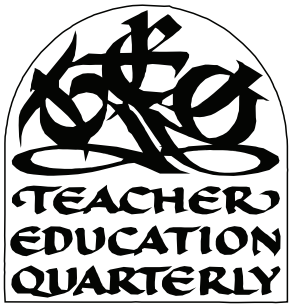

Helping Pre-Service Mathematics Teachers Connect Theory and Practice:

Using Reading, Writing, and Observation Protocols to Structure Field Experiences

By Stephanie Behm Cross & Nermin Tosmur Bayazit

> The Double Entry Journals were probably of the most benefit to me. I hate writing journals but these were not your typical journals and I was able to organize my thoughts with what I was seeing [in the field] and reading. This was the best journaling technique I've ever used. – Julie

Students are slowly gathering their books and handing in their final course evaluations for our 3-credit hour mathematics methods course for pre-service middle level mathematics teachers. We are reading Julie's and other students' final course evaluations and are happy to see positive comments related to our Theory-into-Practice (TIP) project. We designed this project to address our students' expressed frustrations at the perceived disconnect between theory and practice. The project combined course readings, journaling, collaboratively created observation protocols, and classroom observation into a semester-long iterative assignment. Our students' work on this project, and the resulting impact on professional capital, is the focus of this study.

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While research has continually shown the importance of student teaching experiences in teacher education (Cochran-Smith & Zeichner, 2005; Guyton & McIntyre, 1990), many pre-service teachers struggle in these settings, especially as they try to connect what they are learning in their university courses and what they are seeing in their placement classrooms (i.e. Korthagen & Kessels, 1999). Some researchers have suggested the use of reflection (i.e., Wedman and Martin, 1986) and focused observations (i.e., Young and Bender-Slack, 2011) as one way to tackle this disconnect. Our research merges these two approaches and demonstrates the benefits of using a semester-long project to help pre-service teachers connect theory and practice. Using data from course artifacts, interviews, and written reflections, we focused our study on one central research question: What is the impact of a collaborative, semester-long, reading-writing-observation project on pre-service teachers' ability to connect theory and practice? Below we include a review of the literature, offer a short description of our methods followed by a detailed description of the TIP project, and report our findings. We conclude by discussing the potential impact of the project on our students' developing professional capital, share missed opportunities for learning, offer project modifications, and suggest potential implications for teacher education.

Review of the Literature

For this study, we reviewed literature in three fields: student teaching, reflective thinking, and the role of observation in teacher education. These bodies of literature point to the importance of both the project design and our research focus.

Student Teaching

In the U.S. and most parts of the world, the student-teaching internship is the culminating experience of initial teacher education programs (Guyton & McIntyre, 1990; McIntyre, Byrd, & Foxx, 1996). Most teachers view field-based experiences as the most valuable and beneficial part of their preparation (Feiman-Nemser, 1983; Guyton & McIntyre, 1990), claiming that most of what they know comes from first-hand experience (Darling-Hammond, 2006; Feiman-Nemser & Buchmann, 1985). However, there is considerable research showing that pre-service teachers tend to "survive" in the field, instead of using their field experiences to consider and practice the theories they learned in their teacher education programs (i.e. Korthagen & Kessels, 1999). This survival mode may be related to three areas commonly researched in teacher education.

First, pre-service teachers often have a hard time making connections between university coursework and field experiences (see, e.g., Santagata, 2010). As Zeichner (2010) states, "one of the central problems that has plagued college- and university-based pre-service teacher education for many years [is the] disconnect between the campus and school-based components of programs" (p. 89). This may be due, in

part, to some teacher education courses focus on theory in isolation (Greene, 2003). Additionally, there tends to be very little guidance about what teachers should actually do once they are placed in the field (Darling-Hammond, 2006). This lack of guidance may, in part, lead pre-service teachers to find "theories" irrelevant to the development of teacher competencies (Laursen, 2007). As Feimen-Nemser and Buchman (1985) stress, pre-service teachers will need guidance in recognizing how what they have learned as university students can help shape their perspectives and practices as teachers. Making these connections are not necessarily easy or automatic.

Second, schools are generally not set up for teacher training. As pre-service teachers first enter classrooms, they are confronted with the responsibility of teaching while still learning how to teach. Feiman-Nemser and Buchman (1985) describe this experience as the "cross-purposes pitfall." As Feiman-Nemswer and Buchman explain,

> The legitimate purposes of teachers center on their classrooms, which generally are not designed as laboratories for learning to teach… The cross-purposes pitfall arises from the fact that classrooms are not set up for teaching teachers. (p. 62-63)

Finally, pre-service teachers bring their own experiences and understandings about teaching to their programs based on years of experience in classrooms as students (Lortie, 1975). These beliefs impact the ways in which prospective teachers interpret their experiences in teacher education coursework and in the field (Feiman-Nemser, 2001). Researchers continue to argue that activities within teacher education must work to uncover pre-service teachers' tacitly-held beliefs and position them to use their past experiences in productive ways (Mewborn & Tyminski, 2006).

