Problem-Based Learning among Pre-Service Teachers: Implications for Teacher Preparation and Professional Collaboration

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The purpose of this study was to examine how problem-based learning (PBL) incorporated into a literacy methods course influenced the preparation of pre-service teachers. Problem-based learning in teacher education simulates problems faced by teachers and students in kindergarten through twelfth grade classrooms. In this study, pre-service teachers worked collaboratively to solve problems and make recommendations for an English language learner who struggled with reading across the curriculum. Findings suggest that participation in PBL increased collective efficacy and problem solving skills. Furthermore, problem-based learning allowed the instructor to meet course objectives in a way that engaged students and required them to take ownership of their learning. Implications for teacher preparation include the use of PBL cases in pre-service education to prepare pre-service teachers for professional collaboration as well as culturally relevant literacy practices.

Introduction

In recent years, questions have been raised with regard to whether teacher preparation programs and courses are adequately preparing teachers for their first year of teaching (National Council for Accreditation of Teacher Education, 2010). In response to these questions, many teacher preparation programs are making program reforms to better prepare teacher candidates for novice teaching. At the university where this study took place, a critical part of the teacher education program redesign involved the implementation of problem-based learning activities in courses required for licensure. In this study, we explored how problem-based learning activities incorporated in a literacy methods course influenced the preparation of pre-service teachers.

Problem-Based Learning in Education

Problem-based learning (PBL) is grounded in the constructivist view of learning. According to Dewey (1897) "the school must represent present life - life as real and vital to the child as that which he carries on in the home, in the neighborhood, or on the play-ground" (p. 77). This same notion applied to teacher education provides the framework for using problem-based learning as a meaningful way to engage pre-service teachers in learning activities that mirror the problem solving approaches used by K-12 teachers on a daily basis. Medical instructors have used this approach for decades starting with McMaster University's Faculty of Medicine in 1969. When medical instructors began to realize that traditional lecturing and other forms of direct instruction were not adequately preparing medical students, they moved to a problem-based learning and clinical residency model (Albanese & Mitchell, 1993). Teacher education is moving in a similar direction. Until now, research studies on the effectiveness of PBL have primarily been limited to the field of medicine and gifted education (Hmelo-Silver, 2004).

Problem-based learning allows pre-service teachers to explore real-world teaching scenarios, to practice the problem solving process, and to collaborate with peers to gain a deeper understanding of the intricacies of the teaching profession. In teacher education courses, problem-based learning typically begins with a problem scenario and requires students to work collaboratively to investigate the problem, apply prior and newly acquired knowledge and skills, generate and test hypotheses, and draw conclusions to make recommendations related to the problem (Hmelo-Silver, 2004; Savery, 2006). As pre-service teachers collaborate through linguistic interaction (i.e., during PBL collaborative sessions), they create meaning together. Their individual perspectives and backgrounds as well as their collaboration with one another influence the relevant issues that emerge, the meaning that is created, the problems that are solved, and the methods used to attain solutions (Hmelo-Silver, 2000).

Research Design

The purpose of this study was to explore how problem-based learning (PBL) incorporated into a literacy methods course influenced the preparation of pre-service teachers. This qualitative research study drew from the tenets of Grounded Theory (Glaser & Strauss, 1967). As opposed to providing predetermined scripted categories for coding and analyzing the data, the Grounded

Theory design allowed for the themes and patterns to emerge as data were collected and analyzed (Glaser, 1992). Because the Grounded Theory design was incorporated, the overarching research question that guided this study was open-ended: How does the incorporation of problem-based learning in a methods class influence the preparation of pre-service teachers?

Context and Participants

  Twenty-six white female pre-service teachers participated in this study. These participants were enrolled in an elementary education teacher licensure program in an off-campus program located at a community college serving surrounding suburban and rural populations. This off-campus elementary licensure program is an extension of the teacher licensure program offered on the main campus of a mid-size university serving predominantly African American students in a large urban city in the southern United States. These pre-service teachers participated in this study as part of their coursework during the final year of their teacher education program. During the semester of this study, participants were enrolled in a literacy methods course and were placed in K-6 classrooms for clinical practice.

