asynchronously with both the PST and mentor teacher making comments at specific points. To be most impactful, this scaffolding process begins during methods courses. The type of dialogue between the mentor and PST that revolves around real-time video of a lesson allows for reflection, correction, and growth that can help PSTs be successful when navigating the edTPA process later during the clinical teaching placement.

Suggestions for Implementation

While video annotation tools can be extremely helpful, they only work when people use them fully. GoReact is user friendly, but it takes a little time to become familiar with the program. To assist with this, students are given an assignment early on that helps them get used to the video and commenting capabilities. They are asked to video a 10–15-minute mini-lesson in class and then this is shared and everyone is encouraged to make comments. These comments are based on a scaffolded set of feedback questions students are given in class prior that not only help them make relevant comments on GoReact for their peers, but also provides insight into what they need to focus on themselves. Once they receive the feedback, they must submit a reflection that addresses points that were commented on and what action, if any, they would take.

Once students are in the field, this process is repeated with the mentor teacher included as well. This is typically a short lesson or one in which the PST is teaching a portion of a lesson that is not observed by the university supervisor. The PST then shares their reflection with both the university supervisor as well as the mentor. Having students go through the process a couple of times and having the mentor teacher involved, helps them feel comfortable before they record their formal lessons.

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Keeping a Partnership Going: Facing the challenges of scripted mathematics programs

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Planning for a Partnership

In this article, we reflect on how we would adapt the practices of a previous successful university-public school partnership with the ever-increasing adoption by districts of scripted programs for math instruction at the elementary grade levels. Our partnership with rural elementary schools focused on improving students' overall mathematics achievement and engagement through professional learning experiences with teachers. The goals align with Essential 3 of the Second Edition of the NAPDS Nine Essentials (NAPDS, 2021) which states, "A PDS is a context for continuous professional learning and leading for all participants, guided by need and a spirit and practice of inquiry." Reflection on this successful effort uncovered critical factors, which we only considered implicitly during the partnership. As we now realize, clarity regarding why a reform is successful may not become apparent until later when participants have had adequate opportunities to reflect on how the particulars of a context implicitly influenced their decisions. Insights from such reflections can then be used to develop future partnerships.

Prior to establishing a partnership, the district's assistant superintendent, along with fellow administrators and curriculum directors, drafted a set of concerns, which resulted in the following questions: Who should offer the professional development? How many sessions would be required to ensure the partnership's success? Who should attend? and How should its success be determined? The assistant superintendent and her colleagues drafted answers to the final question and sought advice from the university regarding the others. Briefly, district representatives wanted a partnership's success to be determined by students' engagement and learning in daily activities and achievement on mandated end-of-grade mathematics assessments. Regarding teachers, consistent with national criteria for establishing professional learning communities (NAPDS, 2021), district officials believed the partnership would be successful if teachers demonstrated a commitment to professional learning by taking an active role in planning the structure and design of daily mathematics instruction as well as collaborating with peers and outside consultants on the collection and evaluation of formative assessment data.

The authors' institution was chosen due to its familiarity to the assistant superintendent and geographical proximity. The lead author (Richardson) and other colleagues in the school district met with university representatives to develop a plan. Because district officials wanted to test the waters before formally committing to any multi-year partnership, they asked the first author to offer a graduate course as the partnership's first step. This course was part of an existing master's program on elementary mathematics, the content

of which was determined in the following manner. After looking at those topics on mandated end-of-grade mathematics assessments where students did not demonstrate proficiency, the content area of rational numbers (fractions) was identified as the course's focus (Richardson, Miller, & Reinhardt, 2019). The district reached out to each of the principals at their elementary schools and asked them to recommend teachers who might be interested in taking the course.

Seventeen teachers enrolled in the course and the class met twice per month for six continuous hours with asynchronous online assignments between course meetings. The class was held at a centrally located school in the district and substitute teacher coverage was provided for attending teachers. After teachers responded positively to the course, district officials asked Kerri to collaborate the following year at their elementary school with the greatest need.

Theoretical Framework

During meetings to decide possible next steps, the assistant superintendent identified a concern based on the district's history with previous reform efforts. She expressed her district's disappointment with professional development initiatives where the developers offered quick fixes, none of which ever materialized. This tendency for schools to act quickly without full consideration of possible problem-solving alternatives is called *soluntionitis* (Byrk, 2015). Given this concern, neither the assistant superintendent, nor Richardson, believed any evolving partnership would be successful without a long-term collaborative effort. Everyone realized how an effort to improve students' engagement, learning, and mathematics scores could not be accomplished overnight.

