Fall November 2014

A Journal Club: A Scholarly Community for Preservice and Inservice Science Teachers

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A Journal Club: A Scholarly Community for Preservice and Inservice Science Teachers

A Dissertation Presented

By

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Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF EDUCATION

September 2014

College of Education

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DEDICATION

To Bruce Tallman

ACKNOWLEDGMENTS

I would like to begin by thanking all of the amazing preservice and inservice science teachers I have worked with in the journal club. The teachers who participated in this study generously shared their professional experiences and hopes with me. They gave of their time and made a commitment to this group. Without their commitment to the journal club, my study would not have been possible. I am deeply grateful for the trust and respect they provided me throughout this study. It is their hopes and concerns towards improving teaching that I hope I convey with this work.

I would also like to thank my committee, Dr. Martina Nieswandt and Dr. Morton Sternheim, for their astute comments and support throughout the design and set-up of this study. Your probing questions and criticisms have allowed me to reflect back on my writing and work. Thank you for giving me your time and support throughout this dissertation.

I would particularly like to thank Dr. Allan Feldman, my dissertation chair. I would not have conducted this study without your support and commitment to my work. You stayed with me when you did not have to, and I am deeply grateful. Your poignant comments and insightful criticism has pushed me to think deeper and harder about my data. You have showed me how to think like a researcher, and I hope this study reflects how much I have learned from you.

I would like to thank Dr. Kathleen Gagne. You believed in my work from the start and provided me an opportunity to explore how a journal club can function in teacher education. Without that initial start in your program, this study may never have been able to take place. Thank you to Dr. Sara Schupack, you supported me through the entire

doctoral process. You listened to my half-baked ideas and encouraged me to explore these concepts. You helped me through the writing of this paper with your perceptive feedback.

Thank you to my parents, who always encouraged me in education. My father as a secondary high school history teacher demonstrated what a professional teacher looked like every day. To my children, Katherine and Eric, you listened to me go on about communities of practice and challenged me to explain my understandings to you. Thank you for always providing support and encouragement. Finally, thank you to my husband, Bruce, you have always encouraged and supported me to pursue this degree. Thank you for helping me to actualize a lifelong dream. You have been a constant, steady, support throughout my career.

ABSTRACT

A JOURNAL CLUB: A SCHOLARLY COMMUNITY
FOR PRESERVICE AND INSERVICE SCIENCE TEACHERS

SEPTEMBER 2014

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This qualitative case study examines how a journal club can be used as a pedagogical tool in science teacher education. Six preservice and inservice science teachers, for seven months, participated in a journal club where they chose, read, and discussed science education research articles from problems or concerns they had in their teaching practice. The data included field notes, audio-recordings of meetings, pre- and post- interviews with all the teachers, two focus groups, artifacts collected (e.g. journal articles, reflective paper, e-mail exchanges, and researcher's field notes). The data were analyzed using the techniques of grounded theory (Corbin & Strauss, 2008). Unlike grounded theory, I also used preconceived categories created from existing literature on journal clubs and communities of practice (Newswander & Borrego, 2009; Tallman & Feldman, 2012; Wenger, 1998). The findings reveal the journal club functioned as a community of practice where the teachers learned how to search for and critique research articles and participated in discussions that examined the implications of educational theory to their practice. The teachers engaged in scholarly talk. Scholarly talk was defined as using three modes of collaborative discourse: critically analyzing a research article, sharing teacher anecdotes, and weighing different perspectives through exploratory talk. In the journal

club, these conversations helped the teachers learn about their teaching practice and reflect on how to bring changes to their practice. It is through the collaborative conversations in the journal club that all the teachers began to examine teaching through a new lens. The findings suggest the teachers embraced the educational theory read in the journal club. They welcomed being scholars in the journal club and forming a professional network among inexperienced and experienced science teachers. The journal club provided the teachers the tools to engage with intellectual concepts and become critical thinkers and consumers of theoretical knowledge.

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CHAPTER 1

INTRODUCTION

In January 2010, the editors of the *Journal of Research in Science Teaching* stated a new vision. Krajcik and Barton (2010) wanted the journal to connect science education research with practitioners. They highlighted several ways in which they could achieve this. One way they outlined was to provide summaries of articles that were written specifically with the practitioner in mind. Krajcik and Barton (2010) recognized the need for science teachers in the schools to read and benefit from the research being published.

In 1989, the National Board for Professional Teaching Standards, (NBPTS), issued its goals for an accomplished teacher through five core propositions. These five core propositions are still today the cornerstone for identifying and recognizing effective teachers (NBPTS, 2002). The fourth proposition of the standards states, "Teachers think systematically about their practice and learn from experience" (NBPTS, 2002, p 16). Under this fourth proposition, the NBPTS board states that one way teachers learn about teaching is through staying abreast of current research and knowing how to incorporate new findings into their practice. NBPTS also states that professional teachers collaborate with other teachers to examine their teaching.

The National Board for Professional Teaching Standards and the editors of the *Journal of Research in Science Teaching* are both recognizing the increased need for teachers to stay abreast of current research findings. In this study, I am proposing that a journal club become a pedagogical tool to help teachers collaboratively stay abreast of current literature, learn how to critically read studies, and then examine the findings' implications to their practice situations. The medical, nursing, and science fields use

journal clubs to engage pre-professionals and professionals in discussions about cutting edge research in their fields and practice.

Journal clubs were first noted in medical education over a hundred years ago (Linzer, 1987) as a powerful tool in keeping members of the field up on current findings and their applicability to practice. Since then, journal clubs can be found in many fields such as social work, nursing, engineering, and undergraduate science education (e.g., Blumenfield, 1985; Glazer, 2000; Newswander & Borrego, 2009; Seymour, Kinn, & Sutherland, 2003). However, it is very rarely used in teacher education (Barak & Dori, 2009; Brill, Fark, & Yarden, 2003), and not as a tool, but to support conversations about science education research studies among experienced and inexperienced science teachers.

Journal clubs are about bringing a group of people together who share an interest to engage in an intellectual discussion about a subject raised in an article from their shared field. Typically, the journal club has one member present the article, but two can share the task. The article should be about a topic the club or individual presenter feels is a problem encountered in practice. The presenter provides a brief summary of the article and then leads a discussion with a few starter questions. It is also the presenter's job to make sure the discussion stays on topic and that everyone contributes at the meeting. At the end of the allotted time, the presenter will often summarize the discussion. In journal clubs, conversations are centered on research articles and practice (Brill et al., 2003; Doney & Stanton, 2003; Glazer, 2000; Nicolette, 2011).

The research based literature is a part of the theory of the educational field (Fenstermacher, 1994). In science teacher education, formal theory includes knowledge

generated from research of teaching that has been peer-reviewed. The studies can be qualitative or quantitative, but they have followed acceptable methodology to produce peer-reviewed studies that are deemed valid and reliable (Shavelson & Towne, 2002). Practical theories are knowledge generated from a specific place, action or situation at a particular time (Fenstermacher, 1994). Practical theories are usually "interpreted only privately by the teacher and thus are based on that practitioner's individual history, understandings, interpretations, and personal style" (Sanders & McCutcheon, 1986, p. 64). Practical theories are theories that do not necessarily apply to many situations like formal theories, but instead are theories that are useful for a particular situation in practice. Teachers can be consciously aware of their practical theories, but there are many practical theories that are unconsciously held (Sanders & McCutcheon, 1986). Feldman (2000) sees potential for teachers to change their practical theories when they reflectively inquire into their practices while engaged in serious conversations with colleagues. These conversations help the teachers examine and make sense of how a new formal theory could be useful and beneficial to their practice. Journal clubs cultivate a community that engages professionals in conversations on how formal theory relates to their practical theories.

There are programs in teacher education that are designed to bridge theory and practice, but they have not necessarily examined research theory with the teachers' personal theories of practice (e.g., Byman et al., 2009; Clough, Berg, & Olson, 2009; Hiebert, Morris, Berk, & Jansen, 2007). These previously mentioned teacher education programs all encourage reflective practice so that teachers can critically examine their practice and their assumptions of practice. In this way, reflective practice allows teachers

to examine their personal theories on teaching as well as their actual practice of teaching. However, reflective practice does not necessarily connect these reflections on practice to reflections on formal theory.

Journal clubs offer practitioners the opportunity to reflect on practice from the viewpoint of formal theory (Price & Felix, 2008). The reflection comes from an examination of the information learned from the study with the knowledge the practitioner already knows through practice. Journal clubs engage professionals in conversation on an article and its application to practice. Through this reflection on theory to practice, journal clubs have been found to foster learning in problem-solving and creativity (Newswander & Borrego, 2009).

Very few journal club studies have explored how practitioners utilize current research practices in a community of practice (e.g., Newswander & Borrego, 2009; Price & Felix, 2008). A community of practice promotes conversations on practice and theory among experienced and inexperienced professionals that lead to new understandings about the practice (Lave & Wenger, 1991). It helps both the beginner and the experienced member become absorbed in the "culture of practice" (Lave & Wenger, 1991, p. 95). A question that arises in a community of practice is how beginners and experienced members contribute to the development of new ways of knowing. Examining Vygotsky's (1978) zone of proximal development helps explain how social interactions help students' problem-solving abilities move from being not yet matured to the "process of maturation" (p. 86). Vygotsky (1978) sees a student reaching this zone of proximal development when he/she is interacting with his/her environment and peers, with many of those peers being more capable. In this study, I examine how experienced and

inexperienced teachers help one another move from their current level of development to a more highly developed level through talk in a journal club.

Purpose of the Study

The purpose of this study is to explore how preservice and inservice science teachers, in a journal club, connect theory to practice through conversations initiated from reading educational theory and reflecting on teaching. An underlining question in this study is whether the journal club functions as a community of practice, and if so, how do the community and the conversations contribute to learning in the journal club?

The questions that guided my study were the following:

1) Is the journal club a working community of practice? If so, how is the journal club a working community of practice?
2) In what ways does community seem to affect the teachers' perception of their teaching practice in the journal club, as experienced by them and manifested in their conversations?
3) How do the research articles inform the journal club discussions around practice?
4) How does talk facilitate the teachers' learning about a variety of research topics, and their implications to practice?

I am looking to understand if, in the journal club, the teachers develop a community of practice, and then, in what ways does the community of practice change the teachers' awareness of their teaching practice. Finally, I will examine how as a community the conversations around the research articles and the teachers' practice aid in their learning of new insights to inform their teaching.

A Personal Perspective

The impetus to establish a journal club with teachers is based on my academic and personal experiences as a science student and someone associated with the medical profession. My first experience with a journal club came as an undergraduate student, when I worked as a research assistant over the summer synthesizing organometallic

structures in a laboratory at a large university. In this laboratory, I worked alongside Master's and Doctoral chemistry students. At first, it was a very intimidating position. Everyone seemed to know what they were doing, and I felt I knew very little about chemistry. Once a week, the professor had a journal club meeting where the graduate students, the professor, and I would meet, over coffee and donuts, and read and discuss articles. At first, I would attend the meetings and say nothing, but I would talk with the graduate students before the journal club started, and I became familiar with the other students in the lab. As time went by, the professor said that I should present an article on the type of synthesis I was doing that summer. I presented an article and received so much positive feedback. Now students in the lab would come up and ask me about my work, and I would ask them for advice. I was no longer intimidated. I considered myself a contributing member of the lab. I also learned about fellow lab students' projects through the articles they were presenting. This experience in a journal club stayed with me; it became my gateway into science. After that summer, I felt much more confident in my chemistry skills, but I also felt more confident to talk with chemistry professors back at college. Over the years, I also saw my husband, a physician, gather other rheumatologists at our house once a month to discuss rheumatologic issues. I would see how happy he was to talk with his colleagues that he rarely had time to see in his own busy practice. My memories of journal clubs were only positive and collegial.

Then as a doctoral student, Dr. Feldman started a journal club with the members of a research project of which I was a research assistant. I was excited at the prospect of joining a journal club. I did not know many people on the research project and I looked forward to meeting with them every other week. I joined the project late; it was year three

of a four year project. I often felt unsure of the direction and purpose of the research. Hearing discussions on literature related to the project immersed me in the fundamentals behind the project and the future scope of the research. I found too that I contributed more as the semester went by, and I learned the skills needed to participate in this journal club. I found that, in my education classes, when other doctoral students were struggling with how to search for research articles, I was able to assist them because I had gained skills in how to do effective literature searches and relate the literature to my topic. I conducted an action research study of the skills and knowledge I gained from being in the journal club (Tallman & Feldman, 2010). I found that I became more adept at searching for literature, summarizing it, and discussing it. I also found that I gained a better understanding of the professional community of teacher educators.

