

Prospective Teachers Serving as Physics Learning Assistants' Perspectives on Reflective Practice

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Abstract: A physics Learning Assistant (LA) program was established at Florida International University (FIU) for recruiting and preparing pre-service physics teachers. One goal of this program is to help prospective teachers to develop reflective practice. The purpose of this study is to understand these prospective teachers' perspectives on reflective practice.

At a large, public, Southeastern university a physics Learning Assistant (LA) program based on the Colorado LA model (Otero, 2010) has been implemented. As a part of this program, science and math majors successful in completing their introductory physics courses and interested in teaching are recruited to serve as assistants in the introductory physics laboratory courses. LAs assist in the laboratory courses by facilitating group discussion and answering student questions. The purpose of this program is to give students with an interest in teaching and strong content knowledge an opportunity to gain teaching experience early in their academic career. We believe this program is important to prospective and pre-service teachers at this institution because it helps them begin to develop expertise in teaching by providing them with opportunities to develop reflective practice, a tool which they can use to develop expertise in teaching long after they have left the LA program and begun teaching. Opportunities for developing reflective practice are built into several components of the LA program (Cochran, Brew, Kramer, & Brookes, 2012). In the LA Seminar, a pedagogy course that all LAs take their first semester in the program, LAs submit weekly reflective writing assignments on their teaching experiences and on course readings. In weekly meetings with a faculty member, LAs reflect on their experience in the previous week's lab and prepare for the upcoming week's laboratory activity. However, the key component to their development of reflective practice is the teaching experience itself—being in the classroom. In this study, we investigate physics LAs' perspectives on developing reflective practice in the LA program by means of semi-structured interviews.

Theoretical Framework

According to the literature on expertise (Ericsson, 2009), it takes approximately ten years for an individual to develop expertise in any field. Generally, education programs last only four or five years. Thus, it is necessary to provide pre-service teachers with a kind of deliberate practice that can be used by the teachers long after they have left the program. Deliberate practice has been found to be key to obtaining expertise in a variety of fields including chess (Charness, Tuffiash, Krampe, Reingold, & Vasuykova, 2005), medicine (Boshuizen, 2005), music (Sloboda, 2000), and sports (Hodges, Ker, Starkes, Weird, & Nananidou, 2004). Deliberate practice is also necessary for developing expertise in teaching. We believe that reflective practice can serve as deliberate practice for pre-service teachers. Reflective practice in teaching is the thinking back on one's teaching experience for the purpose of making future decisions about one's teaching and improving one's teaching skills. In teaching, reflective practice requires that reflection on their taught lesson provides teachers with feedback on their

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lesson and decisions and determinations for future lessons. Thus, reflective practice is the deliberate practice necessary for helping teachers to hone their teaching skills as they develop expertise in teaching.

John Dewey is considered by most to be the father of reflection. The idea Dewey is the key originator of the concept of reflection is not disputed in the literature on reflection (Carson & Fisher, 2006; Gore, 1987; Hatton & Smith, 1995; Valli, 1992). He initiated the conversation on reflection in his work, *How We Think and Act* (1933). In this work, Dewey characterized different modes of thinking. He asserts that reflection or reflective thinking is a special kind of problem solving that involves framing and reframing problems. Donald Schön has been a major influence on reflection in teacher education. He has been instrumental in laying a foundation for our understanding of reflection. Whereas Dewey laid the foundation for reflective thinking, Schön laid the foundation for reflective practice (Spalding & Wilson, 2002). Schön (1983) highlighted the need for professionals to be reflective practitioners and he specifically applied this need to teachers. In this study, we utilized Dewey's theory on reflection and Schön's theory on the reflective practitioner to understand the reflective practice of prospective teachers in a physics LA program.

Purpose and Research Questions

The purpose of this study is to better understand how physics LAs are engaging in reflective practice while participating in the LA program. More specifically, the authors wanted to determine: (a) Under what circumstances do prospective teachers serving as physics LAs engage in reflective thinking? (b) From the perspective of prospective teachers serving as physics LAs, what is the relationship between reflective thinking and reflective action? and (c) How do prospective teachers serving as physics LAs define reflective thinking and reflective teaching? To answer these questions, we conducted a qualitative study. The method for the study is included in the next section.