Drawing on these ideas, we (two mathematics teacher educators) designed a project for a middle level mathematics methods course that helped pre-service teachers bridge the gap between theory and practice, position themselves as learners in the field, and reflect on their own beliefs in light of course readings and field experiences. More specifically, this project was designed to engage pre-service teachers in several rounds of course readings, journaling, focused observations and interviews, and narrative reflection. Reflective thinking and field-based observations were two major components of the project and are therefore reviewed below.

Reflective Thinking

Although field-based courses are seen as the most valuable and beneficial part of teacher preparation programs, these experiences have the potential to be a source of frustration for pre-service teachers when experienced in isolation. Wedman and Martin (1986) suggest that reflection could be a way to overcome the negative effects of the field experiences. Despite the fact that the idea of reflective thinking and its role in teacher education have been extensively studied (i.e., Dewey, 1933; Mewborn, 1999; van Manen, 1977) there is no consensus on what it really means. Dewey (1933), who is credited as the first scholar to discuss the role of reflective

thinking in teacher education defined the term as "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the future conclusions to which it tends" (p. 7). In an effort to understand his definition of reflective thinking, Rodgers (2002) lists criteria that she believed characterized Dewey's concept of reflection. As she states, "Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas" (p. 845). Rogers adds to that an important distinction that "reflection needs to happen in community, in interaction with others" (p. 845). This points to the importance of collaboration among pre-service teachers as they engage in reflective thinking.

Sparks-Langer and Colton (1991) add to the concept of reflection by discussing three elements that are important in teachers' reflective thinking process: cognitive, critical and narrative. As they state, there is a cognitive element that relates to how teachers process information and make decisions; a critical element that "focuses on the substance that drives the thinking—experiences, goals, values, and social implications;" and a narrative element that centers on "teachers' own interpretations of the events that occur within their particular context" (pg. 37). This element is particularly useful in teacher education courses.

Still other scholars have looked at reflective thinking connected to particular content areas. For example, Gagatsis and Patronis (1990) describe the main phases of the process of reflective thinking in mathematics, including initial thoughts, reflection on the subject, partial discovery, introspection, and full awareness. The authors stress the "recursive character" of the stages and claim that "each stage strongly depends on—and in fact uses—all stages before it" (p. 33).

Although there is not a consensus on the definition, characteristics of, or approaches to reflective thinking, the elements and phases discussed above point towards reflective thinking as a recursive process, dependent on one's ability to engage in introspection and use situational context to interpret and act upon situations. As Mewborn (1999) states, reflective thinking is "qualitatively different than recollection or rationalization" (pg. 317), in that it includes both reflection and action within individual and shared experiences.

Finally, moving us from defining reflective thinking to the act of engaging preservice teachers in activities that might promote reflective thinking, Zeichner and Liston (1996) push teacher educators to focus on *what* we have preservice teachers reflect on and the *ways in which we engage them* in that reflection. As Doyle (1990) argues, reflective thinking opens the door for pre-service teachers to see the theories or research-based ideas they read about as opportunities for inquiry and not just ready-to-follow recipes for instruction.

The Role of Observation in Teacher Education

Sparks-Langer and Colton's (1991) notion that a critical element of reflective

thinking centers on teachers' "own interpretations of the events that occur within their particular context" (p. 37) points towards classroom observation as a potential entry point for teacher reflection. In fact, van Es and Sherin (2002, 2008), in their research on teachers' participation in a video club, argue that "learning to notice [in classrooms] is one important dimension within the process of reflection that deserves additional attention" (2008, p. 247).

Historically, classroom observation has been a common component of many field-based courses and practicum experiences. However, despite the frequent use of observation in teacher education, many pre-service teachers find themselves lost while observing more experienced teachers in action in K-12 classrooms. Researchers have suggested that "without guidance pre-service teachers find it difficult to identify what matters in teaching and to elaborate on what they see" (Santagata & Angelici, 2010, p. 339; Scherff & Singer, 2012).

To address this issue, and to help pre-service teachers "learn to notice," several researchers have explored the use of guided observations in pre-service teacher education. As Anderson, Barksdale, and Hite (2005) explain, "guided observations allow pre-service teachers to identify and focus on a single aspect of teaching or learning… [which] may provide them opportunities to draw conclusions that result in improved teaching practices" (p. 101). Young and Bender-Slack (2011) utilized guided observation in a methods course assignment that required their middle level pre-service teachers to record weekly observational field notes from their placement sites during a semester-long language arts field experience. Using the field notes as a foundation, pre-service teachers wrote about one significant event related to their own teaching experiences, student interactions, or their mentor teacher's work. The researchers highlight two interesting findings: (1) pre-service teachers did not recognize or write about literacy events that were not the focus of their methods courses, and (2) despite the requirement to connect back to course readings, the pre-service teachers focused more on classroom management than on literacy instruction.