I became curious to understand the role journal clubs play in connecting theory with practice. As I explored the literature, I noticed that all professions similar to teaching were implementing journal clubs (e.g. nursing, social work, library science). I noticed that these journal clubs were implemented in fields that were connected to the medical profession, and thus, they were aware of the role journal clubs play in learning the theory of the field. I wanted to understand how journal clubs form, how they function, and how they work as collegial communities. As a result, I conducted a preliminary study of a medical journal club that was in a medical education program. The resultant paper I presented at a conference, “Journal Clubs as a Way to Bridge the Theory/Practice Gap in Science Teacher Education” (Tallman & Feldman, 2012). The study of the medical journal club has informed the structure and framework of this journal club. It also led me

to believe that journal clubs could have a role in science teacher education. How journal clubs are received and developed by the teachers, is an ongoing exploration of this study.

My Interests in the Study

There are several reasons why I am interested in studying preservice and inservice science teachers' experiences in a journal club. First, I want to know if it makes them feel more connected to each other and to the field of teacher education. Second, I read a study (Gore & Gitlin, 2004) that found teachers believe they do not have the knowledge or skills to read educational research. I want to know if being in a journal club helps teachers feel more confident in their ability to access, critique, and use educational research. Third, I am interested in how science teachers build a community that helps them learn how to connect theory with practice. What does that community look like? How do science teachers go about applying educational research to their practice in this community? How does educational research and conversations with other teachers over educational theory transform their pedagogy?

Significance of the Study

This research study is significant to teacher educators involved in science teacher education and professional development. It is also significant for science teachers, who are interested in creating their own learning communities. Journal clubs could help the teachers explore new ways to improve and understand their practice. Journal clubs empower professionals to become learners of their discipline by taking ownership of the selection of the articles and reading the research of their field. The science teachers' conversations and critical analysis of research will help provide a new way for science teachers to understand and value educational research.

This study also contributes to how teacher educators form better networks and relationships with science teachers that are more equitable and inclusive. Ball (2012), in her Presidential Address at the 2012 American Educational Research Association (AERA), encouraged educational researchers to close the 'knowing-doing gap.' One way Ball (2012) suggested teacher educators could close the gap was by following the knowledge communities model. This model could help teacher educators and teachers work together on educational issues despite the separate roles the two play in the endeavor of education. I believe journal clubs can bridge the 'knowing-doing gap' by giving teachers the tools to understand and access the data produced by educational researchers.

Clarifications and Delimitations

Assumptions

This study is based on a number of assumptions. The first assumption is that the preservice and inservice science teachers would come to the journal club enthusiastically and eager to read educational research articles, and then discuss them with colleagues. The second assumption is that the preservice and inservice science teachers were willing to participate freely and without judgment. This study also assumes that the preservice and inservice science teachers would come to the journal club with problems and issues they have within their practice. Additional assumptions were made regarding their experience and knowledge of educational research and their previous experiences with collaborative discussions of educational research.

Limitations

Several factors limit this research study. The first is the sampling of the science teachers (e.g. location, size of the sample, and procedures for sampling). The selection of the science teachers is limited by the small number of science teachers in the study (six teachers), the location in which I gathered participants (western Massachusetts), and how I selected the sample of potential teachers. The second factor is that of time. Journal club members need to be engaged in journal clubs for years and meet weekly to lead significantly to change in practice (Mazuryk, Daenink, Meumann & Bruera, 2002; Price & Felix, 2008). In this study, the science teachers and I met every other week over the course of seven months. Some journal clubs have been operating for ten years (Mazuryk, et al., 2002), five years (Moch, Cronje, & Branson, 2010), or two years (Koufogiannakis, Dorgan, & Crumley, 2003). However, my interest in this study lies more with the formation of a journal club and the dynamics of such a community. Thus, I was taking a snapshot of how this model of a journal club works in science teacher education and professional development.

Organization of the Study

In this study, I explore how preservice and inservice science teachers engage in a journal club as a way of building a community of practice and coming to a better understanding of how theory impacts their science teaching. In Chapter One, I provide information about the structure of the study and present information on what a journal club is, and how it functions in other professional fields. This chapter also includes a statement of the problem; the purpose of the study; significance of the study; and assumptions and limitations of the study.

In Chapter Two, I present a review of the literature. This chapter provides the theoretical framework of the study. This includes literature related to journal clubs, reflective teacher education, the role of theory in teacher education, inservice teacher professional development, and the social theory of learning. In this chapter, I review the literature that helps me understand how preservice and inservice teachers read and understand educational literature, and how they use it to transform their teaching.

In Chapter Three, I outline the design of the study. In this chapter, I explain the steps I used to answer my research questions. This chapter includes a description of research approach; data gathering methods; selection of case; making contact; role of the researcher; dilemmas associated with my roles in the journal club; ethical considerations; data analysis; and trustworthiness of the study.

In Chapters Four, Five, and Six, I present the results and analysis of the data. Each chapter includes the results from the journal club meetings, teacher interviews, focus group, and artifacts collected. In Chapter Four, I explain the formation of the journal club, the preservice teachers and why they joined, and then, the inservice teachers and why they joined.

In Chapter Five, I provide details of the community within the journal club, what it looked like, and the characteristics that distinguish it from other organized groups. I also describe the talk that the teachers engaged in at the journal club. I explore how the teachers critiqued research articles, how they shared anecdotes, and how the teachers took on exploratory talk as a means to connect theory to practice.

In Chapter Six, I explain how being in the journal club transformed the science teachers' professional identity. To do this, I explored how the research articles and the

community affected the preservice and inservice science teachers' view of what it is to be a science teacher. I also look at the role the journal club plays in their understanding of themselves as teachers.

In Chapter Seven, I conclude this study. In this chapter, I return to my research questions, summarize my findings, and state what I have learned as a result of conducting this study. I also present implications and recommendations for further research in science teacher education and professional development.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

The focus of this study is on preservice and inservice science teachers' participation in a journal club. I will define a journal club and its role in professional education. Journal clubs are mainly found in the medical and science fields; thus, I explore the potential journal clubs have for teacher education based on studies from other fields. Central to this study is how teachers reflect on theory in relation to their practice; therefore, in this literature review I examine reflective teacher education. I am also concerned with how the teachers in a group setting reflect on their practice; thus, I look at collaborative reflection. Journal clubs are centered on discussions about theory and practice. In this chapter, I look at the role of theory in teacher development. First, I examine how theory is infused in teacher education, and then, professional development. In my theoretical framework, I examine journal clubs through a sociocultural lens. I define formal and practical theories. In addition, I examine sociocultural dialogue centered on text both spoken and written. Finally, I examine the social theory of communities of practice and how it can help connect theory to practice.

Journal Clubs

Journal clubs are traditionally organized reading groups that discuss a peer reviewed research article found in recent research journals. Journal clubs keep all members up-to-date on the latest literature (Golde, 2007; Linzer, 1987). Members of a journal club also learn presentation skills, how to organize a talk, and how to engage in collegial dialogue (Golde, 2007). Members of journal clubs learn how to ask good

questions, how to respond to questions, and how to disagree with others (Golde, 2007). Finally, journal clubs bring people together around a shared enterprise that has the capacity to promote shared meanings (Golde, 2007).

History of Journal Clubs

Linzer (1987) explored the history of journal clubs in medical education. Journal clubs have been a powerful educational tool used in medical education for over one hundred years (Linzer, 1987). Linzer (1987) found journal clubs have always centered on discussion of articles in current journals and their applicability to practice. Linzer (1987) described what a journal club in 1946 looked like; it contained resident fellows and medicine faculty. The members would select what articles to read, and three or four papers were discussed each week. After each presentation of an article, there would be a clinical subject discussion of a case from practice.

Linzer (1987) found that early literature on journal clubs for medical students described the benefits as learning to use the library and introducing students to a systematic use of medical literature. It was not until the 1980s that journal clubs were described as a place for participants to learn critical reading skills. It was at this time that journal clubs became part of a medical resident's morning report setting. Linzer's (1987) historical survey of the literature on journal clubs points to the evolution of journal clubs from a place to discuss the articles from medical studies to a forum to discuss clinical topics that are raised in the literature. Presently, journal clubs are often used as a medium for developing critical thinking and appraisal skills and engaging in critical conversations on the literature from problems of practice encountered by members of the journal club.

Expansion of Journal Clubs

The Linzer (1987) article points to the 1980s as a time when medical journal clubs moved to other fields. An example of these types of journal clubs can be found in a study of social workers by Blumenfield (1985). A four-year study by Blumenfield (1985) of gerontology social workers showed that members found they could use the literature as a catalyst for sharing practice dilemmas. Blumenfield (1985) found that the discussion of an article often led to further discussions of cases. The members found that the study also led to new insights and techniques which increased their knowledge in many areas of elderly care and disease. Blumenfield (1985) argued that members, during discussions, learned from hearing different perspectives and experiences. Many members spoke of how the articles discussed overflowed into their practice where they shared these articles with other social workers not in the journal club. Several members reported they learned about research methodology in the journal club. Blumenfield (1985) concluded that the gerontology journal club provided an effective space for members to learn on their own and from each other.

An editorial by Kleinspell (2002) about nursing education promoted a medical journal club format be used to provide a bridge between nursing research and practice. Kleinspell (2002) stated “reading research and promoting understanding of the research process is important for translating research findings into clinical practice” (p. 412). She argued that the reasons nurses did not read research was that they were uncertain of how to critique research and interpret the data. Seymour et al. (2003) examined how journal clubs could promote both critical and creative thinking in nursing clinical practice and that these skills would help to narrow the research-practice gap. Seymour et al. (2003)

argued that critical thinking and critical appraisal skills should be read in the context of practice, because the nurses would incorporate compassion and respect in their reflection on the article and their practice. Seymour et al. (2003) stated that critical thinking is often taught as an isolated academic skill and not in the context of practice. Seymour et al. (2003) stated,

> Using research in practice requires not only the development of higher order cognitive skills, but a recognition that the priorities embedded in practice may well conflict with those of research and that personal attributes such as confidence, as well as professional judgment, are influential in how nurses use research to inform their practice (p. 292).

Seymour et al. (2003) suggested that in order to seek out new explanations to questions and prompt an impact on practice, the critical thinking must be seen as a collective enterprise.

Both Kleinspell (2002) and Seymour et al. (2003) believe journal clubs promote critical thinking and critical appraisal skills in nursing education. Seymour et al. (2003) stressed that journal clubs can promote collective conversation that fosters creative thinking of knowledge to be used in clinical practice. This examination of the readings in the context of clinical practice, and then, collectively examining the concept in a new unknown way provides a nexus needed for the intertwining of theory and practice. Seymour et al. (2003) pointed to a new potential in journal clubs. Through collaborative conversation, creative thinking can develop that allows theory and practice to be integrated together in a way that promotes inventive implementation of theory.

Journal Clubs: Critical Thinking and Appraisal Skills

Other authors (Khan & Gee, 1999; Newsander & Borrego, 2009; Price & Felix, 2008) have confirmed that journal clubs help develop critical thinking and critical

appraisal skills. Khan and Gee (1999) devised a module that would push journal clubs to a guided-discovery approach. According to their model, literature appraisal skills are taught in the context of a patient. In the Khan and Gee (1999) model, the presenter educates the group on a problem from practice and presents literature relevant to the problem. Members of the journal club provide feedback and alternative reflection on the article. The role of the teacher is merely to aid the presenter. This model of Khan and Gee (1999) moves journal clubs further along as places for critical thinking and critical appraisal. This model departs from previous journal clubs by providing structure, unlike prior journal clubs which were mainly unstructured. The traditional format of a journal club has its merits such as "discussions between like-minded colleagues with a desire and enthusiasm to develop local practice" (Grant, 2003, p. 72). However, a problem in the traditional style journal clubs is critical appraisal skills may not be fostered because the presenter may just pick up an article at random and present it without possessing any skills of appraisal or drawing any connection to his/her practice.

Price and Felix (2008) conducted an extensive exploratory, descriptive study of journal clubs and case conferences, structured as communities of practice, using the guided-discovery approach to the literature. Case conferences are a small group learning session of actual patient medical information. In the Price and Felix (2008) study, six departments of medicine were studied, and a total of 73 sessions were analyzed. They found 200 total learning episodes. Some of the learning categories identified in this study were recommendations on managing diseases to patient education. The study also found 63 barriers to implementing what was learned in the journal club. The barriers ranged from costs to confidence in abilities. Price and Felix (2008) felt addressing these barriers

with members of the journal club would help the members identify the different needs in practice.