Method

In this study hour-long, semi-structured interviews with physics LAs were conducted. According to Rubin and Rubin (2005) interviews are necessary when you anticipate the answers to your questions will not be brief and may require follow-up questions. The interviews conducted in this study can be considered semi-structured because pre-determined questions that had a specific focus were utilized. Because no other data was collected in this study, excerpts from the interviews were used to provide enough detail to paint a picture in the mind of readers to increase the likelihood of having "rich, thick descriptions" (Merriam, 2002, p.29). According to Rubin and Rubin (2005) "main questions get a conversation going on a subject and ensure that the overall subject is covered" (p. 13). Seven main questions were used in the interview protocol (See Appendix). These seven main questions were followed by follow-up questions for clarification depending on participant responses. Rubin and Rubin wrote that "asking everyone the same questions makes little sense in qualitative interviewing" (p. 14). Thus, there are some follow-up questions that all interviewees were not asked. Transcriptions of the interviews were coded for themes and analyzed in terms of the research questions. The findings from this analysis are discussed in the results section. The next section describes the participants.

Participants

All four participants in the study were physics LAs. Each of the physics LAs served as an LA for differing lengths of time: two, three, four, and five academic semesters. The LAs also had differing teaching experiences. One of the LAs served as an assistant in a reformed physics lecture class, another served as an assistant in a reformed introductory physics laboratory course,

and the final two served as both. The participants will not be matched to the specific teaching role in this study for the sake of confidentiality. The following code names are used in this report: Joselito, Sarita, Isabella, and Precious.

Results and Discussion

Analysis of the coded transcripts revealed three major themes: examples of reflective teaching, LAs' engaging in self-tests, and LAs' believe in more than one way to do things. In this section, themes will be discussed and excerpts from the interviews will be included to illustrate the ideas behind the themes. This will be followed by a discussion section that, specifically addresses the research questions. Relevant literature will be integrated when possible and connections will be made to existing theories on reflection.

Examples of Reflective Teaching

In this study, all LAs interviewed provided examples of their engaging in reflective teaching practice. Each of the interviewees talked about noticing something happening in the classroom and making changes to their teaching as a result of it. They decided to make these changes in hopes of improving as LAs. One such example is given by Sarita. Sarita discussed that as a beginning LA, she had little patience with her students. She noted, however, that this resulted in their being frustrated. To calm their frustrations, she decided to practice being more patient:

I've become more patient. Like, I used to be really impatient with the students because they might not understand something. I've learned to develop a little bit of patience with them because ... it's frustrating to not understand something to ask questions and not get answers. ... The ... students ... would sometimes even get frustrated with me for not being able to answer their questions a different way than what I was answering it. So, I realized that change needs to happen in order for them to grow in their learning. I realize that I cannot get impatient with them because then they won't learn. I won't learn anything out of the experience ... I kind of just calm myself down internally [now].

Internally I just talk to myself like, "[Sarita] ... calm down." (Sarita)

Sarita's reflection on student emotions and feelings helped her to change how she dealt with them when they were stuck on a problem or concept. Isabella gave evidence of reflective teaching practice that came out of her reflections of the entire semester. Reflection on her students' competency at the beginning over the semester caused her to change her expectations for her students and the way that she helped them. Isabella says,

Why I change ... because I see that stuff doesn't work ... You can only hold their hand for so long ... I hold them accountable ... You need to meet me halfway ... At first as an LA, I didn't put this accountability on them and I held their hand more ... then I started to realize that ... it's not always the best thing to do ... that's not something that someone would have told me to do and I would have done it. (Isabella)

When asked to explain this process and what sparked it, Isabella says,

... Seeing patterns in students and identifying them ... Over the course of a semester I saw that students continually struggled with a concept ... at the end of the semester they were still asking about this ... concept ... I was like what's going on? What went on? What happened? (Isabella)

Confusion with why students struggle with the same thing over time led Isabella to reflect on what happened during the semester. This resulted in specific changes in what she required of students before working with them and her beliefs on what their responsibilities are in the learning process. According to Dewey, reflective action stems from reflective thinking (1933).

All four LAs indicated that their reflection arose from their reflective thinking. This is in harmony with Dewey's two-step process of reflection. He says that it begins with "(1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates and (2) an act of searching, hunting, inquiring to find material that will resolve the doubt, settle and dispose of the perplexity" (Dewey, 1933, p. 12). In the second stage of reflection, Dewey mentions steps to resolve the difficulty. Coding revealed that LAs generally start this process with a self-test. This is especially true when the issues involve their teaching methodology, strategies, or explanations.

