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ENGAGING IN LESSON STUDY AT GEORGIA COLLEGE

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Abstract

A lesson study cycle is a professional development process that integrates research and reflection through collaboration. The cycle allows a group to refine a lesson based on these collaboration efforts such as interaction with students and the post-lesson discussion. Secondary pre-service teachers in a mathematics methods course engaged in a lesson study cycle through collaboration between in-service teachers, Georgia College professors, and students in a local high school classroom. We systematically investigated this process to determine that through preparing, enacting and reflecting on their practice, Pre-service Teachers (PST) developed insight, reasoning, and understanding of the mathematics that they taught.

ENGAGING IN LESSON STUDY AT GEORGIA COLLEGE

Students in the Methods of Secondary Mathematics Teachers course at Georgia College participated in a lesson study project. In this course, students examined research on instructional strategies, assessment techniques, lesson planning, multicultural and gender issues, beliefs, and student learning in mathematics. These pre-service teachers (PST) worked in groups in order to develop a lesson based on research. Through collaboration with an in-service secondary mathematics teacher (IST) at Georgia College's Early College (GCEC), PST observed his class, created a lesson plan, taught the lesson, rewrote the lesson plan, and retaught the lesson. In this article, we investigate how engaging secondary PST in a lesson study will inform their perceptions of research, practice and students' mathematics.

Background

Lesson study is a professional development opportunity originally used in Japan where teachers collaborate in order to study the teaching and learning of a particular mathematical concept (Tolle, 2010). Since the Third International Mathematics and Science Study (TIMSS) in 1995, American teachers have been engaging in the process to some degree. The TIMSS study highlighted the mathematical success of Japanese students and determined that teaching was a cultural activity of which lesson study was a significant part (Van de Walle, 2013). Tolle (2010) suggested that "the spirit of lesson study embodies collaboration—'collaborating with fellow teachers to plan, observe, and reflect on lessons'" (p. 182). An important thing to note is that the goal is to improve both teaching and learning. The result is a living lesson plan that can continue to progress as more is learned rather than a finished document. The most significant part of the lesson study cycle is the post-lesson discussion, where participants discuss the learning and

engagement opportunities afforded for students and reflect on how the lesson can be changed in order to improve those opportunities (Tolle, 2010). The process of lesson study has been found to help teachers learn mathematics in a deeper way as well as learn how students develop mathematical ideas, which aligns with the National Council of Teachers of Mathematics' (NCTM) Teaching Principle (2000).

NCTM (2000) suggested that assessment should not be something that we do *to* students, but rather something we do *for* students. Performance-based assessments should provide opportunities for students to learn and for instructors to monitor student progress and modify their instruction based on the results of the assessment. This project achieved all of this. We believe that this project was a powerful learning opportunity for the PST, while also allowing for a valuable collaboration between teachers at GCEC and GC professors. This project fostered the students' mathematical knowledge for teaching and their knowledge and use of research in the teaching and learning of mathematics. Our goals for PSTs' in the lesson study project were:

1. The PST will reflect on their own mathematical knowledge and how their mathematical knowledge and approaches might be different than others'.
2. The PST's instructional decisions will be informed by their research framework. Instructional decisions include: planning, choosing tasks, spontaneous decisions, questioning, discussion and reflection. Thus, there will be an opportunity to connect theory to practice.
3. The PST will allow the students' mathematical thinking to inform their instructional decisions. Through this experience we want the PST to learn to listen to and learn from their students from diverse backgrounds.

4. The PST will value collaboration with other professionals in their discipline and see it as an important part of continuous improvement and professional development.

Methods

Participants and Data Collection

In the Fall semester of 2014, eleven PST in the mathematics methods course worked through a sequence of activities that represented the essential elements of a lesson study. These activities involved setting a goal, which was determined once the PST, IST and GC professors discussed the needs of the classroom. Then, the PST examined research on the determined content. A lesson plan was developed based on the research so that the content goals were met. The PST then conducted the lesson to the GCEC students in a format where some PST observed while others taught the lesson; GC professors also took field notes during both lessons. At the post-lesson discussion between the PST, GC professors, and IST, a conversation took place about the opportunities afforded for the students and how the lesson could be improved. In the redelivery of the lesson, the PST switched teaching/observation roles. This allowed PST to be involved in the entire process, which provided a richer discussion during the final debriefing session. A revision of the lesson plan followed and allowed for a full circle of meaningful reflection.