Some studies highlight the difficulties in teaching critical appraisal in journal clubs. Members of a tertiary palliative care unit (Mazuryk, et al., 2002) conducted a study of a journal club that had been operating for ten years with meetings every day at the hospital for twenty minutes. A survey was sent to two different groups who met over the course of one year in the journal club. One group in the journal club was residents who rotated through the program for two week intervals. The other group was fellows who chose palliative care as their specialty and participated in the journal club from four to twelve months. The results showed some differences among the two groups. Both groups of doctors found the journal club to be of educational value; however, the fellows in palliative care expressed much greater satisfaction from the journal club. The fellows expressed that they were able to apply the readings to practice. They also expressed improvement in their knowledge base regarding critical appraisal of the literature. The residents, who rotated through the journal club for a short time, did not have as high a belief in the educational value of the journal club. However, both groups showed a significant increase in the educational values and critical appraisal skills gained from being in the journal club (Educational value: residents 70.8% vs. Fellows, 95.0%, Appraisal skills: residents, 43.5% vs. fellows, 80.0%, Mazuryk et al., 2002, p. 59). The authors attributed the difference in the two groups' results to the shorter time in the journal club for the residents.

Similar results were found by the members of a Nottingham, England health librarian journal club (Doney & Stanton, 2003). The health librarians started the journal

club after attending a conference on ways to assist the medical profession. Fourteen members attended the journal club. The benefits cited by the members were:

1) A supportive environment in which to examine current practice and consider changes to that practice in light of evidence.
2) Networking opportunities. The members come from a variety of health libraries.
3) A forum to develop critical appraisal skills.
4) Incentive to keep up-to-date with literature.
5) A chance to contribute to personal lifelong learning and continuing professional development (Doney & Stanton, 2003, p. 77).

The survey showed that critical appraisal of literature was one area in which the members of the journal club felt they needed more help.

The Mazuryk et al. (2002) article and Doney and Stanton (2003) article, both refer to journal clubs as opportunities to engage in debates and questions with colleagues. The studies showed that in journal clubs members took a closer examination of practice and considered alternative ways of conducting practice. However, both articles also point out that critical appraisal skills take time to learn and are not easily applied.

Journal Clubs as Communities of Practice

I explore the community of practice model (Wenger, McDermott, & Snyder, 2002) later in this literature review, but in this section I examine the data from two journal clubs structured as communities of practice. Communities of practice are defined as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, et al., 2002, p. 4). Of the two journal clubs investigated in this section, one is in the engineering field, and the other is in the medical field.

Newswander and Borrego (2009) studied an engineering journal club at the graduate school level. The journal club consisted of nine students, five of whom had

participated before, and one full professor. Newswander and Borrego (2009) found the journal club offered an alternative pedagogical approach to exposing students to current literature. They found that journal clubs allowed students to practice "the fine arts of criticism" and exhibit problem-solving skills as well as become familiar with current literature and practice presentation skills. Newswander and Borrego (2009) also determined, when a journal club follows the tenets of the community of practice model (Wenger et al., 2002), it can offer students an alternative place "to share ideas, research problems, and expertise" (p. 564). Newswander and Borrego (2009) argued that the community of practice model provided students a safe environment to learn from one another and recognize the expertise each member offered. They also reported that the community of practice model for the journal club helped newer members gain confidence in their knowledge, problem-solving skills, and presentation skills. In the journal club, the members became more engaged in their own learning. There was a high level of thinking, not just about the article presented, but about the entire direction of the engineering field the members were discussing. This study highlights how a journal club can engage participants in conversations that explore the wider discourse of their field.

The Price and Felix (2008) study discussed earlier examined medical journal clubs structured as communities of practice. Price and Felix (2008) in their more extensive descriptive study found that students gained confidence in their skills and learned from each other from being in the journal club structured as a community of practice. In addition, they found that the community of practice model helped members implement, in their practice, findings from the readings. Price and Felix (2008) argued that journal clubs structured as communities of practice did improve practice. I will

explore further in this paper how the community of practice model is potentially rich for linking theory and practice in a journal club.

Journal Clubs in Teacher Education

An extensive four-database search of the literature on journal clubs in teacher education uncovered two articles specifically on journal clubs. Barak and Dori (2009) studied a science education graduate course following the framework of a journal club; it was a hybrid program, which combined face-to-face classroom discussions and on-line discussions of science education articles. The goal of the journal club as stated by the authors "is to enhance inservice teachers' higher order thinking skills, by involving them in, and testing them on critical evaluation of a science education article" (Barak & Dori, 2009, p. 463). The study was repeated over three separate semesters for a total of 51 graduate students in science education. The inservice teachers had from 2 to 20 years teaching experience. The class was divided into seven two-week sessions focusing on a science education topic that was decided by the professor. The professor then guided the students in their search for a relevant article. All the inservice teachers presented their article the first week of the session, and the group analyzed them. In addition, there was a further on-line discussion of the articles that one of the inservice teachers moderated. In the second week of the two week session, the inservice teachers furthered the discussion and debate of the articles in a classroom setting. This two week session repeated itself seven times over the semester.

Barak and Dori (2009) found that the teachers were able to conduct efficient literature reviews, critically read the science education articles, critique the articles, and then offer their own suggestions to improve them. They also generated a small

community of learners who shared knowledge, ideas, and opinions. The journal club format, according to Barak and Dori (2009), got the teachers asking pertinent questions about teaching, but there were no direct conversations about problems in their teaching. The study did not examine if the members continued to keep reading research articles after the course or if the participants felt the literature had any impact on their practice. This study was primarily concerned with how higher order thinking skills could be enhanced through participation in a journal club. The structure of this journal club was similar to a traditional classroom in that the teachers were tested on their knowledge from the articles.

A study by Brill et al. (2003) investigated a journal club for biology teachers on the latest biological discoveries in the literature. The purpose was to encourage the biology teachers to acquire new skills of seeking literature, engage in discussions on scientific issues, and discuss practical implications of the biology articles to their curriculums. At the first meeting, the teachers learned how to search for biological information. Then at each meeting afterwards, one teacher chose a recent peer-reviewed article to present and discuss with the group. Brill et al. (2003) evaluated the program through two open-ended reflection questionnaires distributed to the participants right after the course finished, and a year later to see if they were still using materials developed during the program. Brill et al. (2003) found that the teachers acquired new knowledge through discussions with colleagues, and that they learned to examine critically primary literature and come up with ways to implement materials that were useful to their classroom. All the teachers were still using the articles and findings a year after the journal club. This study mainly highlighted how the journal club stimulated

professional development for teachers in the creation of new up-to-date materials in biology, but not educational research.

Barak and Dori (2009) used science education literature with inservice teachers to enhance higher-order thinking skills in the teachers. Brill et al. (2003) centered their journal club on the literature of the inservice teachers' discipline-biology. The Barak and Dori (2009) study found that the inservice teachers' higher order thinking skills improved by reading and discussing research articles. The Brill et al. (2003) study did show that inservice teachers can implement biology findings from the articles they read to their curriculums. The Barak and Dori (2009) study did not have the teachers choose their own topics to read from concerns they had from their practice. This study also did not address how the readings and discussions informed their teaching. The Brill et al. (2003) study did look at how the biology studies read informed the teachers practice; however, it did not look at science education studies, but rather, biology studies.

Literature Circles

Literature circles or literature study groups are more often found in teacher education than journal clubs. Literature circles strive for the same goals as the medical and nursing journal clubs: tie the text read to the personal level of the members (McCall, 2010; Straits & Nichols, 2007). The main difference between literature circles and journal clubs is that journal clubs involve reading and discussing research studies, and literature circles involve reading and discussing fiction and nonfiction stories.

Literature circles of preservice teachers (Roberts, Jensen, & Hadjiyianni, 1997; Straits & Nichols, 2007) and a journal club of inservice teachers (Barak & Dori, 2009) are similar in that both structures provided their members with different perspectives

about a text, aided members' understanding of the text, and encouraged critical thinking about the text. Another, connection between literary circles and journal clubs is that literary circles allow members to reflect across multiple texts as well as reflect on the multiple voices heard from the members of the literary circle (Newswander & Borrego, 2009; Straits & Nichols, 2007). Both literary circles and journal clubs allow members to explore their own questions, in literary circles through novels, and in journal clubs through research articles. They also both promote discussion led by a teacher educator or facilitator.

A key difference between literary circles and journal clubs is that examining research studies gives teachers the ability to make connections between research findings and their practice. When reading research articles, members of the journal club are able to compare the results discussed in the paper with their experiences in the field (Newswander & Borrego, 2009). Journal clubs expose teachers to the research based theory in education. While literary circles expose teachers to multiple perspectives, they do not bring in the perspective of educational research and help to eliminate the research/theory gap.

Potential of Journal Clubs to Teacher Education

A journal club allows members of a discipline the opportunity to join in the professional dialogue of that field. Journal clubs give their members access to the language and ideas of the field. Teachers in a journal club, during teacher education or as professional development, learn to recognize that reading education research literature is a part of their practice. The teachers in a journal club learn critical appraisal skills. Journal clubs can foster deep conversations where members of the journal club "try to

understand others' meanings by asking questions, posing counter examples, and suspending judgment" (Nelson, Deuel, Slavit, & Kennedy, 2010, p. 177). These are the conversations which could link theory with practice. These conversations could bring teachers into the professional dialogue about research findings and practice implications.

The linkage of theory and practice can come from comparing the results discussed in the literature with the teachers' experiences in the field. The members of a journal club learn to problem-solve. The teachers learn to problem-solve not just from the questions they face in their practice, but from the problems faced in the research articles and the questions raised by their colleagues' selection of an article. Teaching is no longer an isolated activity where the teacher solves problems by himself/herself. In a journal club, teachers can reflect and reason on issues and concerns of education from the perspective of their community of learners and the wider audience of the studies. These perspectives do not provide step-by-step instructions. Wenger (1998) states that, "A perspective is not a recipe; it does not tell you what to do. Rather, it acts as a guide about what to pay attention to, what difficulties to expect, and how to approach problems" (p. 9). The reflection practiced in a journal club has potential to lessen the theory/practice gap for teachers. Next, I will examine the role of reflection in teaching.

Reflective Teacher Education

As early as 1910, Dewey advocated for reflective practice in teaching. Dewey (1997) noted reflection as the back and forth movement teachers make between the fragmentary data of a situation and search for observational data to provide experimental changes to a situation. He defined reflective process as an inductive/deductive cycle, which "involves, that is, a fruitful interaction of observed (or recollected) particular

considerations and of inclusive and far-reaching (general) meanings" (p. 80). He stressed this process could be casually made in an uncritical way, or it could be done systematically. Dewey (1997) warned that systematic inquiry should not be seen as a final conclusion of thought that it too was a working hypothesis, and it was important not to make hasty judgments about the newly interpreted data, but to search for evidence that adds to incomplete fragmentary data. Dewey (1997) saw the process as only ending when the results of the inquiry could be confirmed by experiences in the classroom.

Dewey's view places reflection as a time out from practice when conditions become problematic (Waks, 2001). This idea of reflection done away from practice emphasizes reflection on information not derived from practice, but theoretical constructs (Schön, 1992). Dewey, however, was not so embedded in the model of technical rationality, meaning science provides all the answers to teaching situations. He did see the experiences of practitioners as the only true source of the validity of these scientific laws (Waks, 2001). Schön rejected this view of reflection as a time away from doing for scientific inquiry, but believed that knowledge comes from and is directly a matter of practice (Waks, 2001). Bauer (1992) stated that Schön saw "professional practice is a process of problem-solving" (p. 9).

Schön theorized in 1983 that professionals including teachers have a knowledge-in-action that they inherently use when they encounter a situation. By reflecting-in-action on the problematic situation practitioners become aware of their frame; they also become aware of all the possible alternative ways of framing their practice (Schön, 1983). When teachers frame their practice and examine alternative ways, they now open up to possibilities that can lead to solutions (Schön, 1992). Schön (1992) viewed teachers as

'on-the-spot researchers' (p. 134). He redefined the role of university-based educational researchers. He saw their role now as examining "teaching practice as a context for *generating*, not only for *applying*, usable knowledge" (Schön, 1992, p. 134).

Schön (1983) emphasized that reflective practitioners recognize they are not the only source of knowledge, and also see uncertainty as a source of learning. He stressed that reflective practitioners can become free from the constraint of always being an expert and begin to experience and learn from confusion. Reflective teaching engages teachers and students in what Schön (1992) calls 'communicative design inquiry.' In this type of inquiry, teachers and students

> …inquire into the materials, the situation, and the problem at hand. From the materials and from one another they sometimes get back-talk that makes them rethink their understandings of what is going on. They reflect on their own and one another's ways of seeing these things, and strive-at best, through reciprocal reflection-in-action-to communicate about them. Whatever lessons they may learn about the problem at hand-parallelograms or construction systems, for example-they also learn something about inquiry into inquiry (Schön, 1992, p. 134).