Self-test

As a part of their reflective practice, LAs discussed trying things out on themselves first. Sarita says, "If it's easy for me to remember that explanation or associate things to that explanation then I realize that it's a good way of explaining things" (Sarita). In this instance, Sarita is talking about her use of particular explanations. However, she also mentions that she also does this kind of self-test when it comes to the teaching style she uses. In regard to lecturing, she says,

... I realize that it's not what I want to hear. So, ... they're probably on the same page with me since we're all around the same age and similarly I kind of noticed that they doze off or get glazed and they stop listening if I lecture. (Sarita)

Isabella describes her self-test as first stage as well:

I try to refer back to what works for me. I know that's kind of egocentric and self-centered, but I think it's fair to go back to what worked for you and see. Like a good reference point ... okay, like when I learned this concept this analogy worked for me so let me try ... Okay, that didn't work. Okay, well, in the LA seminar they told me ... okay this could work ... I try to look at different angles ... and see what works (Isabella).

Joselito describes a similar kind of process to that of Sarita and Isabella, but describes a more systematic procedure:

... if this way of explaining makes more sense to me I don't see why I wouldn't give it a try in explaining it to someone else. Maybe it would make more sense to them. Because I have an idea, this is the analogy I'm using, but if I can find another analogy that I can see works better then I will go ahead and start using that analogy. If the way I'm using the analogy doesn't work then I'll just revert back to the original analogy and if something else comes along I might switch it in to see how it works and it's basically a trial and error type deal, but the only ones that get used are the ones that seem to make more sense. (Joselito)

Each of the LAs discuss this self-test as the first step in their reflection. They also discuss the trial and error stage. They said that this trial and error results from their realization that there is more than one right way to do things. This will be discussed in the next section.

More Than One Way To ...

Although all of the LAs mentioned that their use of trial and error comes from the realization that there is more than one way to do things, they arrived at this conclusion from different means. For Precious, this came from her learning that there is more than one way to solve a physics problem:

When I took [a reformed physics course,] they showed us that ... you don't have to just take it. There is always something you can do. There is always some other way to figure something out. There's not just one right way and that everybody learns different. Some people learn quicker. Some people learn by demonstration and some people don't. And—umm—once you see that that's possible, for me that was when I was like "Okay. I

get where you're going ..." And you keep doing it and if it doesn't you try something else ... there's not one right way. (Precious)

Throughout the interview, Precious mentions that she learned that there is more than one way to solve a physics problem in her reformed physics class. This encouraged her to try to figure out a way that was suitable to her. She says that she feels that it is the same with teaching. Since different students learn differently, she needs to try out different things and realize that there is more than one right way to teach. This is a robust concept for novice teachers. Research indicates that most pre-service teachers want to be told the correct way to teach (Korthagen, 1988). Joselito also discussed this idea of knowing that there is more than one way to teach.

However, Joselito's understanding came from a paper that he read as a part of the LA Seminar: [T]here was one particular text from the course [Schoenfield, 1987] that spoke about a mathematician that was doing a problem and he would go back and do it another way if the original way wasn't working and he would keep doing it until he found ... a method that worked and then the students who had the same problem just kept barreling through the same issue. And I'm always reminded of that because whenever I do problems now that are complex and you know they have several different ways of doing it you know I always try to find the easiest one. If one isn't working for me I just step back and try it another way and I feel the same approach can be taken for teaching. If you're trying one way you can't barrel your way through it because then the students are going to be confused and on top of that you're going to be frustrated because they're not getting the concept you're trying to get. (Joselito)

Joselito explains how the article he read helped him realize the importance of self-regulation during problem solving, by stopping to engage in metacognition and then pursuing alternative strategies if necessary rather than just "barreling through." Joselito sees this same principle being apropos to teaching. This discussion of knowing and finding more than one way to accomplish something was the final theme seen in all of the interviews.

All of the three themes were related to the research questions because they described the LAs reflective thinking and included things that prompted their engaging in the reflective process. In the excerpts they also described how they engage in the reflective process. The next section furthers this discussion by more specifically addressing the research questions.

Discussion

The first research question was: Under what circumstances do prospective teachers servings as physics learning assistants engage in reflective thinking? As shown in the examples of reflective teaching practice, the participants revealed that they engaged in reflective thinking as a result of their being cognizant of their students' emotions and progress. Participants also revealed that they engage in reflection in various locations. Sarita mentioned that she engaged in reflective thinking "usually just right after [class]. Like right after it's [the class is] over that I just have time to kind of walk away and think to myself" (Sarita). Although Sarita reflected in the classroom after the students had left, Precious engaged in reflection while class is still going on and afterwards. She said usually right after I talk to them and I walk away and when class ends" (Precious). Schön (1983) labels this as reflection-in-action. He suggests that not only can we think" about doing but that we can think about doing something while doing it" (p. 54). Joselito and Isabella engage in reflective thinking in a variety of contexts. For example, Isabella says, "It happens as I'm walking away out of the classroom ... it can happen randomly like in the shower or something ... during class ... and I ... talk to my fellow LAs or people who are tutors ... (Isabella)