PST developed lesson study portfolios which included the following:

1. A write up of the research used and how it informed their lesson plans and other instructional decisions.

2. A record of the group's collaboration, including the number of times the teams met to discuss and plan the lessons, how the team debriefed after the lesson, how the modifications to the lesson were determined and how the roles were established.
3. Written Lesson Plans (original and modified) including all handouts and activities.
4. Observation notes during the enacted lessons (initial lesson and redelivery).
5. Individual and Group Reflections on the lesson study process.

PST presented lessons in the mathematics methods course as a way to practice prior to implementing their lessons in the GCEC classroom. Feedback was given during this process by their peers, the IST, and GC professors. There was also a final presentation of the entire lesson study process. The above mentioned tasks were part of a required assignment for the course, although the analysis of their documents for GC faculty research was voluntary. One group presented their lesson study experience at a university undergraduate research conference.

At the end of the lesson study experience, PST completed a survey about collaborating in a diverse environment. The IST was also interviewed about his experience in the collaboration, particularly concerning his role in the experience and the impact on his students.

Data Analysis

To qualitatively analyze the effectiveness of the lesson study project, we used several sources of data including the field notes taken during the enacted lesson, the interview with the IST, surveys completed by the PST, presentations given by the PST, and the portfolios submitted by the PST. A rubric was developed to assess both the portfolios and the presentation of the portfolios (Appendix A).

Findings

Theory to Practice

We provided the PST with a field experience that integrated research and practice in a collaborative setting. Many PST stated that this was their first time working with students in the classroom. They indicated that they will continue to use research in the classroom, use a lesson study approach in their future departments, and pay specific attention to students' responses and feedback. One PST stated, "before the lesson study, I was hesitant to believe that research would help us in preparing the lessons, but after this assignment I think differently." Some of the specific references to research that the PST made in their reflections were Driscoll's (1999) *Doing and Undoing*, Questioning from both Reinhart (2000) and Driscoll (1999), Wait time by Reinhart (2000), Journal writing by Kostos and Shin (2010), Cooperative Learning by Johnson and Johnson (1988), Cognitive Demand by Stein et. al (2000), and articles on Lesson Study (Lewis & Tsuchida, 1998; Tolle, 2010).

Changing Instruction to be Responsive to Students' Thinking

All PST indicated that, for whatever reason, they underestimated the mathematical abilities of the GCEC students. One PST wrote, "I underestimated the students at first. I didn't give them the credit, but they blew me away, and we weren't prepared for that. My attitude as a future teacher is that [sic] to never underestimate a student, build a base, and build up from there." This PST is suggesting that in order to teach to everyone's level in the classroom that you begin presenting content in a very accessible way, and then "move forward with harder problems." In their portfolio reflections, all PST suggested that they had to change the level of the content in their redelivery to make the mathematics more challenging for these students.

Changes in Teaching Views

This project showed the potential to be generative in the PSTs' future school systems. One group of PST discussed making shifts from "private practice to collaborative practice, teaching as telling to teaching for understanding, teaching based solely on the textbook to teaching based on research, and teaching as tradition (content) to teaching for improvement (professional development)." The PSTs' realization of these shifts goes a long way toward helping them become culturally relevant teachers, who tend to be successful with ALL students, including populations who are often marginalized in mathematics. Ladson-Billings (2009) found that math teachers who were successful, specifically with African American students, see themselves as "part of the community and teaching as giving something back to the community" (p.38). These teachers typically encourage students to do the same. She also found that teachers who are successful with African American students have shifted from teaching as "putting knowledge into," like a bank deposit as opposed to teaching as "pulling knowledge out" like mining for gold (p.38). The PST engaged in the project indicated similar shifts in their portfolios and presentations. In particular, one PST indicated that as a result of doing an activity, students "were able to construct their own definition." This indicates that she was "pulling out" a definition as opposed to telling the students a definition. This same PST stated, "this method of teaching will help the students remember and better understand the material."