As university professors, the district's expectations intrigued us because their expectations straddled two commonly opposing reform perspectives. This first was Ingersoll's (2003) notion of reform as a 'tightening up of the ship,' with its emphasis on immediately adopting uniform evidence-based instructional practices. The second is Duffy's (1998) model of thoughtfully adaptive instruction with its emphasis on the need to modify instruction to develop practice-based evidence. These modifications are based on students' interests, cultural backgrounds, and prior achievement histories. Schools often view the second approach as a threat to the first because educators can't predict what they should do to promote students' learning across an entire lesson because each part of the lesson depends on students' responses and teachers' ability to adapt instruction based on their responses (Au, 2011). District endorsement of the state's standard course of study and its focus on improved test scores supported the former orientation whereas their confidence in teachers' ability to make moment-to-moment decisions to promote students' engagement and learning supported the latter orientation. While thoughtfully adaptive instruction is often viewed as an obstacle to the goal of 'tightening up the ship' with explicit step-by-step instruction, we believed the assistant superintendent's expectations were realistic given societal expectations for teachers to promote successful classroom learning and the state's expectations on districts to be accountable on mandated assessments for students' learning (Miller & Duffy, 2006).

Implementing the Partnership

Two immediate questions needed to be addressed to initiate the partnership. The first focused on which school should be targeted to participate. District officials selected a school that had the lowest mathematics scores in the district as well as the greatest score variation within and across grade levels. The next question set parameters for the university's commitment. It was decided that Kerri would visit the identified school two to three times per month for the entire day. During this time, she would visit classrooms and conduct bi-weekly grade level meetings. In these bi-meetings, teachers would collaboratively design activities to promote students' understanding of mathematical concepts.

At the grade-level meetings, teachers read relevant materials using a book study format. The readings focused on the principles and practices of Cognitively Guided (Carpenter, et al., 2015). This approach privileges students' self-initiated thinking as the basis for their development as learners of mathematics. Its recommended practices are based on research which documents the many paths students may take as they attempt to solve a mathematics problem. Quite simply, if students take more than one path in their quest to understand a problem, then educators need to allow students opportunities to explore and discover answers to a problem. Without these opportunities, students will not see connections between a lesson's requirements and their present levels of understanding.

During planning sessions, teachers would read a chapter from the CGI text and bring questions to the sessions. They then developed assignments based on readings and discussion, which they implemented the following week. Upon reconvening, teachers and the faculty member evaluated student work samples and identified additional scaffolding. Teachers regularly left planning discussions with a renewed appreciation of the value of listening to students' comments. They realized how difficult it would be for them to anticipate students' responses prior to a lesson or now to ignore them if they wanted students to acquire positive learning trajectories. A 'one-size-fits-all' solution for a particular lesson or across lessons and classrooms did not exist as teachers' evolving expertise evolved based on moment-to-moment decision-making. Teachers modified recommendations from their readings to fit the needs and interests of their students.

After several weeks, quite unexpectedly, teachers asked Kerri to conduct teaching demonstrations. The purpose was not to showcase her expertise: rather the demonstrations allowed teachers to explore student thinking in the context of problem solving. Grade level teams observed the faculty member teaching and circulated around the room to focus on the work of students and how they were making sense of the problem. As a result, the lessons revealed student thinking in a variety of ways because Kerri used different lines of questioning. They then debriefed after the demonstration, which helped the teachers to develop an academic language regarding what they already knew about their students.

What worked: Looking back before looking forward

Our goal in this section is to briefly reiterate what we see as successful components of a university-public school partnership and explain based on recent reflections what steps we would take to form new partnerships given recent adoptions of scripted programs by school districts. As noted in our earlier paper (Richardson et al., 2019), our collaborative efforts with teachers and district administrators positively affected the intended outcomes. Based on observations and discussions, students were engaged in daily lessons, asked questions about its content, and test scores improved. Teachers had adequate opportunities to meet; they were involved as equals in discussions; their practitioner and community-based knowledge were honored as critical to our decision-making; required readings supported the intended outcomes, and administrators provided the necessary support by attending planning sessions and providing substitute teachers.