Similarly, Scherff and Singer (2012) created a course assignment to address students' struggle with what to record and critique during field observations. The pre-service teachers were given an observation template based on course readings to use during their field experiences. Scherff and Singer found that requiring pre-service teachers to use the framework from the required course readings as a lens to view their classrooms helped them "notice elements of practice they had previously overlooked" (p. 271). Taken together, these studies highlight some of the potential benefits of using guided observations in pre-service teacher fieldwork.

The literature discussed above brings together important research on the preparation of teachers. With these ideas in mind, we aimed to merge the research findings above and develop an assignment for pre-service teachers that would (1) help them connect theory and practice, (2) provide guidance on how to engage in a field setting not necessarily designed for future teachers, and (3) focus on reflective thinking

during focused classroom observation. Below we discuss the main components of the project and provide context and additional rationale for this work.

Methods, Course Context, and Project Rationale

In Spring 2010, we were tasked with designing a 3-credit hour mathematics methods course for pre-service middle level mathematics teachers. Twenty-five pre-service teachers were to be enrolled in this course during their senior year (fall semester) while at the same time enrolled in a 3 credit hour practicum experience that would place them in middle grades mathematics classrooms for 16 hours per week for 10 weeks. Prior to the fall term students completed 12 credit hours of coursework in mathematics, but had not yet been enrolled in a formal mathematics methods course. This fall term would also be their first field placement in a middle school.

As we designed the course together, we engaged in extended conversations about pre-service teachers' expressed frustrations at a perceived disconnect between theory and practice. In past semesters, our middle level mathematics pre-service teachers were discouraged that the new strategies and ideas about mathematics instruction discussed in their methods courses were not being enacted in their placement classrooms. Attempting to understand and address these issues with our pre-service teachers, we developed a course focused on what it means to teach middle grades mathematics for understanding. A major component of this course—the Theory-into-Practice (TIP) project—made up 60% of the course grade and is the focus of this article.

Data for this study consisted of the TIP project description, project artifacts, and written reflections. For our analysis, we drew on grounded theory methodology (Glaser & Strauss, 1967). Data analysis began at the beginning of Fall 2011, at the completion of data collection. Once all data were collected, we created an online database and two printed binders that included all data. We each reviewed the data independently, developed initial codes and kept memos to track emergent themes and patterns.

During initial data analysis, we were interested in how participants talked about the specific themes and teaching strategies discussed in the course. However, during our analysis of the interview-reflection piece of the observation protocol we recognized that although our pre-service teachers discussed many different instructional strategies from their coursework and observations in the field (i.e., the use of differentiation strategies, problem-based learning, questioning techniques, etc.) we could not identify specific patterns within or between these specific instructional strategies. Instead, we consistently saw that our pre-service teachers used direct quotes from the readings for their interview questions and in their reflections. This more general category, capturing one of the ways in which pre-service teachers connected theory and practice, refined our research question and helped us more carefully focus the remainder of our analysis. Our final research question—What is

the impact of a collaborative, semester-long, reading-writing-observation project on pre-service teachers' ability to connect theory and practice?—guided the remainder of our analysis.

Once our initial coding was complete, we came together to develop overall codes, concepts, and categories that might help us develop an overall understanding of our research question. Discrepancies in coding and analysis memos were resolved through discussions between researchers and then final coding was completed. During our last round of data analysis, we specifically looked for clues of reflective thinking as discussed in the literature review. Finally, in reporting our findings, we utilized participant voices as much as possible through direct quotations from a variety of data sources.

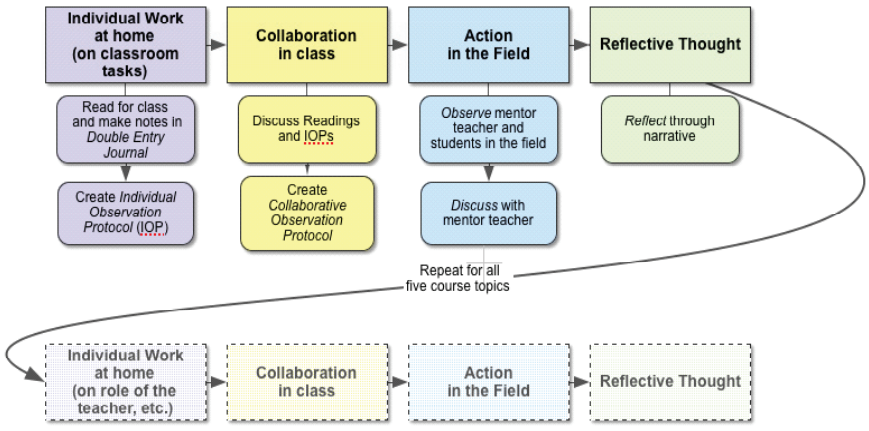
The Theory-into-Practice (TIP) Project

In what follows, we provide a description of each component of the TIP project. We also include Figure 1 below in order to highlight each individual and collaborative component of the project—components that occurred within the course, outside the course, and in the field.