The Content

  This literacy methods course was the second literacy methods course in the participants' program of study. The main foci of this second course included (1) content area literacy, (2) literacy assessments, (3) linguistic and cultural diversity, and (4) differentiated instruction. Thus, the *content* of the PBL case was created to align with those main foci and built on tenets of culturally relevant pedagogy (e.g., Irvine, 2010; ; Judson & Adams, 2006; Ladson-Billings, 1995). The PBL case, *Understanding Isabel*, was developed by the researchers not only to challenge students to solve problems related to literacy teaching and learning but also to deconstruct preconceived notions and potential biases about the cultural and linguistic experiences of English Learners and to provoke pre-service teachers to solve problems using methods and strategies founded in culturally relevant practices. Pre-service teachers participated in a three-session problem-based learning case in which they were presented with information about a Hispanic English learner, Isabel, who was struggling with reading in Science and Social Studies. Figure 1 provides an example of the information pre-service teachers were given during each session.

Figure 1: Excerpt from PBL Case Session Prompts

<u>**Understanding Isabel**</u>
Opening Scenario: After the winter holiday break, Mrs. Jackson, a fifth grade reading/language arts teacher, began her second review of the progress of her fifth grade students. She had many students who were reading below grade level at the beginning of the year. Mrs. Jackson reviewed the learning expectations for fifth graders along with the local district assessments to determine student mastery. Mrs. Jackson was pleasantly surprised to see that all of her students were making progress in reading. However, she was still concerned about one of her students, Isabel. Although Isabel had made some progress in reading, she was still reading below grade level. **Session I:**

After communicating with Isabel's other teachers, Mrs. Jackson discovered that Isabel struggles significantly in science and social studies. As an English Language Learner, Isabel has some English language difficulties. Mrs. Jackson has communicated periodically with Isabel's mother about her progress. From Mrs. Jackson's communication with Isabel's parents, she has gathered that Isabel's mother speaks English and her father mainly speaks their native language with limited English proficiency.

        Contextual Factors: We-Can-Do-It Elementary School is located in a rural town approximately thirty minutes from a larger urban area in the state of Tennessee. We-Can-Do-It Elementary School serves 865 students in grades K-6. The majority of students (93.2%) are white. Thirty-three African American students and sixteen Hispanic students attend We-Can-Do-It. Over fifty percent of the students at We-Can-Do-It are considered economically disadvantaged. Mrs. Jackson has twenty students in her fifth grade classroom: thirteen boys and seven girls. Mrs. Jackson has one Hispanic female and nineteen white students in her fifth grade class. Isabel is from Panama.

Session II:
Even in January, Isabel is hesitant about entering the classroom each morning. Isabel rarely volunteers to participate in classroom activities. During free time and lunch, she appears to interact easily with her peers. Mr. Vaughn, her science teacher, says that Isabel keeps her head down, rarely looks him in the eye, and never raises her hand. He also stated that when they are reading the textbook aloud "round-robin" reading style, the other students moan and groan when it is Isabel's turn to read. In order to determine readability using Frye's Readability Graph, Mrs. Jackson asked if she could see the textbook he was using (the PBL facilitator provides Isabel's Running Records as well as copy of a grade appropriate science textbook).

        Contextual Factors: Isabel and her family moved from Panama approximately four years ago. She has a younger brother who is 5 years old. She and her family only speak Spanish at home. Her mother goes to graduate school at night and is studying to be an accountant. Isabel's father owns a 24/7 Gas Station. Isabel's grandmother takes care of Isabel and her brother after school.

Session III:
In social studies, she is typically very quiet and but occasionally volunteers to participate. Mrs. Lane reported that Isabel's participation and performance tend to fluctuate depending on the activity. When working with classmates on group projects, Isabel generally performs better; struggles with individual and whole class activities. Mrs. Jackson also asked Mrs. Lane for a copy of her U.S. History textbook. She prepares a Cloze procedure to determine the readability of the text. (The PBL facilitator provides a copy of an appropriate social studies textbook.)