Our collaborative efforts led to a greater understanding of mathematics by teachers and students, dissolved traditional power hierarchies between the university and school personnel, and promoted high levels of respect and trust developed among participants (Byrk, 2015; Gutiérrez, et al. 2021; Richardson, et al., 2019). While these outcomes were critical to our collaborative efforts and need to be included in university-public school partnerships, we now realize the need to look more closely at what we might have not fully appreciated at that time. As stated earlier, our reflections are based on recent conversations with district teachers who noted concerns with their district's recent adoption of scripted programs. Their frustrations with scripted programs make it clear to us that unless we adapt accordingly, reform-based best practices might be undermined by this recent development.

Our first adaptation would be to highlight as critical what we will call dual-tiered scaffolding. Consistent with Vygotsky's (1994) notion of obuchenie, in our discussions and interactions, teachers and students increasingly expected to learn from each other, as well as from the processes of learning, documenting how ongoing collaborations influenced everyone's beliefs, behaviors, and orientations towards learning (Scrimsher & Tudge, 2003). As students jointly explored solutions to

mathematical problems, everyone, at times almost simultaneously, assumed roles as both instructors and learners: teachers taught teachers, students assisted classmates, students informed teachers, and teachers instructed students. A direct result of dual-tiered scaffolding was an appreciation by all participants of what has been referred to as informative or adaptive learning, where failures are viewed as essential to future successes (Rohrkemper & Corno, 1988; McCaslin et al., 2006). Our partnership could not be successful without everyone making and learning from our mistakes. If dual-tiered scaffolding is not present in a partnership, then we would question the integrity of the effort.

With scripted materials, the learning focus shifts because the problem space only requires a single predetermined answer based on the memorization of facts, strategies, and algorithms. If students do not understand a particular aspect of a lesson, the recommended scaffolding is to provide more practice within the same prescribed learning sequence, using similar instructional materials. A scripted lesson's design undermines the need for wiggle room because it removes all ambiguity from the learning process. Designers of scripted materials do not consider students' input regarding alternative strategies or misunderstandings and teachers' contributions to curriculum design as critical to determining students' success or

Wiggle room allows students to negotiate meaning, increasing their knowledge and understanding as they share insights with teachers and classmates.

Dual-tiered scaffolding depends upon an understanding of what Cole (2010) referred to as *wiggle room* -- a space for students to find, negotiate, and discuss what meanings they find in a particular challenge. Wiggle room allows students to negotiate meaning, increasing their knowledge and understanding as they share insights with teachers and classmates. Accordingly, the consequences of wiggle room provided necessary and critical input for our inquiry discussions, helping teachers to identify misconceptions or misunderstandings and promoting students' positive development as math learners. Doyle (1983) first linked *wiggle room* with an assignment's ambiguity. On the surface, ambiguity can be defined as signifying a lack of purpose, making something too obscure. More importantly, however, in this instance, ambiguity allows for the discovery or demonstration of multiple interpretations or meanings. Accordingly, Doyle and colleagues (Tekkumru-Kisa, Stein, & Doyle, 2021) recently linked ambiguity to those assignments which require students to comprehend as opposed to simply memorizing content. Unlike memorization, comprehension is a constructive process, requiring the interactive and sequential processing of information from both the instructional context and learners' memory. Within the *wiggle room* provided by ambiguity, students have opportunities to acquire cognitive strategies and develop self-regulatory behaviors, however nascent, when attempting to determine answers to mathematical problems. Wiggle room was an unquestioned essential part of the partnership for both teachers and students.

engagement (Apple, 1995 Au, 2011; Byrk, 2015). Scripted instruction's design is consistent with the 'tightening up the ship' metaphor (Ingersoll, 2003). Unfortunately, in this case, we believe the tightening will undermine teachers' and students' understanding of mathematics. Whereas teachers are not considered in the adoption of scripted instructional materials, we believe they can take steps to ameliorate the situation. These steps involve efforts to bring wiggle room back into the curriculum.

Next Steps: Perhaps a silver lining!

We want to conclude our discussion with what we consider to be the next steps for developing a university-public school partnership. First, the easiest way to help teachers to appreciate the importance of students' insights into their development as math learners is to ask teachers to start with word problems, which curriculum developers often include at the end of their scripted lessons. Teachers in recent conversations with us complained about the lack of available time to complete all the lessons prior to the word problems; as a result, they never have time to get to them to see what students already know and their struggles with different concepts. What we are suggesting is for teachers to begin with word problems because they provide the necessary *wiggle room* for students to discover and explore their expectations for a particular lesson. The goal should be a focus on student thinking which is centered on intuitive ways that children engage in problem solving. However, what does this look like in a scripted program?