Course Readings

Our first task was to identify one text that could act as the anchor of the course. After much consideration, we settled on the book *Making Sense: Teaching and Learning Mathematics with Understanding* by James Hiebert and colleagues (Hiebert et. al, 1997) as the main text for the course. Despite the age of the text (12 years

Figure 1
TIP Project Components



old at the time of our course) we felt this book was a good fit. The primary thesis of this book, as stated by the authors, is that "classrooms that facilitate mathematical understanding share some core features, and that it is possible to tell whether classrooms support the development of understanding by looking for these features" (p. 2). The five dimensions that the authors believe "work together to shape classrooms into particular kinds of learning environments" (p. 2) are: the nature of classroom tasks, the role of the teacher, the social culture of the classroom, the mathematical tools available for use, and equity and accessibility for all student. As the authors argue, engaging teachers in examination of these dimensions is useful regardless of the instructional approach in use in the classroom. Given that our students would be entering classrooms with varied classroom structures and curriculums in place, we thought this book (and the assignment described below) was a good fit. Pre-service teachers' critical reading of all assigned texts, including the Hiebert chapters and supplemental readings, served as the first phase of the TIP project.

The Double-Entry Journal

The second component of the TIP project was the creation of a double-entry reading journal. This component of the project was designed to engage pre-service teachers in active reading strategies. The teachers were instructed to type or write their double-entry journal while they were reading for class each week. We encouraged them to record critical ideas or quotes from the course readings on the left side of their notebook or table. On the right side, the pre-service teachers could then include a response to that quote or idea. We expected our pre-service teachers to come to class each week having read the chapters related to the topic for the week (one of the five dimensions of teaching as described in the Hiebert book) and having completed their double-entry journal related to that reading.

Observation Protocols

The next major component of the TIP project was the creation of observation protocols based on course readings. Pre-service teachers were tasked with creating individual and collaborative observation protocols based on each course topic.

Individual Observation Protocols. After students engaged in the reading and journaling cycle for one of the five dimensions (each cycle was anywhere from 1 to 3 weeks), they were then instructed to use the readings and their double-entry journal(s) related to that topic to create an observation protocol for use in their practicum classroom. Students were tasked with using both the readings themselves and their double entry journals to create a list of things to watch for during their field observations. We hoped that this portion of the assignment would help pre-service teachers start to develop what van Es and Sherrin (2008) term *professional vision for reform teaching*, or the "ability to notice features of a practice that are valued by a particular social group" (p. 244). By writing down the things they wanted to

notice, we hoped that our pre-service teachers were not only engaging with the readings, but also starting to form new professional visions for reform teaching in mathematics. Finally, the pre-service teachers were also required to create a list of questions to discuss with their mentor teachers.

Collaborative Observation Protocol Design. Five times during the semester we would engage our pre-service teachers in discussions on one of the five main course topics. For example, after students had read for two weeks on the role of the teacher, created double entry reading journals for all assigned readings, and created their individual observation protocol focused on the role of the teacher, they would then come together in class to discuss their developing ideas (or their professional vision) about the nature of classroom tasks. At the end of our class discussions, we would then create a Collaborative Observation Protocol. Pre-service teachers were encouraged to use both their individual and collaborative protocols during observations.

Fieldwork and Final Reflection

The final piece of the TIP project included field-based observations and conversations with teachers, followed by written reflection on each of the five dimensions of teaching covered in the course. After several weeks of reading, writing, and discussing each course topic through the means described above, it was finally time to use the observation protocols in the field and write their final reflection narrative on the topic at hand.

Results

In this section, we discuss common themes that appeared in the pre-service teachers' TIP projects. We focus, in particular, on the connections these teachers' made between course readings and their first-hand experiences in their field placement sites. Following this analysis, we share less common but notable themes that appear in a few of the pre-service teachers' papers.

Using Direct Quotes from Course Readings when Analyzing Classroom Activities

As stated in the course assignment, the pre-service teachers were asked to create observation protocols based on weekly readings that "include a list of things to watch for when completing field-based observations and a list of questions to ask mathematics teachers at the placement sites." However, in addition to using the general ideas from the readings as a guide for what to look for during observations, the majority of our pre-service teachers cited specific strategies and larger theoretical underpinnings directly from the readings in their written analysis of classroom activities. They rarely referred back to their beliefs based on their experiences as a student. Consider, for example, the following comments made by Rebecca:

> Our readings stated, "The most important role for the teacher becomes creating a classroom in which all students can reflect on mathematics and communicate their thoughts and actions" (29). Through their role, teachers are to assign certain tasks and assignments to help the students to reflect and communicate their mathematical thoughts, actions, and process. Also, teachers ask their students questions in a certain way to help them with their reasoning. In my practicum classroom there are more questions with answers being asked rather than open-ended questions. Most of the time, students will be called on to answer "what is the next step," "what is 4 times 28," "how many times does 5 go into 25," and so forth.

Here Rebecca is using specific ideas from the readings as a guide to examine what is happening in her classroom, and writes in detail about the types of questions being used by her mentor teacher during lesson enactment. Jack similarly uses ideas straight from course readings:

> Is the "math the intriguing part of the tasks?" No, the math that is given is basic. The students are not asked to think outside of the box. They are not challenged by the questions. They are being prepared for the [state test].