This view of reflective teaching can inform the collaboration between researchers and practitioners in the professions. Schön (1983) emphasized changing the model of reflective practice from applied science to include the experiences of teaching as a source of research. Researchers in this view become consultants to practitioners and teachers as coaches to students. Community and collaboration can be seen as central in Schön's view of reflective teaching and practice, particularly if these collaborative groups are inquiring into understanding and making sense of situations and knowledge.

Collaborative Reflection

The goal of many teacher education programs is to foster reflective teachers (Richardson, 1990). In a teacher education program that follows Schön's reflection-in

action concept, the teacher reflects on a problem encountered and experiments with the situation (Richardson, 1990). Reflection becomes strengthened when grounded in the real world through the social actions of dialogue; otherwise, it runs the risk of becoming a technical procedure (Cinnamond & Zimpher, 1990). Grimmett, Erickson, Mackinnon, and Riecken (1990) argue that when reflection becomes too technically applied it does not allow the teacher to examine the complexities and constraints of teaching.

When examining preservice teachers' development in a community, Cinnamond and Zimpher (1990), envisioned reflective practice as creating dialogue for a preservice teacher with fellow preservice teachers, practicing teachers, administrators, and teacher educators-the members of the community the preservice teachers are joining. Yinger (1990) emphasized, "Conversation is learned through participation" (p.91). He explains how in education programs preservice teachers study about having conversations in practice with fellow teachers, but it is not the same as participating in collaborative conversations with teachers about practice.

Some researchers view collaborative reflective conversation as the engagement of teachers in a supportive and collegial way to examine problems and promote new approaches to them (Pugach & Johnson, 1990). However, some studies found that sometimes collaborative work with practicing teachers remain focused on congenial conversations, stories of practice and not deep probing conversations that lead to a deeper understanding of teaching and learning (Butler, Lauscher, Jarvis-Selinger, & Beckingham, 2004; Nelson et al., 2010).

Collaborative reflection is a tool to be learned. Reflective inquiry can be learned through participation in reflective conversations (Yinger, 1990). Thus, both preservice

and inservice teachers need to engage in inquiry-based conversations. Teachers engaged in peer reflection begin to see that conversation is valued over isolated thought and that learning can occur as a community and not just by an individual (Yinger, 1990). Reflection conducted by teachers engaged in collaborative inquiry makes dialogue not just self-reflection, but rather, leads to reflection on the self in the community (Yinger, 1990).

I will examine three models of collaborative peer reflection (e.g. learning circles, lesson study, and collaborative action research), and how these programs help teachers reflect on their teaching experiences. I will also explore how these programs generated new knowledge for the participants on teaching that helped them understand the connection between theory and practice.

Learning Circles

Learning circles involve peers coming together to learn from each other on a self-decided topic. Learning circles are peer-directed activities that allow many different perspectives to be heard. The context of the learning circle varies according to the group. Learning circles, often called study circles, are a place where a community of peers can address questions and problems and use each other as a resource for solutions and answers. The teacher educator is only turned to when the resources of peers is exhausted (Traore, 2008). Learning circles are also used in secondary schools by teachers to move the learning in their classrooms from teacher-centered to student-centered (Traore, 2008).

Le Cornu (2009) studied twenty-five students in an eighteen month Graduate Bachelor of Education (primary) program engaged in a learning circle. Learning circles, in this study, represent learning communities of preservice teachers placed in the same on

campus workshop and the same school for their practicum. The members of the learning circles met regularly to engage in professional dialogue. Each participant shared experiences in addition to listening and asking questions about fellow participants' experiences. The results of this study are from a survey containing open-ended questions distributed to two cohorts of this program-a total of fifty-two participants. In addition, a self-study was conducted by the two academics leading the program. Fifty-two subjects took an open-ended survey that asked how satisfied they were with the support their peers gave them in the learning circle.

Two main themes emerged from this study. Le Cornu (2009) found that the preservice teachers valued the peer support offered by the learning circles. The preservice teachers found they had to attend to not only their own learning, but the learning of their peers. The other finding was that of resilience. They needed to be strong not only for themselves, but by working closely with their peers, they had to be emotionally strong for their peers. More than half of the preservice teachers in the study found they developed the skills to conduct collaborative reflection. A key outcome from the relationships formed in the learning circle with the mentor teachers was that the preservice teacher came to see mistakes as learning opportunities. The preservice teachers saw through dialogue in the learning circles that asking for help was strength and not weakness.

A barrier found from the learning circles was emotional exhaustion. The members found meeting after school with the learning circles could be exhausting, but the participants found being attentive to another's learning helped them become resilient and remain persistent. This study shows that reflection on practice did occur through the learning circles. However, the Le Cornu (2009) study showed no evidence of a dialogue

that probed the preservice teachers' perspectives of practice or analysis of educational theory to practice. This study points to a learning circle as a supportive community. The members of the learning circle also developed reflective skills when listening and responding to other members (Le Cornu, 2009). Learning circles in this study provided preservice teachers opportunities to reflect, but not necessarily to reflective inquiry on problems of practice or the theories behind teaching.

Lesson Study

The purpose of lesson study is to help teachers understand how to make effective changes to a lesson to improve student learning. Lesson study has a long history in Japan where teachers conduct collaborative research in hopes of increasing learning, deepening their knowledge of the subject matter, elevating the classroom activities, and transforming the school community (Arani, Keisuke, & Lassegard, 2010; Lewis, 2002). The teachers come together around a common problem and together through preparing lessons, observing the lessons of each other, and reflecting on practice come up with shared solutions to address the problem (Arani et al., 2010). Collaboration focuses around support for student learning. The emphasis is not just on a single teacher improving learning for the students, but all the teachers of the school collaborating to improve the learning for the students (Lewis, 2002).

A study by Marble (2007) examined twenty-four preservice elementary education majors enrolled in a lesson study designed to integrate science and mathematics lessons during their initial teaching experiences. The preservice teachers broke into teams of two. The preservice teachers observed all the lessons taught by their team member and participated in the debriefing and redesigning of the lesson with their team member. Data

were gathered from direct observation of teaching episodes and from portfolios that included reflective analyses of individual and team experiences. The preservice teachers in this lesson study observed noticeable improvement in lesson design, particularly in how they delivered and assessed the lesson. The preservice teachers also were able to explain how the changes they made to the lessons improved them. This study found that preservice teachers successfully addressed effective changes in the lessons to improve student learning.

Another study conducted at thirteen schools examined inservice science and mathematics teachers in partnership with university educators (Saito, Harun, Kuboki, & Tachibana, 2006). The collaborative lesson study cycle consisted of three stages: 1) planning session, 2) open lesson, and then, 3) reflective session. During the planning session, teachers consult with colleagues on the lessons and methodologies to be used throughout the semester. The lesson study cycle involved the university teachers and teachers from other counterpart schools observing a lesson. At the end of the cycle, there is a reflective session with the university teachers and any other teacher observers who went to the classroom lesson. The teachers in all the schools noted a change in their teaching methodologies and an increased engagement in the participation of the students. A problem noted was that teachers were effective at developing lessons based on teaching theories, but often never attempted to develop their own theories from classroom situations. Thus, the teachers were not as concerned with the learning processes and misconceptions of the students as they were with the lesson design.

Learning circles do not have a pre-determined direction before the first meeting. However, lesson study has a focus on improving a lesson and using collaborative

conversation and reflection to support change in the classroom. The focus of collaboration in lesson study is on making the necessary changes to lessons to improve student learning in the classroom (Arani et al., 2010). Lesson study provides a tool for teacher education that involves reflective inquiry by peers of a problem-based situation. While this tool is helpful, it has its limitations in that it does not take into account the holistic model of teacher education, which involves an understanding of the community and school issues in teaching. In addition, the emphasis on implementing educational theory focuses more on how to implement the theory, in the lesson methodology, and not as much on reflecting on the students' learning (Saito et al., 2006). The teachers in lesson study do not learn how to critique and analyze educational theory, which in turn may hinder how the teachers interpret the teaching/learning process in their classrooms.

Collaborative Action Research

Collaborative action research is more general than lesson study and accentuates more the systematic examination of problems of practice with the goal to improve practice, not just one lesson. Collaborative action research is dissimilar to learning circles and lesson study, in that it utilizes research literature to provide help in understanding an issue or problem identified by the group (Zhang et al., 2010). In a collaborative group, members interpret and analyze each other's research (Goodnough, 2010). In teaching, collaborative action research is often conducted to address school problems and improve the school (Goodnough, 2010).

Goodnough (2010) examined a three-year collaborative action research project of fifty science teachers over three school districts. The teachers worked collaboratively in sixteen groups to enhance their understanding of their practice and improve student

learning. Goodnough (2010) conducted an in-depth case study of one teacher. The teacher in the study engaged in a collaborative action research on how a web quest could foster student learning in science. Goodnough (2010) found in the study that the teacher not only used the knowledge from her fellow collaborative members, but also examined research-based literature to help her frame the questions she studied in her practice. The teacher in the study stated that she continued to integrate the literature she examined from the study into her teaching. This study of a collaborative action research found that the teacher took responsibility for her own learning and became proactive in finding answers to the challenges she faced in teaching. This was, however, a study of only one teacher.

A study by Zhang et al. (2010), also, examined a collaborative action research project. It involved five inservice kindergarten teachers using "Science Talks" to promote science learning in kindergarten. In this research project, participants consulted research-based literature to help understand the focus of their action research plan for their classrooms. Teachers researched a learning problem of concern to them in their classroom, and then presented it to the group. The teachers, in the collaborative action research group, helped clarify for each other important topics to examine and research questions to ask. Zhang et al. (2010) found that the inservice teachers learned from each other's research as well as how to engage in discussions on common interests. However, Zhang et al. (2010) encountered problems when the teachers were conducting their own action research. They (2010) found the teachers had an easier time when the research was modeled by more knowledgeable researchers.

The Zhang et al. (2010) study like the Goodnough (2010) study had teachers reading research-based literature to help frame problems of practice, and then, use this

information to research and reflect on their own classrooms. The authors, from both studies, did not explain if participants were critically reading and analyzing prior research studies, or rather, reading studies to support their assertions on problems in the classrooms.

Collaborative Reflective Inquiry: Connecting Theory to Practice

The three models of collaborative peer reflection examined above (i.e. learning circles, lesson study, and collaborative action research) focus on practice, but not all three include the research literature and research-based information. Learning circles do not accentuate research literature, but rather support dialogue on teachers' problems of practice in order to offer support.

Lesson study highlights collaboration among participants on a lesson. The group observes and critiques and plans a lesson to improve practice. In lesson study, like collaborative action research, there is a research question that drives the cycle of observation, dialogue, and evaluation. In addition, there is a systematic process that the teachers conduct. Collaborative action research is also an interactive inquiry into a question of practice by a group as with lesson studies.

The key difference with collaborative action research is the question examined is not always with the lesson, but it could be about the practitioner or the community. In addition, collaborative action research refers to research literature to help the teachers frame their questions of practice. Collaborative action research has the potential to connect the teachers' practice theories with theories derived from educational research. However, this approach does not help teachers learn how to assess and evaluate educational research in ways that empower and include them in the discourse of

education. This often leads to a separation between the teachers' research studies and the academic community's research studies. Next, I will examine the role of theory in teacher education to understand how teachers learn to implement educational theory during schooling.

The Role of Theory in Teacher Education

Theory-into-practice is the traditional approach used in teacher education (Korthagen, Loughran, & Russell, 2006). Education programs are often centered on preservice teachers reading theory from psychology, sociology and education, and then these theories are applied into classroom practice. Many researchers (Britzman, 1986; Gore & Gitlin, 2004; Korthagen et al., 2006; Veenman, 1984) have found that this model of teacher education that supports learning theory in the university classroom then applying it while in the field has many limitations. Teacher education is often criticized for this tension that then develops between theory and practice from this theory-into-practice model. What the beginning teachers think they need to know and what the role of theory is in teacher education becomes at odds with each other. Britzman's (1986) and Lortie's (1975) studies of the apprenticeship model of teacher education found that this model tends to de-emphasize the education courses at the university for the practical on-the-job training in the classroom. Students view university courses as not being real teaching experience (Britzman, 1986). Practice teaching gives the student a feeling of real teaching that makes them think they are accomplishing their goals of becoming teachers (Lortie, 1975). The work at the university feels less real to the student and more idealistic and speculative compared with what the prospective teachers see and learn during student teaching (Britzman, 1986). Preservice teachers feel disconnected between what they are

reading at the university and what they see during the practicum, which has them siding with the reality of their practicum.