The second research question was: From the perspective of prospective teachers serving as physics learning assistants, what is the relationship between reflective thinking and reflective teaching? The third question was related to the second: How do prospective teachers serving as physics learning assistants define reflective thinking and reflective practice? In both their descriptions of their reflective practices and their responses to a prompt asking for their definitions of reflective thinking and teaching, LAs asserted that reflective teaching is applying what you learn from reflective thinking. Sarita says that reflective teaching is “similar to reflective thinking except actually applying that change that you thought about ... to the classroom.” Joselito says, “Every time you teach something happens ... if you are a reflective teacher ... you think about what has happened in your reflective thinking, but the next time you go to teach you implement those new ideas.” LA responses were similar in this regard. Precious describes reflective thinking:

Looking back on—when you reflect on something you look back on it. You think about what happened, why did it happen, could it have been different, could it have been better? You know, was it—was it right or wrong, good or bad? ... It’s like putting actual thought into it; not just okay this is what happened, but why?

Other participants described reflective thinking similarly. They also mentioned where their definitions came from. Joselito was not asked this question. Isabella and Precious mentioned that their responses came from the LA seminar. Sarita says that her definitions came from her experiences.

Conclusions

All four participants engaged in reflective teaching practices and provided examples of this. According to Korthagen (1988), reflective teaching practice involves facing a challenge, problem, discovery or some other phenomenon while teaching and then making changes in one’s teaching to address or investigate the phenomenon. Each participant mentioned making changes in their teaching as a result of what was going on in the classroom and with the hope of becoming a better LA. Schön (1983) mentions that a practitioner engages in reflection when stimulated “by surprise, they turn thought back on action and on the knowing which is implicit in action” and then begin to ask themselves questions (p. 50). All four LAs interviewed described changes in their teaching that resulted from their reflective thinking. Thus, participants’ perspectives on their reflective practice are in harmony with theory on reflective action. The second theme that emerged is that as part of their reflective process, LAs tested their ideas on themselves. This self-testing applied to a variety of pedagogical tools including: explanations, analogies, and even teaching strategies (i.e. lecturing). Finally, all four participants also discussed that their belief in the need to be reflective arose from their understanding that there is more than one right way to do things. They translated this idea to the fact that there is more than one way to teach and that students learn differently. In discussing an artful teacher as a reflective practitioner, Schön says, “because the child’s difficulties may be unique, the teacher cannot assume that his repertoire of explanations will suffice, even though they are ‘at the tongue’s end.’ He must be ready to invent new methods and must ‘endeavor to develop in himself the ability of discovering them’” (p. 66). Thus, the physics LAs’ idea that one cannot necessarily have one routine way of solving problems in their practice is in harmony with Schön’s theory on the reflective practitioner.

Implications

This study shows that physics LAs in this institution are engaging in reflective practice. Although causation cannot be assumed in this study, this study does provide

information useful to the administrators of this program. The physics LAs interviewed revealed that their reflection was sparked by or arose from their observations of what was happening in the classroom. This indicates that the actual teaching experience is indeed the key component of their developing reflective practice while participating in the program. These results may indicate that more teaching experience may be beneficial to these prospective teachers as they engage in reflective practice and begin to develop expertise in teaching. The results of this study also revealed that LAs are engaging in reflection in a variety of ways and settings. Thus, it may be necessary to develop a diverse set of tools for assessing the reflective practice of LAs in this program.

Future Work

Although these interviews were revelatory, more work is necessary. This study revealed that physics LAs are engaging in reflection and three themes were determined from the analysis of the interviews. However, to get a full understanding of the physics LAs' perspectives, more interviews must be conducted. In the future, interviews will be conducted with physics LAs until saturation is reached. Saturation will be considered to be reached when no new codes emerge from analysis of the interview transcripts. Moreover, to better understand how physics LAs take advantage of opportunities for reflection in the LA program for the purpose of developing expertise in teaching, explicit questions regarding expertise in teaching will be added to the present interview protocol.

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Appendix

Interview Protocol

- a. Thinking about the class you're teaching now, [or the most recent class you taught], has there ever been a time when you thought back on the class and wished you had said something you did not or maybe said something differently?
- b. Is there a time when you wished that you had done something differently?
- c. Have you made any changes in the way that you teach since you became an LA?
- d. Have you ever faced a problem while teaching?
- e. Do you ever discuss your teaching with anyone else?
- f. What would you say reflective thinking is?
- g. What is reflective teaching?