Here, Jack utilizes exact questions from the readings to guide what he looks for in the classroom. Along these same lines, Lilly uses a particular term from the course readings to analyze classroom tasks posed by her mentor teacher. She states,

> Trying to have a conversation using the usual worksheets I see in my mentor's class now would be like trying to pull teeth! Without good tasks you cannot have a good conversation. If the problem is not "problematic" (I love this term from the readings) there can be no discussion.

As another example, Tonia uses general ideas from a supplemental reading from Small et al. (2009) to analyze particular statements made by her mentor teacher:

> My mentor uses open-ended tasks regularly…. Her favorite saying is "I'm not concerned with the answer. My concern is the steps you take to derive at the answer." I think this links directly to what Small was saying in Good questions: *Great ways to differentiate mathematics instruction*…. Allowing [students] to explore their way through a problem may be the best way for them to learn.

Finally, Lexi compares her own experiences as a student with what she is seeing in her practicum classroom and reading about in her methods course:

> I have always had teacher-oriented lessons and to see that this is only a small part of my teacher's class is very eye-opening. I have seen very positive examples of group work that is successful.

Similar to the majority of the pre-service teachers enrolled in this course, Tonia, Jack, Lilly, Rebecca and Lexi appear to be making direct connections between the theory of the course readings and the practical happenings of their placement classrooms in their written analysis. Going further, some of the pre-service teachers, like Lilly and Tonia, appear to not only make important connections between

the course readings and the field-based observations, but push further to express their support or critique of the classroom happenings. Lastly, Lexi's quote is an example of how many of the pre-service teachers used the readings and their field experiences to push back against their own past schooling experiences.

Using Course Readings to Engage in Conversations with Mentor Teachers

Although we asked our pre-service teachers to use their assigned course readings to create a list of questions to ask mathematics teachers at their schools, we did not instruct them specifically about how they might engage their mentors in these conversations. What we found, however, was that many of our pre-service teachers used the course readings directly as conversation starters with their mentor teachers. Consider, for example, Jack's comments related to his conversations with his mentor teacher about the types of tasks posed in the classroom:

> My mentor teacher and I had many conversations about the group of students that we are teaching and what tasks he provides to them…. We talked a lot about the group tasks we are reading about in class, and he has come to the conclusion that the students are not ready for this kind of room set up. I disagreed but he explained that it is hard because the kids are never given time to get any energy out and they are never allowed to talk to each other.

Jack describes using the course readings as an entry point into a conversation with his mentor teacher about what he is seeing in the classroom. He continues to describe the conversation with his mentor, adding more detail about why his mentor did not feel these methods would work with his students or within the time constraints imposed by the school district:

> I tried to describe [to my mentor teacher] problem-based learning and how we could make the class more relative by implementing more of these types of problems. He said he liked the idea but because of the schedule that they made to follow the standards, there was not enough time to loose a week trying to get the students to reach outside of themselves to understand what was happening.

Here again, Jack is able to begin conversations with his mentor teacher about what he is not seeing in the classroom by referencing course readings. Similarly, Melissa used the course readings analyze classroom tasks, but went on to further express her discontent with her mentor teacher's answers as to why these types of open-ended mathematical tasks were not assigned:

> While talking to Mrs. Robins she seemed pretty unwilling to want to try the open-ended questions and parallel tasks that we read about. I can understand her frustration with these topics but it was a bit unnerving.

Similar to other pre-service teachers in the course, it appeared as if Melissa may have felt more comfortable initiating a discussion about teaching strategies when

she could support her arguments with theory and research from the methods course. While Melissa and Jack, and many of our other pre-service teachers, bumped up against resistance when they used their readings as an entry point for conversation, Julie found that these conversations led to more open-spaces for her own teaching in her practicum classroom:

> Thankfully, I have an open mentor teacher. She is very supportive of the things that I speak about and the things that I want to try from the readings. She says she will support me next semester and help me accomplish whatever I want to do.

Overall, the TIP project appeared to provide multiple entry points into productive dialogue between our pre-service teachers and their mentors.

Using Course Readings to Guide Classroom Actions

As we analyzed the written observation protocol assignments, we were also surprised at the frequency of pre-service teachers' discussion of their own currently enacted teaching strategies, as well as suggestions of what they hope to do in the future as related to course readings. Consider, for example, comments made by Julie related to her goals for the future:

> I wanted so badly to be with the picture perfect teacher, but I am not. I feel like I am ready to just get my feet wet and try the things I am reading about like questioning. As I go around the room and help individual students I try to implement techniques that I've learned about questioning. I am trying to get in a habit of responding to my students with a question.

Although Julie had not been placed with a mentor teacher who, in her opinion, utilized effective questioning strategies, Julie does write about using the readings as a guide for her own teaching practices. Similarly, Rebecca, who did not appear to be connecting with her mentor teacher's methods, suggests how she might use the readings as a guide for effective questioning strategies in lieu of modeling what she is seeing in the classroom:

> Does my mentor teacher ask questions like the table in our reading suggested? No, she does not. However, like the reading suggested I think I would have a copy of the table on top of my desk to see and follow some of the suggestions. Or maybe even write down the type of questions I would ask before the day begins.