Fuller (1969), in his extensive study of 100 prospective teachers, found that, in the early phase of teaching, teachers are primarily concerned with themselves. Fuller (1969) suggested that unless the teaching experience of the preservice teacher is critically analyzed in conjunction with educational theory, the apprenticeship model will just reinforce what the prospective teachers already think. Lortie (1975) offers that practice teaching runs a high risk of propagating past practices if the prospective teacher is "not forced to compare, analyze, and select from diverse possibilities" (p. 71).

A problem created in teacher education is that university courses and field placements are often not connected (Grossman, Hammerness, & McDonald; 2009). The reading of academic theory and reflective practice is frequently linked to teacher education completed at the university and not teacher education done during the practicum (Smith, 1992). Smargorinsky, Cook, and Johnson (2003) have argued that to separate theory and practice as distinct thoughts takes away from the fact that theory is interwoven in everyday experiences. The teacher education frameworks examined below restructure teacher education so that preservice teachers incorporate theory into their practices.

Frameworks of Teacher Education

Teacher education has traditionally divided teacher education into the foundation and methods courses (Grossman et al., 2009). The foundation courses provide knowledge in educational psychology and philosophy of education. The methods courses often focus more on practice such as the teaching of a particular subject matter or classroom

management. Grossman et al. (2009) argue for a re-conceptualization of teacher education, where there is no longer a separation between foundations and methods courses. The frameworks examined below try to blend foundations and methods.

Practice-Oriented Teaching

The work of Hiebert et al. (2007) highlights a framework to help teachers learn how to teach from studying teaching. This approach emphasizes learning from experience. Hiebert et al. (2007) propose doing this by working with a framework that accentuates four main skills. The first skill is to have prospective teachers specify the learning goals for an instructional episode. Preservice teachers, by having explicit goals, then conduct the second skill of this program that is observations for evidence of student learning. This second skill involves the preservice teachers learning to focus on their students as learners and not themselves as teachers. They have to learn to examine student work and understand how the student's work reveals evidence of learning. The third skill of this framework is to construct hypotheses on the effects of teaching on a student's learning. The final skill is a culmination of the prior skills. It involves using this analysis to make improvements in teaching that help students learn more.

Hiebert et al. (2007) refer to these skills as teachers making evidence-based decisions about teaching. They compare these evidence-based decisions to the inquiry skills cited by Dewey in *The Sources of a Science of Education.* This framework accentuates learning "through continual and systematic analysis of teaching" (Hiebert et al., 2007, p. 49). This analysis of the teaching episode does not need to be made in real-time, but can be done outside the classroom in teacher education programs. The study of the teaching episode can come from examining videos of the preservice teacher teaching

or analysis of transcripts of the classroom teaching. This practice-oriented framework is similar to teacher as researcher (Cochran-Smith & Lytle, 1993) in that teachers collect data to inform decisions about teaching. The work of Hiebert et al. (2007) also borrows from reflective practice, with an emphasis on instructional practices and students' achievements. Hiebert et al. (2007) argue that what makes this framework promising is that the skills they call for are not alien to what teachers in practice currently do, it is just that teachers do not practice these skills deliberately, and it is not a daily part of the teachers practice.

The practice-oriented teaching program encourages teachers to possess critical analysis skills. These skills are needed to make meaning of their teaching and students' learning. The framework does not offer, other than through the analysis of videos or transcripts, other ways the teachers can learn analytical skills. The study of videos or transcripts brings about reflective change, but is this reflection done with peers or mentoring teachers? This program attempts to bridge theory and practice by taking a problem of practice, noted through review of a video of a teaching episode, and using it to help the preservice teacher learn from teaching not abstract readings. However, this program still separates the theory appraised from research-based literature from the experiences learned in the practicum.

Inquiry-Oriented Teaching

Another framework looking to meld foundations and practice in teacher education is the inquiry-oriented teacher education program. Inquiry-oriented programs call for preservice teachers to be engaged in action research and be critical consumers of research (Gitlin, Barlow, Burbank, Kauchak, & Stevens, 1999). From an inquiry approach,

teachers can challenge research or confirm research; however, research does not direct practice, but research can lead to preservice teachers posing new questions, examining assumptions and considering alternatives (Gitlin et al., 1999).

Byman et al. (2009) highlight an inquiry-oriented program that accentuates what teachers learn through a research-based teacher education program. The keys to their inquiry-oriented teacher education program are that preservice teachers teach what they study. The program consists of four characteristics. First, it is structured to systematically analyze education. Second, it is based on research. Third, activities in the teacher education program are organized so that preservice teachers practice argumentation, decision-making, and justification when they inquire into pedagogical problems. Finally, students learn formal research skills. The preservice teachers learn about qualitative, quantitative, and mixed research methods and how to practice research through small activities. They develop practitioner research skills from the beginning of the program. The emphasis of this program is for preservice teachers to see "all teaching is based on research" (Byman et al. 2009). The research-based approach becomes applied to all courses in the teacher education program from mathematics to education literature. The teacher education curriculum becomes a spiral, from which preservice teachers learn to inquire into their teaching. Then they learn research methodology, and educational theory.

This study was conducted over two years in Finland. In the first year, there were 116 teachers in the program. In the second year, there were 168 teachers in the program. Their study investigated two types of students in the teacher education program. One group had experience teaching but no prior teacher education, and the other group had no

teaching experience or prior teacher education. In addition, many students with prior teaching experience were continuing to teach throughout the program. The data were analyzed through a mixed-methods approach. The goals of the study were to determine the preservice teachers' experiences and attitudes towards the research-based approach to teacher education. Byman et al. (2009) found that all the preservice teachers appreciated the inquiry approach; however, the preservice teachers with prior teaching experience had an easier time implementing the research-based approach. They accounted for these differences between the two groups in the inquiry method by the length of time spent in the classroom. They found the preservice teachers that had prior teaching experience recognized real needs and problems to solve in the classroom. Byman et al. (2009) concluded that students with no previous teaching experience did not appreciate the inquiry approach as much as the preservice teachers with prior teaching experience because they had not yet encountered unknown problems in the field of teaching.

A study by Gitlin et al. (1999) investigated further into inquiry-oriented programs by researching what preservice teachers think about research before and after participating in an inquiry-oriented program. In this study, a questionnaire was given at the beginning and end of an inquiry-oriented program to 17 elementary preservice teachers and 20 secondary preservice teachers. The questionnaire asked the preservice teachers: "What is educational research? What are its goals? Who does it? Does research address your concerns as teachers? How do you decide to make changes in a classroom setting? How can research be improved?" (Gitlin et al., 1999, p. 756) In addition, they interviewed eight elementary preservice teachers and eight secondary preservice teachers to provide a more in-depth explanation of the results.

This study showed that the preservice teachers preferred practical research over conceptual or theoretical, which they viewed as too inaccessible. The preservice teachers also viewed theoretical research as political and subjective, particularly the elementary preservice teachers. However, the secondary preservice teachers by the end of the inquiry-oriented teacher education program no longer saw educational research as inaccessible, but rather as taking up too much time. The secondary preservice teachers felt they had little time to read about teaching as a result of their busy schedules of classes and teaching. When all the preservice teachers were asked whether any of the schools they conducted their practicum in had any research literature available for the teachers, some of the preservice teachers noted there were journals that provided practical hints to teaching, but not research on a topic. The preservice teachers, after being in the inquiry-oriented teacher education program, felt experience rather than research was the most important source of knowledge in teaching. Gitlin et al. (1999) also found that intuition framed their work. For example, when students were happy and actively engaged in a preservice teacher's classroom, then the preservice teacher would stay the course, regardless of what literature or other practicing teachers said.

Gitlin et al. (1999) concluded that the preservice teachers, after the inquiry-oriented program, viewed research as providing immediate answers to teaching, and when the study did not provide immediate answers the teachers viewed the research as ineffective. Gitlin et al. (1999) suggest that teacher education may need to encompass a critical examination of what is research and what are the scopes of research goals. In addition, Gitlin et al. (1999) believe teacher education programs need to focus on decision-making approaches that are based on a variety of knowledge forms. They also

advocate restructuring the practicum away from survival mode and towards a model where the preservice teacher has time to reflect on teaching, read research, and collaborate on research that would allow dialogues between academics and teachers. Teacher practicum's, according to Gitlin et al. (1999), should accentuate that data comes from a broad array of resources. Gitlin et al. (1999) do not specifically say what resources are important, but this study seems to promote teaching as problem-solving. The teacher is to weigh experiences from the students and school with knowledge of teaching developed from a variety of resources, with one of the sources being educational literature.

Both the Byman et al. (2009) and Gitlin et al. (1999) studies found that inquiry-oriented programs exposed preservice teachers to more research based literature, which for the most part was received well. However, the preservice teachers still did not realize that problem-solving involved weighing many different options and was not an immediate fix from one source of data. One important feature about these two inquiry-oriented programs studied is that the readings were supplied by the professors, and not the preservice teachers. Having the professors supply the readings helped the preservice teachers critically examine the literature, but it did nothing to motivate the preservice teachers to examine and read the literature outside of the university setting.

Decision-Making Teaching

Clough, et al., (2008) proposed a decision-making framework for science teacher education that emphasizes ways of making sense of learning and teaching and the goals of science education. This framework of decision-making explicitly highlights that there is no one answer in teaching and that decisions are based on a synergy of many tools.

This framework integrates education research into a unified program that guides teachers, but does not determine the decision-making. For example, when preservice teachers read about wait-time, the teacher educator links the readings to the decision-making framework. This means the teacher educator guides the conversation through what wait-time means to the learner and the desired goals of the teacher.

The importance of this model of Clough et al. (2008) is that preservice teachers "weigh many factors including desired student goals, how people learn, and the interaction among pedagogical practices" (p. 832). The framework emphasizes that teachers need to implement research in relation to their whole classroom's learning and interactions. Clough et al. (2008) use the decision-making framework in their science teacher education programs by explicitly drawing preservice teachers into the layered complexities of teaching, by linking readings to the key aspects of the decision-making such as questioning, wait-time, and student learning. The program describes preservice teachers critiquing lesson plans, and analyzing videotapes of experienced teachers to help them gain insight into their decisions in the classroom, and then examine the impact of these decisions on their students. When preservice teachers engage in dialogue with fellow preservice teachers on learning and teaching, they make sense of educational research, and how it is or is not relevant to their desired goals for their students (Clough et al., 2008). Clough et al. (2008) state this in turn will help make teachers critical consumers of educational research and will help them understand when and how to integrate it into their practices.

The decision-making framework promotes an "art of teaching" (Clough et al., 2008, p. 842). In this teacher education program, the emphasis is on the types of

decisions teachers must weigh to make their choice for their class. This framework guides teachers in understanding that the decisions they make in their teaching are based on their students' needs. It also requires preservice science teachers to understand all the multiple factors that go into the education process. The "art of teaching" does not diminish the intuition a teacher brings to teaching, but also calls for an understanding of all the available options when choosing a course of action; one of those options is research-based literature.

The decision-making framework stresses the importance of personal experience while also recognizing its limitations. Research findings are acknowledged as important in the decision-making framework as well as having limitations. Personal experience, research based literature, collaboration with colleagues, and teacher research are important tools to be practiced by the teacher when making decisions about practice. Clough et al. (2009) point to a restructuring of teacher education towards an institution that provides the tools for teachers to be lifelong problem-solvers in their classrooms.

Assessment of the Three Frameworks

All three of these frameworks: practice-oriented, inquiry-oriented, and decision-making, attempt to place student learning as the key to teacher education. The practice-oriented framework of Hiebert et al. (2007) examines evidence for teaching and learning in the classroom, and then uses theory and experience to make improvements to the classroom. This procedure seems to rely heavily on a cause and effect connection in teaching and learning. Not enough emphasis is placed on teaching and learning as a process where the complexities of each instructional episode need to be weighed. The inquiry-oriented method, along with the decision-making framework, promotes research

and practice as an interactive process where teachers can confirm or challenge research findings or even pose new theories based on careful studies of their own classrooms (Lucas, 1988). Both the inquiry-oriented and decision-making frameworks allow teachers to examine the limitations and possibilities of what experience in teaching and educational theory offer the practice of teaching.