Mutually Beneficial Experience

From the perspective of the IST, "It was a useful and beneficial experience for ALL." He stated, "Your students [the PST] gained classroom experience while my students learned stuff in multiple styles, through technology, hands-on, traditional, and discovery. They did it all!" He

reported that students liked the activities that the PST provided. He mentioned that the variety of methods used to teach mathematics was beneficial for both the students and for him. He also mentioned that he valued the collaboration with the GC mathematics education professors. From our perspective (GC professors), we found immense value in having input from an IST and using real students to provide our PST with an authentic classroom experience.

Discussion & Implications

Challenges

In their reflections, the PST mentioned several challenges concerning classroom dynamics. For instance, with their lack of classroom experience, they saw classroom management and pacing their instruction appropriately as challenges. They noted difficulties in keeping students on task without distracting others. A few of the PST mentioned a need for deeper content knowledge to be able to explain it adequately to students. This lack of the PSTs' content development was, in part, due to another challenge of scheduling. The topics from which the PST chose were not available until relatively close to the time that they had to teach. With the time constraints, it was difficult to connect the content knowledge and research on how students learn that particular content, which was a major goal of the project and the course as a whole. On the other hand, there may have been too much time between the redelivery lesson and the initial lesson causing issues with the continuity of the content development for the high school students. The last challenge indicated by a few PST was coordinating their meeting times and incorporating their different perspectives into a coherent lesson. However, the PST also noted the positive aspects of collaborating with other teachers.

Potential for broad impact

Through this project, the PST became more aware of how students learn particular content. Knowledge of mathematics and how students learn mathematics have been identified as the most important aspects of successful mathematics teachers (Van de Walle, 2013). It has been noted that competence in mathematics opens doors to productive futures where as a lack of such keeps those doors closed (NCTM, 2000). Through our PSTs' work with the students at GCEC, we believe that students had the opportunity to begin to see mathematics as a field to pursue. The PST appreciated working in a classroom in the community with a diverse group of students. One indicated, "The makeup of the classroom was much more diverse than the population of GCSU, so we were able educate ourselves about how to interact..." with this population. The PSTs' work with the students may have broadened the mathematical pipeline by providing access and interest to those who may not have been interested in the subject before. All students should have opportunities to engage in worthwhile mathematical tasks, where they will have the potential to learn mathematics with depth and understanding (NCTM, 2000).

Through this process of continuous improvement and reflection, our PST produced worthwhile mathematical tasks and lesson plans that can continue to be used by their peers, the faculty, and other mathematics teachers. After reflecting on the project as a whole, the PST were able to come up with personal and broad implications. In particular, one group of four PST was able to synthesize the lesson study cycle into a visual representation for their presentation at the Georgia College Undergraduate Research Conference. The continued collaboration between GC faculty and GCEC faculty benefits all stakeholders, including the Georgia College students and faculty and the GCEC students and faculty.

Conclusions

Overall, the PST who participated in the lesson study project indicated that the experience as a whole has forever changed their philosophy of the teaching and learning of mathematics. Their research supported lessons that they delivered in the high school classroom and their dissemination at later conferences indicated they understood that it is imperative to incorporate theory into their instruction. In addition, the PST indicated that being responsive to students' mathematical thinking is imperative to effective mathematics instruction. This is an essential element to the Teaching and Learning Principle that states, "An excellent mathematics program requires effective teaching that engages students in meaningful learning through individual and collaborative experiences that promote their ability to make sense of mathematical ideas and reason mathematically" (NCTM, 2014, p.5). PST discussed that collaboration offered many benefits, but came with a few challenges. When we engage PST in the lesson study process again, we will be more intentional about meeting with the IST in selecting times and topics that work for the PST. We will also provide more articles with cases where students are engaged in a research-based task, and give PST more opportunities to observe the students prior to the lesson. What did work well with implementing the lesson study is giving PST class time to work on the lesson study as well as having them log outside of class time meeting with their group, allowing the PST to present their initial ideas and their lesson to the methods course prior to instructing the high school class, and working closely with the IST throughout the lesson study process. We believe that this carefully constructed field experience has a powerful impact on PSTs' views about students, teaching, research and collaboration.

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