in the data collection and analysis processes. Teachers thought it could have been meaningful for students and their families to see a student's graphed progress monitoring data and talk about how that was one reflection of student learning. Teachers thought that because curriculum-based measures are especially sensitive to change that students could have had more frequent feedback about their progress (instead of waiting for more formal assessment results) and that this could have demonstrated to families that their student was learning, even if such learning was not detected on other types of assessments. Another unanticipated benefit could have been the use of graphed data to support students in setting goals and feeling motivated by seeing their growth. Within special education, it is common for students to examine their own progress monitoring data. Yet researcher-coaches in this study did not translate that instructional routine to their general education colleagues, wrongfully assuming that such a practice extended beyond the scope of the project.

REFLECTION: One way the study could have planned for and encouraged the inclusion of students in the DBI process would be to turn the collecting and graphing of data into an instructional opportunity. There are myriad ways a teacher could design opportunities for students to learn from graphing, interpreting, and predicting their own (or the class') data. In addition to instructional opportunities, simply asking students to graph and interpret their own data can meaningfully engage them in the DBI process. Most of our teachers used a spreadsheet to track and graph students' progress monitoring data. However, those graphs were primarily monitored by the teachers, leaving students almost completely disconnected from their own progress monitoring. Having students keep their own graphs, on a spreadsheet or even by hand, would be a simple but purposeful way to include students in the DBI process.

Beyond graphing their progress monitoring data, students could be included in decision-making conversations. Teachers could engage students in analyzing their own data for trends. Teachers in our project used Microsoft Excel, which automatically generated a scatterplot and line of best fit. Instead of interpreting the graph themselves, teachers could have analyzed the graph with students. Students could offer insight into scores that seem like outliers, which could give rise to discussion about the influence of a single data point on a line of best fit. After analyzing the graph, teachers could invite students to suggest solutions they think would support them in making progress towards their goal.

The Affordances of Interdisciplinary Coaching

While much of our project involved naming, addressing, and navigating disciplinary tensions, because we committed to understanding and resolving (to some degree) those tensions, there were some over-arching affordances that were born from our experience. In this section, we share the affordances associated with this interdisciplinary partnership.

This year-long partnership necessitated willingness and humility. One of the top-level affordances of this collaboration was the opportunity to work with new colleagues with new ideas, over time. Because this project was centered around the coaching relationship, this fostered a sense of commitment and teamwork. Furthermore, because this project required the teacher-coach dyad to remain intact for the duration of the project, individuals had to persist in working through tensions that arose. Each teacher-coach pair responded to these tensions by forging their own pathways towards better understanding of new concepts, but also a deeper appreciation for the other's disciplinary expertise. Each person's disciplinary expertise and values facilitated work towards the larger shared goal.

One unexpected affordance was the opportunity for general education mathematics teachers to confront the idea that supporting students with disabilities fell within the scope of their instructional responsibility (see Cornoldi et al., 2018 for a description of this tension). While none of the teachers in this study were overtly insistent that supporting these students was not their instructional responsibility, there was evidence that other colleagues, like the special education teacher or interventionist, was considered more responsible. The interdisciplinary nature of this coaching interaction challenged teachers to reconsider how they address the needs of all students in their classroom, even if the range of needs seemed, at times, daunting.

Special education researcher-coaches had to address the genuine concerns of their general education counterparts, which included questions of logistics, as well as the consequences of what it means for students with disabilities to navigate learning in a general education setting with general education peers. Special education teachers often work with students with disabilities in settings in which the only other students are also students with disabilities. However, the general education environment prompted researcher-coaches to weigh the implications of pulling certain students into a small group or asking a small group to do a task that the rest of the class was not asked to do. In this interdisciplinary context, researcher-coaches were pressed to evaluate their standard models of intervention and listen to the perspective of their general education colleagues.

Both teachers and coaches had to bring a certain degree of open mindedness and creativity to the practical problems of implementing DBI in a general education setting. Teachers had to demonstrate a willingness to try new instructional routines and rethink their definition of "instructional support." Coaches had to reconceptualize how instructional supports took shape, looking for opportunities within teachers' existing instructional routines where the instructional strategy might naturally integrate. Since everyone was having to redefine components of instruction and intervention they previously considered static, space was made for posing unconventional solutions or simply trying something and then recalibrating. This interdisciplinary partnership was ripe for instructional experimentation.

Recommendations

Mathematics education leaders are poised to champion interdisciplinary coaching. Based on our experiences, we share some actionable recommendations for taking up this practice.

View Disciplinary Differences as Strengths

Before diving into an interdisciplinary coaching relationship, the coach should see disciplinary differences as strengths. Interdisciplinary coaching requires additional intellectual effort on the part of both the teacher and the coach. Both parties may find themselves feeling misunderstood or like this type of partnership is clunky compared to a traditional disciplinary partnership. Viewing differences as strengths means hearing another's point of view and then challenging ourselves to evaluate and articulate the theoretical foundations of our own ideas, either strengthening or reimagining our views on teaching and learning. Ultimately, this perspective is about valuing the process of engaging in this type of work.