The inquiry-oriented programs emphasize reading research literature while conducting one's own research in the classroom. The decision-making framework calls for research literature to be synthesized into the teacher education program. The decision-making program emphasizes reading educational theory as part of the whole teacher education process. Clough et al. (2008) wants teacher educators to "work with prospective and experienced teachers to help them understand how the research base can be used to inform practice" (p. 825). However, the decision-making framework does not provide a prescriptive strategy for how teacher educators create these decision-based programs and incorporate research studies, perhaps because the framework calls for a unified program with many parts brought together. Of the three frameworks I examined that looked at blending foundations and methods courses in teacher education, the decision-making framework is the only one that emphasizes theory and practice as an interconnected relationship.

All three of the frameworks encourage reflection as part of the teacher education programs. The Hiebert et al. (2007) framework uses reflective practice as a process to help teachers think about what is going on during a lesson. Teachers think about what happened during the lesson and what could be improved in the lesson. In the inquiry-oriented framework, preservice teachers learn to reflect on the theoretical aspects of the

pedagogical thinking behind their inquiry (Byman et al., 2008). In a similar way, the decision-making process employs self-reflection to understand why a lesson went well or did not go well (Clough et al., 2008). An important part in the reflective process of the decision-making method is to make implicit beliefs explicit. A component missing from all three frameworks is how best the reflective practice should be implemented into the program. None of the programs bring up collaborative peer reflection, which provides an alternative way of making implicit beliefs explicit.

The three frameworks all run the risk of being implemented as a step-by-step approach if the preservice teachers are not able to develop their own teacher stance. In addition, none of the above mentioned frameworks explain how the preservice teachers will learn how to read and access what the study is saying. All three frameworks have the preservice teachers explore a problem of their own and conduct action research on the problem. Action research is about reflecting on practice and generating theories that are tested in practice and reflected upon again (Altrichter, Feldman, Posch, & Somekh, 2008). It is a continuous cyclical research process whereby the practitioner seeks to improve their practice. A problem with all three frameworks is that the preservice teachers do not find, read, and interpret research literature on their own. The research literature is always provided for them. This can prevent the preservice teachers from acquiring ownership in how to access, understand, and incorporate research literature into their practice. Teachers need to wrestle with the theories of teacher education and how this impacts how they teach and what their students learn (Shulman, 1987). It is important for preservice science teachers to understand how to access the research literature, how to read it, and how to evaluate it in order to incorporate it into their practice.

A study by Gitlin et al. (1999) of an inquiry-oriented program, mentioned previously in this paper, noticed preservice teachers need to develop critical analysis skills to read research–based literature. Gore and Gitlin (2004) stressed the need for education programs to engage preservice teachers in the examination of research and practice. They advocated for preservice teachers to learn how to access, read, and translate educational research for their practice. They said for preservice teachers, during teacher education, to take "an approach to decision-making and practice that utilized both research and experience and challenged some of the limitations inherent in both forms of knowing" (Gore & Gitlin, 2004, p. 51). They argue for both researchers and teachers to engage in discussions over research that will inform each other.

Gore and Gitlin (2004) state that academic research will only become useful to teachers when teachers become educated about research and not just trained in basic skills of conducting research. They said that education about research should include critically examining the possibilities and limitations that research literature offer to the preservice teachers' context. Gitlin et al. (1999) state that somehow teacher education must compare preservice teachers' theories with the ones rooted in the research literature for the preservice teachers to see the purpose of using research studies in their classrooms. Below I will examine the literature on incorporating formal theory into professional development.

Professional Development

In this section, I examine why teachers engage in professional development and what defines successful professional teacher development. In 1994, Bell and Gilbert

researched how teachers develop both professionally, personally, and socially in professional development programs. They conducted a three year study that found:

> The teachers entering into the teacher development activities were seeking new teaching suggestions that work, new theoretical perspectives with which to think about their teaching, to improve the learning in their classrooms, to feel better about themselves as teachers, and to learn how to put new ideas into action (Bell & Gilbert, 1994, p. 486).

Bell and Gilbert (1994) also found that the teachers who joined the professional development were aware that isolation was problematic. The facilitator's goal in this professional development was to emphasize that the teachers were competent and not struggling because they encountered problems in practice. The professional development program also highlighted teachers as researchers. The teachers adopted a teacher as learner role in the program. They were given teaching activities to try in their classroom, and then opportunities to share these lessons with fellow teachers.

Bell and Gilbert (1994) found that professional development worked best when teachers were able to talk to each other about a task such as using a new teaching activity. The conversations were most effective when the teachers were not just discussing facilitator led questions, but rather they were deciding what to talk about regarding the teaching activity. The teachers expressed how they felt hindered when told what activity to try in their classroom, and that their development as teachers was supported when given activities where they could choose what worked for their situation. Bell and Gilbert (1994) found that the teachers got as much from each other as they did from the facilitator. Bell and Gilbert (1994) also stated that teacher development is on-going and that teachers need to feel empowered and socially able to seek and initiate new relationships and activities with each other outside the professional development

program. This study stressed that teacher development is about teachers learning rather than "getting teachers to change" (Bell & Gilbert, 1994, p. 493). They emphasize that metacognition is part of the development of teachers where teachers purposefully inquire into an aspect of their teaching that they see as problematic and wish to change.

Constructivist/Sociocultural Model

Following the work of Bell and Gilbert (1994), Howe and Stubbs (1996) developed a constructivist/sociocultural model to professional development. This model was constructed over ten years. Howe and Stubbs (1996)

> focus was on teachers' construction of their own knowledge of science (content knowledge) and science teaching (pedagogical content knowledge), but over the years, the focus expanded to include the three aspects of teacher development articulated by Bell and Gilbert (1994) as professional development, personal development, and social development (p. 169).

The model is a continuing process that begins with extended workshops that bring research scientists and science teachers together and uses teacher educators as facilitators at the workshops. The purpose of the workshops is to help science teachers develop curriculum materials for their students; in addition, they share their knowledge and skills from the workshops with their colleagues that encourage support and dissemination throughout their schools.

This model, of Howe and Stubbs (1996), is based on teacher as a learner with the hope that teachers will construct new knowledge of science and teaching through participation in a creative cycle of learning. The findings, from the Howe and Stubbs (1996) study, found that the teachers became empowered to take charge of their own professional and personal development. The teachers became independent learners

because they acquired the tools of their craft and were more knowledgeable in science, which helped them become more competent teachers.

The study of Howe and Stubbs (1996) showed that science teachers could grow and become competent by being in charge of their own professional and personal development, through a professional development program that provided the teachers tools to use in their classroom. The workshops from this study were constructed around weaving environmental science in the science curricula. In this program, the teachers learned about environmental science, and then explored ways, as a group, to merge environmental science into their teaching. The teachers were learning new ways to incorporate science into their curriculum. This study did not focus on educational research and how to integrate those findings into their curriculum; however, this study did point out how a constructivist/sociocultural model of professional development empowered teachers as learners.

The Role of Theory in Inservice Teacher Development

Gore and Gitlin (2004) conducted a study on teachers' views of educational research. Gore and Gitlin's study of 147 practicing teachers found that inservice teachers felt educational research was not relevant to their teaching practice. The teachers struggled to understand how academic research acquired at one teaching site could be transferred to another classroom. Another key finding, from Gore and Gitlin's study (2004), was that the teachers did not feel the researchers were credible because many of the researchers may not have had recent classroom experiences; thus, they questioned how they could understand the problems the teachers face in the classroom. Gore and Gitlin (2004) found that of the teachers who stated that they did value research, many felt

that they had no time to read and engage with research given their work lives. Teachers also reported in the survey that the language of research papers was not easily accessible to them. In summary, the findings were that teachers were skeptical of educational research and tended to rely on experienced colleagues when they had problems in practice.

Broekkamp and van Hout-Wolters (2007) conducted a literature review to explore strategies to improve the gap between educational research and practice. Broekkamp and van Hout-Wolters (2007) examined the following four models to improve the connection between research and practice. The first model, Research, Development, and Diffusion Model (RDD model) is based on the assumption that only a few practitioners pay attention to research, as a result, this model advocates a mediator to select, and adapt research results. The mediator reads the research and translates the theories and learning tasks, and then disseminates these translations to practitioners through teacher guidelines or practice journals. The problem I see with this model is that someone is deciding for the teachers what research should affect their classrooms. This method saves the teachers time in that they do not have to read and search through endless amounts of studies. However, teachers do not gain ownership of the research materials, because they do not learn how to evaluate and interpret these findings for themselves. There are many questions that arise from this model. For example, “Who is the mediator?” “Are the mediators school based?” “Are the problems explored in the literature from teachers’ concerns?”

The second model is the Evidence-Based Practice model (EBP). Broekkamp and van Hout-Wolters (2007) examined two ways research can be systematically applied to

educational research. One way is through conducting action research (Altritcher, et al., 2008), which I examined earlier in this literature review. The second EBP model is evidence-based teaching. Evidence-based teaching uses empirical scientific research that has been rigorously evaluated and shown to work (Slavin, 2002). Evidenced-based teaching advocates for scientifically based research that uses randomized experiments to provide relevant evidence like what has become the norm in medicine (Evidence-Based Medicine Working Group, 1992). This second EBP model maintains that hundreds of randomized studies on educational practice will help lead to substantial improvement in education (Slavin, 2002). Slavin (2002), who advocated for the evidence-based model, explains how presently educational research is rarely implemented and that rigorous randomized experiments can help provide the linkage between research and practice like in medicine. This model calls for randomized experiments where schools are randomly assigned different instructional conditions (Slavin, 2002). However, there have been very few studies that show such a connection in education.

The next model is the Boundary-Crossing Practices (BCP model). This model involves combining the tasks from different professional domains. Broekkamp and van Hout-Wolters (2007) referred to programs in their native Netherlands, where professional teachers, policy makers, and researchers work together in secondary and primary schools to design professional development and innovative education for schools. Boundary crossing schools in the United States are called professional development schools (Broekkamp & van Hout-Wolters, 2007). Professional development schools focus on research-practitioner collaboration (Darling-Hammond, 1994). In these schools, teachers contribute to gathering data and research, and researchers are involved in teaching. This

model explores how practitioners and researchers influence each other through collaboration (Broekkamp & van Hout-Wolters, 2007). My review of four databases has not found any research on how researchers and practitioners read and interpret educational studies at professional development schools.

Finally, Broekkamp and van Hout-Wolters (2007) advocate the Knowledge Communities (KC model) to link research and practice. They define the KC model as people building professional networks that allow the participants to share their expertise and generate new knowledge. What Broekkamp and van Hout-Wolters (2007) call Knowledge Communities is based on the communities of practice model (Wenger, 1998). This model is most effective when the professional background of the participants is heterogeneous, and the activities of the group involve boundary-crossing practice (Broekkamp & van Hout-Wolters, 2007).

Broekkamp and van Hout-Wolters (2007) see these four models as complementary and not conflicting. They state that these four models are still in the abstract phase and have not been developed yet in a concrete way to make lasting change. They advocate all four models to be developed further, and if possible, integrated into each other. I believe all four models could be strengthened through the development of journal clubs. Many of these models are calling for teachers to be implementing research studies into their practice (e.g. EBP model, BCP model, and RDD model). Broekhamp and van Hout-Wolters (2007) stated that practitioners should learn how to access and critically evaluate research studies but they do not explain how practitioners will learn these skills. I believe if conversations are being had on how to infuse effectively theory into teacher development then journal clubs need to become a key component of teacher

development. Physicians learn to interpret research studies for their own use throughout their medical education and early training in journal clubs (Evidence-Based Medicine Working Group, 1992). If teacher development goes in the direction whereby teachers truly use research findings in their practice then we will need to incorporate journal clubs during teacher education and professional development.

Preservice and Inservice Science Teachers Learning Together

Besides the traditional mentor teacher and mentee relationship between preservice and inservice teachers, I wanted to examine programs that bring preservice and inservice teachers together to learn from each other. I examined two studies that have explored new areas for the relationship between experienced and inexperienced teachers. These studies place the preservice and inservice teachers as learners working together.

Co-teaching

The first model I examined is co-teaching. A study on co-teaching (Roth, Masciotra, & Boyd, 1999) involved an experienced teacher and a preservice teacher working together to co-teach a four-month unit on the ecology and physical properties of water. The preservice teacher learned the practice of teaching, through developing lessons as a group, observing the experienced teacher in real-time, asking students questions, and later through reflection on actions together by observing the videos of the lessons. The inexperienced teacher learned the tacit knowledge of a classroom: how to guide questions, walk around the classroom, call on students, and provide wait time when asking questions. This study pointed to a new relationship between experienced and inexperienced teachers, that of a team. Through co-teaching, there were many opportunities for the preservice teacher to learn from the inservice teacher and acquire the

tacit knowledge necessary for mastery of teaching. However, this study did not explore how the relationship impacted the inservice teacher and what the inservice teacher learned from this experience.