The Process

Data Collection
        In each session, the pre-service teachers were presented with new information and contextual factors that may have contributed to Isabel's academic and social challenges. Throughout the process, the course instructor (also participant-researcher) acted as facilitator and guide, allowing the pre-service teachers ownership of the case as they directed their own group meetings. Each week, in static groups of five or six, they discussed factors that influenced

Isabel's academic performance given the information provided by the facilitator and the information that they had gathered and researched since the previous session. At the end of each session, they identified tasks (i.e., research) that each member would complete before the next session. One member of each group submitted notes from their group sessions (i.e., group session notes). In addition, each member submitted an individual weekly reflection about the session including thoughts about the problem-based learning case as well as the collaborative process.

Data Analysis

To analyze the problem-based learning texts produced by the pre-service teachers (i.e., notes, reflections, reports, etc.), we incorporated Grounded Theory design using the constant comparative method (Glaser & Strauss, 1967) and built on methods of qualitative coding (Strauss & Corbin, 1998). Through our initial review of the texts, our *emerging theory* was that the problem-based learning process increased collective efficacy through collaboration, produced a sense of self-efficacy, and enhanced abilities to solve problems using critical thinking skills. Thus, we created four categories along with operational definitions for coding the textual data: (a) self-efficacy, (b) collective efficacy, (c) problem solving, and (d) critical thinking.

Self-efficacy refers to an individual's personal evaluation of his or her own ability to perform a particular task or skill (Bandura, 1997). Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). Self-efficacy determines the "strength of people's convictions in their own effectiveness" and therefore establishes "whether they will even try to cope with given situations" (Bandura, 1977, p. 193). *Collective efficacy* refers to the equivalent shared efficacy level of each individual within the group (Bandura, 1997). An individual is motivated to action if he or she has a personal belief that his or her actions will produce a desired effect (Bandura, 1989; 2002). These beliefs control whether the individual's actions are self-enhancing or self-debilitating. When teachers are given the opportunity to work collectively, the sense of isolation is eliminated. The group's efficacy levels influence their actions in terms of the amount of effort they are willing to produce, the level of adversity they are willing to withstand, and the longevity of their careers (Bandura, 1989; 2002). *Problem solving* is the process of determining an appropriate response to a given problem, situation, or scenario based on known and gathered information. Known information is used to determine what is unknown in order to identify the information needed to solve the problem as well as how and where to find the needed information. As the hypotheses are tested, inconsistent findings are eliminated and new ideas are generated (Dewey, 1910). *Critical thinking*, although not synonymous with problem solving, is an essential part of the problem solving process. Critical thinking is necessary in order to challenge assumptions and test hypotheses. Halpern (1999) asserted that critical thinking is "the use of cognitive skills or strategies that increase the probability of a desirable outcome. Critical thinking is purposeful, reasoned, and goal-directed" (p.6).

Our descriptions of critical thinking, collective and self-efficacy, and problem solving above served as operational definitions for coding the data. After reviewing all of the texts for the emerging themes, we selected one set of one pre-service teacher's texts as an exemplary text from which to discern linguistic cues that would signal each theme or category. We developed a list of potential linguistic cues for each category. In order to "test" our emerging theory, each text

was coded using a simple numerical system assigned to the categories: (1) critical thinking, (2) self-efficacy, (3) collective efficacy, and (4) problem solving. Table 1 lists each coding category along with linguistic cues that signaled each category.

Table 1

Qualitative Text Coding

Code	Category	Sample Linguistic Cues
1	Critical Thinking	question, clarify, conclude, disagree, rethink, argue, analyze, test, reexamine, need to know, do not know, and *problem solving linguistic cues listed below when followed by a decision about the problem, relevant data, recommendations, etc.*
2	Self-Efficacy	I can, I see, I understand, I shared, I stated, I discussed, I found, I am confident, I am able, I am sure, I know, I feel sure
3	Collective Efficacy	we shared, we discussed, we collaborated, we reviewed, we worked together, we agreed, we decided
4	Problem Solving	find out, identify, determine, conclude, research, ask, assign tasks, review, examine, analyze, look for, decide

In addition to coding for the above categories, by use of the constant comparative method, we also noted evidence of patterns across texts with regard to the problem-based learning *process* and the *content* of the case. *Process* refers to the nature of problem-based learning with regard to collaboration, research, problem solving, and critical thinking. *Content* refers to the content of the case including knowledge and application of literacy pedagogy as well as culturally responsive pedagogy.