We will use an example from a scripted mathematics program used in a local school district. This program (Eureka Math, 2021) uses a set of guidelines that teachers are expected to follow consisting of *Fluency, Application, Concept Development, Problem Set, Debrief, Homework,* and *Exit Ticket*. We encourage teachers to center the *Problem Set* guideline and implement it as an open-ended task. It is within the problem set idea that the principles of CGI can be attended to because student thinking is allowed to be expressed and highlighted. At the same time, teachers can use the language of this program in their lesson planning by highlighting the *Concept Development* within the context of the problem set. Additionally, when students express their thinking and the teacher requires students to share that thinking with others, this can be described as the *Debrief* part of the lesson. Rather than operating in a step-by-step manner, this lesson plan can be reconfigured while still attending to the parts required by school districts. We find in many cases that teachers must use the language of whatever scripted program that is required of them and simply need assistance and encouragement on how to align such language with research-based practices.

An additional idea is for teachers to change scripted lessons into bigger ideas. For example, by using familiar experiences as the context, rational number concepts can be taught in ways that center student thinking on fractions, part-part-whole relationships, and problem solving with fractions. Students intuitively share items in their everyday lives, especially a whole object and part of another. Prior to introducing any formal rational number notation, teachers can easily pose problems in which students equally share items and describe the pieces. It is in those moments that teachers can then help students label their thinking with the proper mathematical notation. Students then have a contextual reference in their mind that connects with abstract notation of fractions.

Both of our examples allow teachers to access students' thinking about how they approach mathematical problems. As noted by Cognitively Guided Instruction (Carpenter, et al., 1996; Carpenter, et al., 1999; Carpenter, et al., 2015), learners often discover more than one way to solve a problem and our examples will let teachers examine the multiple ways by which students approach mathematical challenges. Most importantly, they allow this access using problems that require more than simple memorization (Doyle, 1983). Such problems provide the necessary *wiggle room* (Cole, 2010) for students to discover, explore, and share perceptions with classmates and teachers. In our partnership, such processes contributed to the establishment of a shared community of understanding, allowing for the one thing, which scripted instruction advocates view as the main outcome variable, higher math scores on mandated assessments (Au, 2011). In alignment with Essential 1 of the Second Edition

of the NAPDS Nine Essentials which talks about a comprehensive mission, we accomplished this outcome as one of many positive developments, due to a partnership among teachers and students and administrators, where the goal was to teach-beyond-the-test (Miller et al., in press).

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Participatory Research to Improve PDS Initiatives: Trying-on Problem-Based Pedagogies with High-School Students

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Introduction

For three weeks each June, our PDS hosts a summer program called the Academy for Future Teachers (AFT), serving high school students interested in a teaching career. Partners across the PDS convene to support high-school AFT participants, including master teachers (P-12 teachers from local school districts and university faculty) and PDS teacher candidates at our university. AFT is approaching 15 years as a meaningful component of our university programming in an ongoing partnership with our community's schools, teachers, and students.

As researchers involved with PDS initiatives at our urban research university, the Academy for Future Teachers is a highlight each summer. We join master teachers and PDS teacher candidates' planning and interview high-school AFT participants each year to increase our program's responsivity to our community's needs. We share results from data collected during the previous year at the first planning session each year. One year, we discussed our finding that while high school AFT participants enjoyed the program, they did not feel that real-world connections were prioritized. Upon hearing this, the master teachers and PDS teacher candidates who facilitate AFT decided to implement more problem-based pedagogy. In our role as researchers, we collaborated with master teachers and PDS teacher candidates on a participatory action research project about shifting AFT toward a problem-based learning (PBL) approach.

In this paper, we first describe the Academy for Future Teachers, including the roles of high-school participants, master teachers, and PDS teacher candidates. Next, we outline the characteristics of a PBL approach, and discuss the methods used in our participatory action research project. Then we share the results of implementing problem-based pedagogies at AFT. Finally, we conclude with recommendations for incorporating PBL within PDS initiatives.

Academy for Future Teachers

AFT is a program sponsored by our university's PDS. This program leverages PDS's strengths