Partnership Based Approach: A Triad

Another study examined a new relationship in teaching, "triadic partnership." This partnership is between preservice teacher, inservice teacher, and a school-based teacher educator (Kenney, 2010). The teacher educator's role was to offer support for the preservice teacher. The teacher educator coordinated the meeting of the inservice and preservice teacher. The preservice and inservice teacher collaboratively planned, delivered, and evaluated a science unit over the course of six weeks. The inservice teacher was not evaluating the preservice teacher, but rather planning and teaching a unit alongside the preservice teacher.

The teacher educator provided professional development to the preservice and inservice teachers in enacting reformed-minded science activities. The collaborative relationships in this partnership helped the preservice teachers feel more confident in their teaching. The preservice teachers felt they learned to create assignments that connected to the unit's objectives and develop skills needed in the classroom. The inservice teachers felt they were more aware of resources from the professional development, and they were able to reflect on their own teaching. However, many inservice teachers complained that they hoped to learn new ideas and strategies from the preservice teachers; instead they felt the partnership was not given enough time to develop over the busy six weeks of the program.

This program allowed preservice teachers to work side-by-side with an inservice teacher. It also provided professional development on the latest studies on reform-minded science, but it did not allow the experienced and inexperienced teachers to read and critique the literature on the reform projects. The teachers choose which learning activities to incorporate into their units, but not the knowledge of how to theorize how these activities fit into their curriculum. In addition the program did not provide learning opportunities to grow between the inservice and preservice teachers.

In the next section, I look at the literature that helped me examine a journal club through a sociocultural lens. I explore how talk can be used to access formal theory and practical theory. I also examine the role a community of practice plays in helping members of a profession learn and grow from their social interactions around an activity related to practice.

Theoretical Framework

A Sociocultural View of a Journal Club

In this section, I take a sociocultural view of the journal club. A sociocultural view places emphasis on the social interaction among members engaged in a joint activity and the knowledge bound to these social practices (Howe & Stubbs, 1996). The goal of the journal club is to have the teachers collaboratively learn to use language and knowledge as tools to reflect on formal and practical theory. In the journal club, the activities are embedded in authentic tasks (Lave, 1996) and learning is mainly a sociocultural dialogic activity (Wells, 1999). This means language is an important process of the learning in the journal club. For the study, I will apply the definition of learning as appropriation. Wells (1999) stated,

> …learning is the taking over and mastering of cultural artifacts and practices in the course of engaging in joint activities, in which the functional significance of these artifacts and practices is modeled and the learner receives assistance in their use (p. 155).

Following a sociocultural model in the journal club, the following pedagogical strategies were used: dialogue, peer collaboration, and questioning (Bonk & Kim, 1998). In addition I co-learned with the teachers, the teachers brought knowledge to the club, and there was joint knowledge construction during the journal club meetings (Bonk & Kim, 1998). I modeled how to develop a question from practice and then research the literature. I provided assistance to the preservice and inservice science teachers throughout the journal club helping them improve these skills. Talk became the means by which the science teachers appropriated the symbolic artifacts, texts, and practices of teaching. Before examining the meaning of talk and text, I will examine the formal and practical theories of teaching knowledge.

Formal Theory and Practical Theory

Fenstermacher (1994) explored the epistemological character of teachers' practical reasoning in the chapter *The Knower and The Known: The Nature of Knowledge in Research on Teaching.* He examined two notions of knowledge: 1) "the 'know how' that teachers accumulate through experience and reflection" (p. 26), and 2) the knowledge of teaching generated by teacher educators "from studies of teaching that employ conventional scientific methods" (p. 7).

The knowledge generated by teacher educators Fenstermacher (1994) called formal knowledge. He defined formal knowledge as the knowledge generated from studies of teaching that follow "certain standards of significance, generalizability or validity…one's knowledge claims must be justified in such a manner that they range

beyond the immediate context, situation, or slice of time" (Fenstermacher, p. 28). The knowledge can come from qualitative or quantitative studies that have followed acceptable methodology and were peer-reviewed. Fenstermacher (1994) refers to practical knowledge as the knowledge teachers develop "from participating in and reflecting on action and experience" (p. 11). Practical knowledge he defines as the situated information obtained by reflecting on action and experience that may not be expressed in speech or writing. Fenstermacher describes practical knowledge as having similar distinctions to the work of anthropologist Geertz's (1983) local knowledge. Like local knowledge Fenstermacher (1994) believes practical knowledge

> can be propositional, explicitly stated, tested, and fully justified in a manner similar to any scientific claim; the sole difference is that its range of application is restricted to the context to which it was formed (p. 32).

Fenstermacher (1994) views practical knowledge as a legitimate epistemological category if this information follows the same demands as formal knowledge calls for justification and warrant. Fenstermacher (1994) acknowledged that discourse of both formal and practical knowledge has potential to produce new understanding. However, Fenstermacher (1994) did not suggest how teachers develop practical knowledge of teaching.

Sanders and McCutcheon (1986) in their article "The Development of Practical Theories of Teaching" reasoned that teachers possess practical knowledge that helps guide them in the classroom. This information varies from what questions to ask students to how to prepare handouts. Teachers use practical experience to produce desired consequences in their classroom. The conceptual structures guiding the teachers' desired intention in the classroom are their practical theories. Sanders and McCutcheon (1986)

defined practical theories as “conceptual structures and visions that provide teachers with reasons for acting as they do, and for choosing the teaching activities and curriculum materials they choose in order to be effective” (p. 54-55). These are the theories teachers use to accomplish their goals in the classroom.

Practical theories are partially developed early on when teachers are students (Lortie, 1975). They experienced firsthand, as students, what worked for them and what did not work. Teachers’ theories of teaching are influenced by the experiences acquired while becoming teachers, and then, modified as they teach and discover what works and what does not work for their students. Teachers often value the knowledge of other teachers over the knowledge given by research studies because teachers are more concerned with not whether a new practice will work, but rather will it work in their context (Sanders & McCutcheon, 1986). Sanders and McCutcheon (1986) argue that practical theories are not like scientific theories, because unlike scientific theories, practical theories may not be able to withstand the logic, rigor, and public discourse scientific theories hold. Practical theories are like formal theories in that the teachers have undertaken practical inquiry to develop them. In addition, these theories have been tested by the individual teachers who hold them.

Sanders and McCutcheon (1986) hypothesized that teachers conceptually test new ideas and past experiences. The teachers do this by: 1) envisioning mentally what the new idea would look like in the classroom; 2) if a new approach passes the conceptual test then a teacher will try it in the classroom; 3) the teacher reflects on the effectiveness of his/her theory, which in turn may change, modify, or expand the previous theory. Sanders and McCutcheon (1986) stressed that teachers will develop practical theories based on

the findings of educational research when the findings have gone through the teachers' own personal test of effectiveness based on their empirical observations and reflections to their practice.

Feldman (2000) examined teachers' practical theories through a conceptual change model and found that teachers do not easily modify their practical theories. Feldman (2000) found that teachers did not give up a practical theory unless they became disconnected with it because it had become ineffective or led to problems in practice. However, a teacher's disconnect with an old practical theory did not necessarily lead the teacher to take up a new practical theory. Feldman (2000) found that certain criteria needed to be met for teachers to accept a new practical theory. The new practical theory should be beneficial, sensible, and enlightening when applied to situations. New practical theories need to make sense and give teachers a new way to understand their practice. Feldman (2000) suggested practical theories may change through teachers engagement in sustained conversations with other teachers. In the journal club, the teachers will read formal knowledge of education, but then discuss the formal theory with other teachers using the practical theories of teaching that they have acquired while teaching.

Sociocultural Dialogue

Text can be spoken or written. The language used in written text is often more abstract than that of speech (Wells, 1999). Wells (1999) states "compared with speech, written texts have much greater permanence; they are also much slower to produce, and, in reception, much more under the control of the receiver" (p. 142). Thus, the function of written text is more suited for personal reflection, whereas speech is more suggestive of collaborative action (Wells, 1999). In learning, it is the practical texts, speech, and the

reflective text, written, that become tools for thinking and developing new meaning (Wells, 1999). In a science teacher journal club, the research study becomes the text for thinking and developing new meanings about teaching. New meaning does not necessarily come through individual reading of the study or the teacher educators' interpretation of the article; it is the talk the learners exchange in with peers over the study, with the teacher educator modeling the activity like an apprentice (Collins, Brown, & Holum, 1991) that are most productive for learning (Wells, 1999).

Wells (1999) explained that text takes on new meaning when the formal language of the text is interchanged with the "everyday language of common sense" (p. 156). Wells (1999) emphasized that apprentices learn best when they are performing an activity and explaining it to others. His work also supports the learning of tools, such as texts, to be undertaken while working on challenging projects that require the knowledge from the tools. This can lead to further use of the tools or even the invention of new tools. Applying Wells' (1999) concepts of talk, text, and activity to journal clubs means that the educational articles would be of greatest value to the teachers if used when they are working on challenging problems. This will then initiate a need for teachers to use these new tools (research article) or even invent new tools (new adaptations of the concepts from the articles to practice).

Literacy research has shown that students' understanding of a written text grows when the students make connections from the written text to their lives (Gutuerrez, 2009; Jewett, Wilson, & Vanderburg, 2011; Langer, 2001). Jewett et al. (2011) assert that dialogue about the written text allows students to hear diverse interpretations of the written text and gain new ideas and knowledge to use. Vygotsky (1978) explains how

language use and activity prompt new ways of thinking. A study of English and history classrooms showed reading and discussing the written text are the cultural tools students use to make sense and critically evaluate multiple perspectives (Miller, 1996).

Reading and discussing text are not always directly tied to problem-solving and incorporating multiple perspectives. Sometimes when students read and discuss, they use what Chernobilsky, Dacosta, and Hmelo-Silver (2004) refer to as unelaborated language use. This means the students use the information they already have before the discussion and reading without using new knowledge. Chernobolisky et al. (2004) found that sometimes students move beyond unelaborated talk to exploratory information. Exploratory talk involves students using new information and ideas, through discussing readings, and drawing on past knowledge that is relevant. However, Chernobolisky et al. (2004) stated that language and knowledge only become conceptual tools when the new knowledge transforms past knowledge. The discussions need to incorporate the vocabulary of the community and employ the knowledge gained to problem-solving. This study of Chernobolisky et al. (2004), on a problem-based undergraduate Educational Psychology course for preservice teachers, found that learning the language of the course and developing that knowledge was bridged through collaborative discourse in groups that function as a learning community.

I explore further exploratory talk and the different types of talk that arise among peers in groups to help me understand the conversations the teachers had in the journal club. I used the dialogic theoretical framework of Wegerif and Mercer (1997) for the study of peer talk that is likely to arise in small group work which is task-based. The journal club is a small group of peers engaged in what Wegerif and Mercer (1997) call

interactive dialogue. They define talk as being of three modes: disputational, cumulative, and exploratory.

Disputational talk is evident by disagreement and individual decision-making. The participants in the conversation are not interested in offering constructive criticism or share knowledge. Disputational talk has particular characteristics such as "short exchanges consisting of assertions and challenges or counter assertions" (Wegerif & Mercer, 1997, p. 53). Disputational talk often ends with each person feeling they have "won" the conversation (Wegerif & Mercer, 1997).

Cumulative talk is when participants speak positively but it is uncritical thought. In cumulative talk, participants use talk to build a "common knowledge" through accumulation of ideas (Wegerif & Mercer, 1997). "Cumulative discourse is characterized by repetitions, confirmations, and elaborations" (Wegerif & Mercer, 1997, p. 53). Cumulative talk unlike disputational talk is cooperative talk that can lead to new knowledge when participants share new perspectives. The problem with cumulative talk is that the knowledge is not critically examined. In cumulative talk, information is more accepted for face value and not critically examined for its truth. Partners in cumulative talk are more concerned with maintaining harmony in the talk and very rarely are mistakes corrected throughout the talk.

Exploratory talk is more complex than disputational or cumulative talk. The partners in exploratory talk challenge each other for an understanding but in a cooperative way (Wegerif & Mercer, 1997).

> Exploratory talk occurs when partners engage critically but constructively with each other's ideas, statements and suggestions. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses offered (Mercer, 1996, pp. 368-369).

When talk is exploratory, the partners in the conversation do not respond with a simple yes or no, but instead they explore and weigh different perspectives brought forth in the discussion (Wegerif & Mercer, 1997). Wegerif and Mercer (1997) explain that disputational talk can be used when partners have irreconcilable differences and cumulative talk is used for an accumulation of common knowledge that does not need to be critically examined; however, exploratory talk "allows different voices to inter-animate each other in a way which not only constructs shared knowledge but also critically assesses the quality of that knowledge" (Wegerif & Mercer, 1997, p. 58). Exploratory talk is the mode "closest to reasoning as a social practice" (Wegerif, Mercer, & Dawes, 1999, p. 496).