Findings

Findings revealed evidence of collective efficacy and problem solving among pre-service teachers. In terms of the PBL case *content* and *process*, we found that pre-service teachers deemed the process effective and demonstrated a deeper understanding of the content (i.e., literacy pedagogy) after having participated in the problem-based learning collaborative sessions.

After analyzing each of the texts in more depth using the coding system we developed, we found that our assumptions (i.e., emerging theory) were correct but not to the extent we had believed through our initial review of the texts. As stated previously, results showed strong evidence of collective efficacy and use of problem solving skills. Contrary to our initial assumption, we found less evidence of self-efficacy and critical thinking in the data. However, findings did reveal evidence of all four categories throughout the texts.

In all, we coded 94 texts including group session notes and individual weekly reflections. Comprehensive results, as seen in Table 2, revealed the following: (1) 138 occurrences of critical thinking, (2) 115 occurrences of self-efficacy, (3) 293 occurrences of collective efficacy, and (4) 294 occurrences of problem-based learning.

Table 2
Comprehensive Coding Results

	Group Session Notes			
Text	Critical Thinking	Self-Efficacy	Collective-Efficacy	Problem Solving
1	4	2	23	28
2	9	9	21	19
3	5	9	21	26
Total	18	20	70	68
	Individual Weekly Reflections			
1	27	28	60	57
2	48	31	78	86
3	43	36	86	92
Total	120	95	224	225
	Group Session Notes and Individual Weekly Reflections Combined			
Total	138	115	294	293

Also noteworthy, collective efficacy, problem solving, and self-efficacy increased from session one to session three while critical thinking increased from session one to session two, but slightly decreased from session two to session three. As the pre-service teachers became more familiar and comfortable with the problem-based learning process from session to session, their confidence in their group's ability and their own abilities to solve the problem increased. Furthermore, their final reports revealed evidence of critical thinking as they accurately identified the factors contributing to Isabel's academic challenges and selected appropriate intervention strategies. In order to have been successful at this task, they had to have employed critical thinking to discern factors and make choices with regard to selecting one literacy strategy over another.

Findings suggest that problem-based learning enhances collective efficacy and problem solving skills. In addition, there was a direct connection between self-efficacy and collective efficacy. Pre-service teachers depended upon one another for information as they worked collectively to determine what course of action was necessary. They also realized the importance of their own roles in the group as well as other individual group members' roles. In other words, they knew that they needed each other in order to be successful. However, in terms of the tasks

that each individual group member was responsible for each week, their reflections demonstrated a sense of confidence and ability in what they could also do individually to contribute to the group's goal—a sense of self-efficacy. For example, one pre-service teacher wrote in her final personal reflection:

> I learned a lot from doing this [problem-based] case study on Isabel. I knew that as a teacher, we would have to deal with diversity in the classroom, but I guess I didn't realize how much work/paperwork it would involve. I learned a variety of strategies, lessons, modifications, assessments, etc. that I can use to help ELL students. It is very important that teachers build on the student's background knowledge and what they already know (strengths, rather than weakness).

Many pre-service teachers began the process believing something was "wrong" with Isabel. They assumed her problems were a result of her limited proficiency in English and cultural differences. However, after researching Panamanian culture as well as information about English Learners, their assumptions were deconstructed. They began to consider the notion that Isabel's challenges may have had more to do with the school environment (e.g., lack of support for English Learners) in addition to the ineffective instructional strategies her teachers were using (i.e., "round-robin" reading).

Process and Content

The data revealed patterns in the individual weekly reflections in which pre-service teachers discussed the effectiveness of problem-based learning, including how they were given information, the process of working in groups, and the effectiveness of problem-based learning, in general. With regard to the content of the case, we analyzed the final problem-based learning reports to determine if they met the objectives of the course and made accurate recommendations for Isabel and Isabel's teachers.

Process: Collaboration and Connections

Pre-service teachers expressed dissatisfaction with having only a limited amount of information in the beginning. They struggled with the "ill-structured" problem scenario indicative of the problem-based learning model outlined by Gallagher (1997). However, after they began to talk through the problem, they began to understand that this was part of the problem solving process. One pre-service teacher wrote:

> Today's class was a bit confusing. This is the first time I have ever been exposed to PBL, and I must admit, it seemed overwhelming. I was confused about what was due tonight, and concerned about how to get started. Once we started working cooperatively, many of my concerns vanished.