And finally, Lilly, who also writes about questioning strategies, focuses on things she is currently doing in her practicum classroom:

> When students ask me questions, I usually ask them a different question not from the textbook or worksheet they are working on [from my mentor teacher]. I guess kind of like the open-ended questions we are reading about, we start discussing the mathematics behind what they are doing. I end up with a crowd around me and we bounce ideas off each other. We start talking about what works and why it works! And when we finally get back to the worksheet they look at the questions and go "oh, I get it!"

For Lilly, Rebecca, and Julie, the course readings appear to act as a second, and possibly even higher, authority regarding appropriate strategies for mathematics teaching. In this case, the readings that focused specifically on effective questioning techniques in the classroom appear to have had more influence over our pre-service teachers' current and future teaching plans than did the model of teaching they were observing in their practicum classrooms or that they had experienced as a student.

Less Common Focus among a Few Pre-service Teachers: A Look at Two Extremes

Comments made by two of the pre-service teachers, although not typical of the larger group of teachers, offer some important ideas that are worthy of consideration. Here we discuss pre-service teachers who appeared to discount course readings in favor of what was happening in practice.

Both Minh and Brett appeared to be using their classroom experiences and observations to question or discredit the course readings. Consider, for example, Brett's apparent disequilibrium between what he is reading and what he is seeing in his practicum classroom:

> I was surprised when I discussed the idea of showing multiple ways to attack and solve problems in allowing students to choose what works best for them. My mentor teacher said that for some classes that is more confusing, you should only show them one way or it will confuse them. The first block is definitely much further behind than the other two blocks, but is that a reason to not show them different ideas? I defer to her methods when teaching this class in assuming that she knows them better.

Here, Brett is questioning both the methods expressed in the readings and the methods used by his mentor teacher, but appears to be falling on the side of practical experience over theoretical course readings. As another example, consider comments made by Minh regarding the abilities of the students in his practicum classroom:

> The readings suggest beginning with an application such as a problem and let students work at it, but in my observations, the content is taught first and then they apply their knowledge to develop a skill. I doubt many students can come up with the correct answer if you try to teach students using "residue" because as I have seen, even when the students are taught how to do the problem they can barely apply their new learning to another problem that the teacher gives them.

Here, Minh discounts course readings focused on allowing time for student exploration in mathematics based on his analysis of his students' mathematical readiness and capabilities as they engage in the larger environment designed by his mentor teacher.

Similarly, Brett appears to again discount the theoretical underpinnings of the majority of the course readings, but focuses instead on external constraints and pressures. He states, "many of the theories and ideas introduced are not practical in the

settings we are in. Maybe we can change as we get our own students, but right now we are stuck in standardized testing land." Brett continues to question the validity of course readings based on the current climate of accountability within education:

> We've talked a lot about these conceptual ideas and theories that I think everyone agrees are fantastic. The question is, are we the environment now in the education system in the public schools, are we really going to be able to implement these? I don't know if currently we're in the situation where we can do that. It's so rigid and you have to cover so much during the year and I mean I was amazed that I went in here and [my mentor] said "here's the pacing chart" and it's laid out right there for you.

Both Minh and Brett, throughout their observation protocol assignments, appear to discredit their university coursework in favor of current practices in their placement sites. While we were encouraged that only two of the 20 students felt that the current classroom practices they were seeing discounted what we had read about and discussed in our mathematics methods course, it is still vital to consider the apparent disconnect that occurred between readings and field-based observations for these two students. It is interesting to note that neither Brett nor Minh felt inclined to write about how their current classroom climates, including both student achievement and engagement and teachers' feelings of autonomy and perceived external pressures, might be altered if strategies and theories from their readings were to be implemented.

Discussion

The TIP project was designed with one primary purpose in mind: to merge course readings and class discussions with what pre-service teachers see and do in the field. We hoped that this merger might help pre-service teachers bridge the disconnect between campus and school-based components of teacher education, situate field-based classrooms as a space for their own learning, and challenge their often tacitly-held beliefs about effective mathematics instruction through reflective thinking. In this section we revisit these purposes in light of the results of the observation protocol assignments.

Preservice Teachers' Developing Professional Capital

As we analyzed our results and reflected upon the usefulness of this project, we found ourselves thinking about what assets pre-service teachers might leverage to accomplish their goal of teaching while learning to teach. Leana (2011) and Hargreaves and Fullan (2012) have recently discussed the role of certain types of capital in the teaching profession. Leana, in her study of over 1,000 teachers in NYC, discusses both human and social capital. Hargreaves and Fullan add decisional capital as a third important dimension in the lives of teachers (and combines all three collectively as professional capital). These three forms of capital are described further in Table 1.

Using this framework, we discuss the ways in which our teachers may have developed these three types of capital through their engagement with the TIP project.