This practice also requires that, in addition to investing in understanding another discipline, we interrogate our own discipline for facets that can be strengthened or changed. We do not intend to suggest that interdisciplinary work is full of dichotomies in which one side is right and the other wrong, where one practice is taken up while another is discarded. Quite to the contrary, we adopt an integrative view in which distinct aspects of each discipline are intentionally interwoven to create a richer and more interesting outcome.

One teacher at Center Middle School was especially committed to supporting all students, including students experiencing difficulty, in mathematical reasoning. This teacher had a deep understanding of the mathematical content and a comfortable grasp of different pedagogical tools. Yet, this teacher expressed a belief that students enrolled in pre-algebra could answer high-level questions, while students in "regular math" were less capable. This belief was translated into practice through the types of questions this teacher posed to students in different classes. The researcher-coach shared this teacher's commitment but saw questioning as a way to increase instructional explicitness and support students with disabilities in reasoning mathematically and developing conceptual understanding. Together, the teacher and coach integrated their expertise and devised questioning sequences that were intended to support all students, but especially those experiencing mathematics difficulty enrolled in the teacher's "regular" mathematics class.

Start Small

A tangible first step to creating an interdisciplinary coaching relationship is to start small. In addition to engaging teachers in more interdisciplinary professional learning opportunities, consider finding one willing teacher who has a different disciplinary background than yourself.

With your partner, work together to establish:

- a shared goal;
- depending on the nature of the goal, the duration of the partnership;
- a commitment to meeting regularly; and
- a framework for coaching conversations to ensure everyone's perspective is heard.

In our project, the goal was to support a particular group of students within the general education classroom. While both the teachers and coaches held views about how that goal might best be accomplished, the goal itself was clear. Teachers in our project committed to a seven-month partnership, which resulted in enough time to strengthen the coaching relationship and work together. As mentioned, coaches and teachers met twice monthly (once in person and once virtually). Finally, we used a Coaching Conversation Form (see Appendix A) to add structure to each coaching session. Following each in-person classroom observation, the coach and teacher would complete this form together. After the session, the coach would email the teacher with a recap of the conversation and highlight each person's next steps. At virtual coaching meetings, the coach would refer to the Coaching Conversation Form, follow up on action items, and complete a new Coaching Conversation Form to document the virtual coaching session.

Address Disciplinary Differences

Part of choosing to take on an interdisciplinary coaching relationship is the honest acknowledgement that each person has different disciplinary expertise. We recommend people have these conversations early and often. Start by listing terminology related to your project or goal. Terminology or concepts that might seem obviously universal may in fact have differing disciplinary meanings or unknown nuances. Relatedly, you may both know about and use a particular instructional strategy or move, but call it different things. Making a list of these similarities and differences fosters open and productive communication and understanding. Terminology and concepts are just one example of how disciplinary differences make themselves known. As your partnership progresses, agree to name and discuss disciplinary differences as they arise.

In our project, we often discovered practices or concepts that held relatively similar definitions, but were simply called different things. For most general education mathematics teachers in the study, DBI was a new term, though the process of collecting student data and using it to make some instructional decisions was not new. Relatedly, all teachers in the study were familiar with the idea of using multiple representations to support students' mathematical reasoning, but few considered using those tools specifically to support students with disabilities. During these and other moments throughout the study, our team addressed disciplinary differences in order to understand one another, which allowed us to problem solve and move forward.

Conclusion

Mathematics education instructional leaders are positioned to promote interdisciplinary coaching relationships. The model shared here is one step towards designing instructional supports for teachers that go beyond traditional disciplinary boundaries and seek to expand our practice by drawing from a range of disciplinary knowledge bases and unique expertise. While this experience included tensions and challenges, it also provided an opportunity to maximize disciplinary differences and create richer and more innovative learning experiences, especially for students experiencing mathematics difficulty. ✪

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Appendix A

Coaching Conversation Form

Teacher & Coach: Use following Action Plan to discuss challenges, concerns, and next steps

Action Plan	
Teacher Perspective	**Coach perspective**
Instruction: Strengths/Challenges	Instruction: Strengths/Challenges
DBI: Strengths/Challenges	DBI: Strengths/Challenges
Potential solutions:	
Teacher's next steps:	Coach's next steps: Recommended resources:
Notes from this session:	
Next meeting: Date: ___/____/ 20__ at ________ Focus of Conversation for Next Meeting: ________________________	

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NCSM is the premiere mathematics education leadership organization. Our bold leadership in the mathematics education community develops vision, ensures support, and guarantees that all students engage in equitable, high quality mathematical experiences that lead to powerful, flexible uses of mathematical understanding to affect their lives and to improve the world.

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