A pre-service teacher expressed appreciation for the collaborative process even when her group was not working efficiently. Jaden reported that she experienced some frustration when a member of her group did not complete her assigned tasks, but still acknowledged the importance of working collaboratively to help students:

> Despite the frustrations, working on this case is interesting. It important to know how to work with a team or even individually to help the student, and I think that going through all the steps of this case, and gathering the information needed, is really going to aid us as

future teachers. As diverse as our country is, many of us will have ELL students or students with other learning problems, and it will be our responsibility to find a way to help them be successful in the classroom.

Another pre-service teacher also acknowledged a sense of confusion, but she was quickly calmed by the opportunity to work collaboratively:

I felt like I was the only one who didn't understand, and then Jaden announced that she was very confused as well, and others agreed. Once it was explained that we were only to take the information given today and collaborate with our group members about what we thought was affecting the students in the case, I felt much better about the assignment.

Pre-service teachers made connections with actual classroom experiences. For example, in addition to the quote above alluding to the diversity in schools today and the importance of teamwork, one pre-service teacher noted:

I think doing problem-based learning is helpful in schools. I find it to be relevant to the real world, plus I think it gives us practice. In addition, I think it helps prepare us for a real situation that we could end up facing during our teaching career. Another thing I liked about the PBL was that we got to work in groups.

In her third reflection, pre-service teacher, Susan, noted in the importance of this "exercise" to gain experience with linguistic and cultural diversity they might encounter in the classroom:

The problem-based learning exercise should be an interesting educational experience. I believe it will be very challenging, and at times very frustrating. However, it will help us gain insight into how students learn differently as pertaining to their cultural and linguistic backgrounds.

Overall, these pre-service teachers indicated that they valued the experience and felt it to be an authentic learning activity that should be continued. In an anonymous, final personal reflection, one pre-service teacher wrote:

I really enjoyed the PBL project. In fact, I would like to see more of it. It gave us the chance, like if we were a real teacher…I can see how it would help us out in classrooms as we become teachers.

Elizabeth made a clear connection between problem-based learning and the teacher licensure exams required by the state in which this study took place. She wrote:

I think that this whole exercise would be great for juniors also. When I was reading about Isabel, I was having flashbacks about [the] Praxis [exam]. The whole set up reminds me of taking the PLT [Principles of Learning and Teaching], and I think that working on something like this as a junior would have definitely helped with PLT scores, and just with experience on working on these types of case studies.

These pre-service teachers also made an explicit connection between problem-based learning and their future teaching. For example, Lara wrote:

I believe the case study to be a true representation of what an actual scenario would be in the classroom…. I also believe the process we will use to devise a plan of action for this student will mirror the process we would use in a real life situation. I, for one, am

grateful for this experience under an experienced supervisor simply because this is a situation I will experience during my teaching career. I believe that I will gain knowledge and direction in how to develop a plan of action for a struggling student.

In the final personal reflections, several pre-service teachers advocated for the continuation of problem-based learning in licensure courses for future pre-service teachers; noting explicitly that, "PBL should continue," and that PBL is "useful for beginning and current teachers."

Content: Culturally Relevant Literacy Pedagogy
      The final problem-based learning reports submitted by the pre-service teachers included relevant curriculum standards, a summary of the problem including all factors that they had deemed responsible for Isabel's challenges, recommendations for Isabel's teachers, and specific literacy intervention strategies to help Isabel navigate and understand content area textbooks. Findings revealed that, after having participated in PBL collaborative sessions, pre-service teachers correctly described the problems and challenges related to Isabel's struggles in content area reading and made appropriate recommendations. They also identified appropriate strategies that would help Isabel as well as her teachers. In an excerpt from one pre-service teacher's report, Cathy summarizes some of the factors that may have contributed to Isabel's problems in social studies and science:

> Isabel is the first Hispanic student that both Mr. Vaughn and Mrs. Layne have taught. It is obvious that Mr. Vaughn and Mrs. Layne have not had any instruction on how to modify lessons for ELL students. Also, neither of the teachers have had experience with reading comprehension instruction. In Mrs. Jackson's class, where Isabel has made progress in reading, Mrs. Jackson has had experience with ELL students, and experience with reading comprehension instruction. Mrs. Jackson knows how to help Isabel, whereas the other two teachers do not. Mr. Vaughn uses Round Robin Reading to read the text in his classroom. Isabel is very intimidated by Round Robin Reading because of the negative actions other students have when it is her turn.