A recurring question in teacher education is whether the effects of university coursework are "washed out" by classroom experiences (Ebby, 2000; Raymond, 1997; Steele, 2001; Zeichner & Tabachnick, 1981). In many ways, the project helped to push back against the "wash out" cited by many educational researchers. We were pleased to find that early in their field experiences, the majority of our pre-service teachers were still using course readings and the theoretical underpinnings of the program to guide their analysis of classroom experiences and structure their first teaching practices. In fact, many of our pre-service teachers used direct quotes and ideas from the readings to analyze classroom events. We wonder if requiring pre-service teachers to keep a double-entry journal (where they pull out direct quotes and general ideas from the readings) pushed many of them to link directly to quotes and specific ideas from the readings when creating their observation protocols and writing their final reflections on each of the five dimensions of mathematics teaching covered in the course. Regardless of which components pushed students to carefully consider how their course readings were related to classroom practices, we do feel this project positively influenced pre-service teachers' human capital, or their knowledge and effectiveness as individual teachers.

Another, and possibly more important finding, is that pre-service teachers' social capital appeared to increase while engaging in the TIP project. For example, the pre-service teachers were given an opportunity to work with their peers to create a collaborative observation protocol. This process every few weeks in class gave them a chance to reevaluate their own individual observation protocol questions by considering what others thought were important topics to include. As instructors of this course, we found that pre-service teachers' observations were more focused and comprehensive when we spent the time together in class to create the collaborative

Table 1
Forms of Teacher Capital (from Leana, 2011 and Hargreaves & Fullan, 2012)

Capital	*Description*
Human	Human capital focuses on enhancing knowledge and effectiveness of individual teachers. Measures include individual teacher training and qualifications, experience, ability to teach, and motivation.
Social	Social capital focuses on building relationships among teachers. Measures include frequency and focus of conversations and interactions with peers that centers on instruction, and feelings of trust and closeness with others sought out for advice.
Decisional	Decisional capital focuses on making decisions in complex situations. Decisional capital is acquired through structured and unstructured experience, practice, and reflection.

observation protocol. Additionally adding to teachers' social capital was the unexpected interaction between mentor teachers and student teachers. Although we did not suggest to our pre-service teachers that they should share ideas from the readings with their mentors, this assignment appeared to open an avenue for discussion and debate regarding mathematics teaching strategies. As an essential ingredient of a student-teaching experience is a mentor teacher's guidance (Britzman, 1991; Fairbanks, Freedman, & Kahn, 2000; Feiman-Nemser, 2001; Frykholm, 1998), we are pleased that this assignment opened up space for conversations between pre-service and mentor teachers related to the balance between theory and practice.

Finally, this project appeared to have an impact on our pre-service teachers' decisional capital. As explained by Hargreaves and Fullan (2012) decisional capital focuses on making decisions in complex situations and is typically acquired through structured and unstructured experience, practice, and reflection and is developed in teachers only after years of classroom teaching. Using the collaboratively created observation protocols, our pre-service teachers wrote extensively about the decisions their mentor teachers made during instruction and hypothesized what they might do in similar situations in their own classrooms. Some students even appeared to use their course readings and classroom observations to guide their in-the-moment decision making as they engaged in practice teaching. For example, Lilly reflected on her own questioning strategies as different from her mentor teacher and guided by the "open-ended questions we are reading about." Her resulting instruction, with "a crowd around [her] bouncing ideas off of one another" highlighted her developing decisional capital. Based on our results, we question Hargreaves and Fullan's (2012) suggestion that decisional capital is only developed in experienced teachers and suggest that projects like the one outlined in this paper may push pre-service teachers to start developing decisional capital earlier in their careers.

Missed Opportunities for Learning

In addition to citing the potential learning opportunities and positive impacts on professional capital that arose for the majority of our pre-service teachers as they engaged in the TIP project, it is important to consider missed opportunities for learning. Below we revisit the experiences of the two pre-service teachers who discounted course readings and discuss a potential missed opportunity for reflective thinking for all participants.

As mentioned in the results section above, two pre-service teachers did appear to move down the path of "washed out" effects of university coursework. For these two students, their field experiences seemed to overpower their course readings. Instead of using the readings as a lens to critically analyze current practices, they used their observations in the field as a way to discredit currently accepted educational theory and practices in mathematics. This was, in many ways, the opposite effect we were hoping for. One possible take-away is that these two teachers would have felt the effects of "washed out" teacher education to an even greater extent

without this project in place where they had to at least consider the course readings and conversations with their peers and course instructors in relation to what they were seeing in the field.

Examining the experiences of these two particular student teachers, however, led us to question our overall goals for pre-service teachers to connect theory and practice through critical reflection. It could be argued, after all, that Brett and Minh did make connections between course readings and teaching practices in the field; they simply did not draw the conclusions we were initially hoping for. In fact, it appears that all of the pre-service teachers participating in the study made connections between course readings and current teaching practices as they used the readings to analyze practices, engage in conversations, and guide classroom actions, but their comments (whether they were discrediting course readings or questioning methods in use by practicing teachers) did not appear to reflect introspection and the use of situational context to interpret situations. Many of the comments appeared to analyze teaching practices simply as "good" or "bad" and did not push pre-service teachers to consider further how context plays a role in teacher decision making. As Doyle (1990) argues, reflective thinking opens the door for pre-service teachers to see the theories or research-based ideas they read about as opportunities for inquiry and not just ready-to-follow recipes for instruction. In some ways, while the TIP project did encourage connections between theory and practice, it may have also led students to adopt these "ready-to-follow recipes" whether they came from readings or from the teachers they observed in practice.

Conclusions and Implications

Returning to our research question, we found that our TIP project did appear to have an impact on pre-service teachers' ability to connect theory and practice. An additional and unexpected finding was the alignment of those results with all three dimensions of teacher professional capital as recently outlined by Hargreaves and Fullan (2012). Our results suggest that a project of this nature has the potential to not only help pre-service teachers make connections between best practices literature and discussions and classroom practices, but also might have an important impact on teachers' developing professional capital. If, as the authors suggest, professional capital—including human, social, and decisional capital—is a "cure for what ails and assails the teaching profession" (Hargreaves & Fullan, 2012, p. 9) than this project and others like it seem very important in pre-service teacher education. However, we also found that pre-service teachers seemed to evaluate teaching or course readings as simply "good" or "bad" and may have missed opportunities to engage in critical reflective thinking. In the section that follows, we offer implications of our work related to project improvements and teacher education more generally. We conclude with suggestions for further research.

TIP Project Improvements

In light of the results and discussion above, we recognize that there are several ways that the TIP project might be improved. We therefore propose that improvements be aimed at the following three areas: (1) requiring the use of direct quotes, (2) suggesting that pre-service teachers share passages from the readings with their mentor teachers, and (3) add components to the project that may increase pre-service teachers' opportunities for critical reflection. These ideas are elaborated below.

First, given that many of our pre-service teachers have already used direct quotes from the readings, we intend to require the use of direct quotations when designing their observation and interview questions in order to further enhance teachers' human capital. The pre-service teachers who utilized direct quotes in both their questions and protocol papers appeared to focus more carefully on the details of the readings, instead of just talking in generalities about the overall goals of the mathematics methods course and overall program.

Second, an unintended result of this project—that mentor teachers and pre-service teachers engaged in dialogue regarding the ideas inherent in university coursework—appeared to open up new avenues for learning for our pre-service teachers. Many were able to start thinking about why their mentor teachers did or did not do what they were reading about. Our biggest concern, as highlighted in the results section, is that sometimes these conversations led both the mentor and pre-service teachers to discount the readings. In response to this, we intend to encourage pre-service teachers to share particular passages from their readings with their mentor teachers prior to these conversations, in the hopes that these conversations might work to increase social capital and become mutually beneficial learning opportunities for both mentor and mentee. We will also ask our pre-service teachers to work with their mentor teachers to identify critical moments of decision making in their field classrooms. Although decisional capital is developed in teachers over many years of practice, we hope the addition of this topic will push more of our pre-service teachers to consider the in-the-moment decisions necessary in teaching.

Finally, we intend to add or modify components of the TIP project to further encourage critical thinking. Zeichner and Liston (1996) suggest that teacher educators need to focus on what we have pre-service teachers reflect on and the *ways in which we engage them* in that reflection. After considering our results and the overall design of the TIP project, we realized that we likely set up students to critique practices as either "good" or "bad" instead of encouraging pre-service teachers to consider classroom context and overall impact on student learning. A focus on these good or bad "recipes" for instruction may have been further exacerbated by the absence of questions focused on the larger theoretical underpinnings from which many of these "good" or "reform" practices are rooted (such as sociocultural and constructivist learning theories).

With this in mind, we suggest two improvements to the TIP project. First, we will ask our pre-service teachers to reflect on why they may not be seeing some of

the strategies suggested in the readings in their placement classrooms. While we were excited that many of our pre-service teachers were using course readings to make decisions about their own future teaching, it is critical that they reflect on why these strategies may not currently be in use in their practicum classrooms. Second, we will add a section to the TIP project that asks pre-service teachers to connect observed or enacted practices to sociocultural and constructive learning theories. We hope that encouraging pre-service teachers to make connections to these larger theoretical underpinnings and also asking them to consider classroom context and their mentor teachers' in-the-moment decision making might avoid the good/bad teaching practices dichotomy that tends to over-simplify the art of teaching.

Final Thoughts

We encourage teacher educators to investigate ways to merge other genres of university coursework with initial field experiences through the use of this project. For example, with the release of the Common Core State Standards (CCSS) in Mathematics and Literacy in the US, teacher educators might also use this project to connect a close reading of the CCSS, associated articles, and curriculum materials (surely to be developed soon) with double-entry reading journals, observation protocols, and reflections.

Further research related to the connection of university and field-based experiences, for both pre-service and in-service teachers at varying stages of their education, is critical to our field of teacher education. We must be responsive to what is happening in the field and help our teachers make sense of the differences they experience across university and field-based settings.

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