Another pre-service teacher clearly selected appropriate literacy strategies that would be helpful for teachers to implement in Isabel's classes.

> It is further recommended that Isabel be taught to make the following graphic organizers to use in Science: *Problem and Answer Organizers*, *Cause and Effect Organizers*, and *Semantic Webs*. Further recommendations for graphic organizers to use in Social Studies include the following: *Time Lines, Venn Diagrams*, and Hierarchical Organizers. To support Isabel's social growth, it is recommended that her teachers design some lessons that can be completed in cooperative learning groups such as the *Jigsaw Cooperative Learning Group* or *the Socratic Seminar.*

The problem-based learning process proved to be beneficial to pre-service teacher learning with regard to literacy pedagogy as they cited and described appropriate and effective literacy strategies. Furthermore, through the implementation of the PBL, the course instructor was able to meet course objectives in a way that actively engaged pre-service teachers in the course content and required them to take ownership of their own learning.

Conclusions and Implications

On the whole, the implementation of problem-based learning as an instructional strategy in a literacy methods course resulted in the development of both collaborative problem-solving skills (i.e., process) and culturally relevant literacy pedagogy (i.e., content) among pre-service teachers. Systematic and purposeful collaborative work with regard to problem solving promotes increased collective efficacy and enhanced problem solving skills among pre-service teachers. In addition, pre-service teachers showed increased self-efficacy as well as evidence of growth in critical thinking skills. Bandura's (1989) research implies that stronger levels of self-efficacy increase the effort and persistence levels of individuals. Without the development of effective coping methods to help ensure success in the classroom, many new teachers leave the profession. Peer collaboration and support not only helped pre-service teachers to solve problems, but also aided in the identification of the problem. Without the support of peers, pre-service teachers could not accurately identify the problem or the factors that contributed to the problem. For Isabel's challenges, they collectively offered factors based on their research as well as on their experiences in K-6 classrooms that may have affected her performance. They began to consider, in a more tangible and concrete way, the broader contextual factors including classroom resources, classroom dynamics, and issues of diversity that may cause students to struggle academically and socially.

It is clear that problem-based learning is beneficial to the preparation of quality teachers. Pre-service teachers took ownership of their own learning, and in turn, they became more confident in their problem solving abilities. This self-confidence led to self-efficacy as pre-service teachers began to display behaviors and problem solving abilities of more experienced literacy teachers.

The findings for this study have implications for teacher preparation programs across the grade levels and the curriculum as an authentic learning experience to better prepare pre-service teachers for novice teaching. In addition, a problem-based learning case that is designed in such a manner, that where pre-service teachers are collaborating to analyze student assessment data has implications for the preparation of pre-service teachers for professional collaboration or Professional Learning Communities (DuFour & Eaker, 1998) in which they will likely participate as in-service teachers.

Problem-based learning fosters an environment of professional collaboration that has become increasingly influential in 21st century schools. The National Commission on Teaching and America's Future (NCTAF) has encouraged school leaders to culturally transform their schools by implementing a series of changes to current school practices including establishing their schools as learning environments that support collectivity and teamwork among the teachers (NCTAF, 2007). Collaborative environments have proven to increase teachers' feelings of efficacy (Talbert & McLaughlin, 2002). Working in isolation often results in teachers' commitment and energy levels waning over time causing them to consider careers outside of the classroom. However, collective work brings new levels of commitment to address the problems at hand and proves to be rewarding for teachers. Teacher educators across the content areas should find ways to incorporate meaningful problem-based learning activities in their teacher preparation courses to enhance the collective efficacy, problem solving skills, critical thinking skills, and self-efficacy of pre-service teachers.

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