Scholarly Talk

In this study, I have defined the type of talk the teachers engage in at the journal club as scholarly talk. Scholarly talk comes from the teachers own use of the word scholarly to define what they are doing in the journal club. It also is defined using the different modes of collaborative discourse that I have explored in the literature and witnessed them using. Scholarly talk often began in the journal club with teachers critiquing a research article. The teachers would then share anecdotes from their teaching experiences to help explain and connect concepts from the article to their practice. Another mode of scholarly talk the teachers engaged in was exploratory talk. Exploratory talk helped the teachers weigh different perspectives heard in the journal club and examine how to apply the ideas learned in the journal club to their teaching situation. I provide examples of this type of talk in chapter five.

Summary of Sociocultural View of a Journal Club

I examined the theory behind sociocultural dialogue to better understand how as a group engaged in talk, the teachers can connect theory to practice. In the journal club, it is the formal theory of science education (Fenstermacher, 1994) that the teachers are jointly inquiring into and looking to master. However, it is the teachers own practical theories (Sanders & McCutcheon, 1986) of classroom practice that are examined in the conversations through the lens of the formal theory.

I wanted to understand the difference between text that is both spoken and written since both texts are an important component of the journal club. Wells (1999) states that written text is more often reflected on personally whereas spoken text is indicative of collaborative action. I examined how a group can learn together by personal reflection on a written text and collaboratively engaging on their reflections. I turned towards literacy research to understand how connecting written texts to a student's life helps the students understand the written text (Gutierrez, 2009; Jewett et al., 2011, Langer, 2001). This concept supports how having the teachers choose a topic from a problem or issue they have in teaching will help them connect the written text to their teaching practice. In addition, Jewett et al. (2011) found that dialogue about written text helps students hear new interpretations and ideas from the written text. This helps provide a basis for how reading science education articles in the journal club is different than just assigning articles for students to read on their own.

The dialogic theoretical framework of Wegerif and Mercer (1997) provided the basis for me to examine the teachers' talk in the journal club. This framework is based on small group interacting around a specific task. Thus, this framework was helpful to use to

examine the journal club dialogue and understand how the teachers used talk as a tool to understand and learn the written text of the research articles.

Communities of Practice

"Communities of Practice" is a social theory of learning (Wenger, 1998). In a community of practice (CoP) members share information on concerns or passions of a topic, and by interacting over time, they deepen their knowledge and understanding of this topic (Wenger et al., 2002). In this social theory of learning, it is the interplay of participation, engagement in the community, and reification, the objects or tools of the community, that gives new meanings to the artifacts and situations encountered by the community (Wenger, 1998). Wenger (1998) explains that the concept of reification is about creating "points of focus around which the negotiation of meaning becomes organized" (p.58). When communities write procedures for meetings or write down laws for functioning, these become part of the reified materials that shape the community (Wenger, 1998). In the journal club, the agreed upon guidelines may become reified.

For teachers, the national and state frameworks could represent the reification the teachers need to decipher to become a teacher. These reified standards may become the focus in which the teachers' classrooms may become organized around. In the journal club, the research articles represent one point of focus the teachers are trying to decipher. In a community of practice, the reified concepts are unpacked and examined (Wenger, 1998). It is both participation and reified materials that allow multiple perspectives and interpretations to become a crucial part of the negotiation of a community (Wenger, 1998).

However, in a community of practice reified concepts are not the only anchor to a group, if they were then that would mean learning was just about acquiring knowledge and information (Wenger, 1998). Participation is an essential part of learning in a community of practice. In a community of practice, "the focus on the social aspect of learning is not a displacement of the person. On the contrary, it is an emphasis on the person as a social participant…" (Wenger, 2010, p. 181). Learning in a community of practice involves the participants 1) discovering how to mutually engage in the practice; 2) understanding and amending a joint enterprise; and 3) developing a shared repertoire with fellow participants (Wenger, 1998). These three characteristics help members to continually engage and learn in a community of practice. I examine below, in more detail, the three characteristics of a community of practice that create coherence within a community and opportunities for learning in practice (Wenger, 1998).

Mutual Engagement

Mutual engagement is the way the members of a practice interact with each other. Members of a community of practice do not all share the same beliefs or problems, but rather, through their interactions; they influence each other's meaning of the practice. They negotiate a way to be in this community despite the differences they bring, and through that, the members change. Participants learn, in a community of practice, the competence in a practice and how they will identify with this competence (Wenger, 2010).

When reading a research article from the perspective of teaching practice, the teachers are able to interpret and analyze the formal theory based on their practice situations. Sanders and McCutcheon (1986) refer to this as a reflection "on the meaning

of the information acquired in light of the educational aims and expectations of that setting, and in comparison with other alternative practices, in order to decide whether to modify, replace, or retain the practice under consideration" (p. 66). Therefore, a community of practice can help teachers explore practical theories through comparison with alternative practices.

Joint Enterprise

A joint enterprise comes through the shared problems and solutions members collectively try to negotiate to their practice. Through collectively conferring over what is important and what is not important in their practice, the members become accountable to each other. The accountability does not necessarily mean accountable to outside rules or policies of society, but responsible to each other around the rules or goals this community has interpreted about their practice. In a community of practice, the translation of standards and tools of practice are not done in isolation, but negotiated through the communities' joint understanding of their meaning to teaching. It is conversations that lead to a joint meaning of teaching. Wells (1999) refers to talk that directly deals with problems members have with text as "messy conversations." Wells (1999) stated that these "messy conversations" are usually the most productive conversations "for learning how both talk and written text are used to make meaning and develop understanding" (p. 157). A joint enterprise of a community may lead to "messy conversations" that can foster new understandings about practice.

Shared Reportoire

Shared repertoire is the third characteristic of a community of practice. A shared repertoire is the shared tools, stories, symbols, actions, and concepts that the community

has adopted, and in turn, this becomes a part of practice (Wenger, 1998). It is through the sharing of tools or stories of practice that the community develops its practice (Wenger, 2010). Communities of practice can grow spontaneously, but they can also be cultivated (Wenger et al., 2002). Wenger et al. (2002) argue "organizations can do a lot to create an environment in which they can prosper: valuing the learning they do, making time and other resources available for their work, encouraging participation, and removing barriers" (p. 13). I am exploring in this study if a journal club can provide the seed for a community of practice to grow.

Peer-to-Peer Learning

Communities of practice have been organized in public and private sectors to be a vehicle for peer-to-peer learning (Wenger, 2010). The cultivation of a community of practice in a teacher education setting is to foster horizontal learning and not vertical learning (Wenger, 2010). Horizontal learning comes from the interactions of peers in a community. Vertical learning describes learning from a prescribed curriculum administered from someone of more authority over someone with less authority. In a community of teachers, horizontal learning could involve preservice teachers not just watching a mentor teacher teach, but watching each other teach, or, horizontal learning could involve a preservice teacher co-teaching a lesson with a mentor teacher.

One of the benefits of horizontal learning in teacher education is that it can foster for the teachers a greater commitment to learn (Wenger, 2010). Horizontal relationships encourage horizontal accountability. Wenger (2010) describes horizontal accountability as giving rise to strong learning partnerships where members establish the standards of practice, provide peer recognition, and collectively make a commitment to learning.

Wenger et al. (2002) view knowledge not as an object that is written and then stored and filed away, but knowledge resides in the understandings and relationships other members of a community have with the knowledge. It is the understandings and relationships teachers have with formal theory in education that gives the formal theory its meaning. Wenger et al. (2002) argue that when responsibility is placed with the practitioners "to generate and share the knowledge they need" (p. 12) then knowledge of a practice will flourish. Journal clubs place the responsibility of learning with the teachers. The reading and understanding of the formal theory of education comes from the teachers' personal desire to answer questions of practice.

Situated Knowledge

A teaching curriculum, according to Lave and Wenger (1991), is one where the teacher supplies the curriculum and structure for learning, which in turn may limit the learning opportunities that arise. During teacher education, the curriculum is often structured more as a teaching curriculum. Lave and Wenger (1991) argue for a learning curriculum that is not an external view of learning like the teaching curriculum, but rather the learning curriculum comes from the learners' everyday experiences and perspectives. Lave and Wenger (1991) define a learning curriculum as a characteristic of community. In teacher education, there should be opportunities for the learning curriculum to be based on the preservice teachers' legitimate peripheral participation. Lave and Wenger (1991) define legitimate peripheral participation as the role newcomers participate in with old-timers as they master the knowledge and skill to be a practicing member of the community. The preservice teachers' experiences and peripheral perspectives of the

teaching community that they participate in during teacher education should emerge with a learning curriculum.

The preservice teachers learn how to use their knowledge of teaching during the practicum. Knowledge acquired through peripheral participation during the teaching practicum yields situated information that often goes unexamined, and then helps create the perceived divide between theory and practice. Brown, Collins, and Duguid (1989) argue "that by ignoring the situated nature of cognition, education defeats its own goal of providing usable, robust knowledge" (p. 32).

Lave and Wenger (1991) refer to learning as not just situated in practice, but that learning must be an integral part of the social practice. Lave and Wenger (1991) state that knowledge becomes instructional prescriptions or reified when teaching knowledge, skills, and tasks are separate from the social practice of the field. When the knowledge is internalized in this way by the practitioner, it is "construed as an unproblematic process of absorbing the given, as a matter of transmission and assimilation" (Lave & Wenger, 1991, p. 47). Learning that is dissociated from practice helps create conflicts among practitioners' viewpoints (Lave & Wenger, 1991).

It is during the teaching practicum that preservice teachers begin to understand the different problems and opportunities that inservice teachers encounter in their practice. Both preservice and inservice teachers need time and a place to engage in collaborative problem-solving where formal theory is a tool incorporated in their problem-solving conversations, which then allow the teachers to directly reflect on formal theory and practice. As a result, formal theory would not be seen just as a reified knowledge outside the practice and as "largely cerebral" (Lave & Wenger, 1991, p.47). Instead, the formal

theory could become a tool for problem-solving. In order to use formal theory in their practice, teachers will need to learn how to use the tool either during teacher education or professional development.

Identity

Participation in a community of practice helps teachers negotiate who they are in their professional practice. This connection between identity and practice is not overtly stated in communities of practice (Wenger, 1998). Participants in a community of practice learn who they are in this practice through engaging with other members of the field (Wenger, 1998). Wenger (1998) explains there are five characteristics that draw on the relationship between identity and practice. They are:

1) Identity as negotiated experience. We define who we are by the ways we experience ourselves through participation as well as by the ways we and others reify ourselves
2) Identity as community membership. We define who we are by the familiar and unfamiliar.
3) Identity as learning trajectory. We define who we are by where we have been and where we are going.
4) Identity as nexus of multi-membership. We define who we are by the ways we reconcile our various forms of membership into one identity.
5) Identity as a relation between the local and the global. We define who we are by negotiating local ways of belonging to broader constellations and manifesting broader styles and discourses (p. 149).

Wenger (1998) said that identity is the interweaving of the actual participation in practice and its interpretation from social experiences within the practice.

I am also examining the teachers' identity through the lens of Gee (2000-2001). He defines identity as "being recognized as a certain "kind of person" in a given context" (p. 99); thus, people have multiple identities that are connected to what they do in society. Gee (2000-2001) outlined four types of identity and explained what influences their formation and growth over time. Gee (2000-2001) recognized these four ways of viewing

identity may be present together or singularly as a person acts in the world. The first view of identity is the nature perspective (N-Identity). The nature perspective holds that identity is part of nature, and not society; however, this gets recognized and given meaning through institutions, discourse, and affinity groups. The second type is the institutional perspective (I-Identity). This perspective is shaped by the authorities of a particular institution. For example, science teachers have an identity that comes just from the position of being a science teacher and the responsibilities and privileges that go with that position.

The third perspective is a discursive perspective (D-Identity). This identity gains meaning through the way people treat, respond, and interact with others. This perspective may be influenced by institutional identity, which can sustain a discursive identity through an institution. The way a science teacher interacts and is treated is influenced by the responsibilities and rights of being a science teacher. The final and fourth type of identity is the affinity perspective (A-Identity). This perspective is shaped by allegiance to and participation in a group. The allegiance could come through sharing joint experiences locally or globally. Science teachers who are members of the National Science Teachers Association share an affinity identity. They become affiliated with the advocacy and values of the group.

These perspectives of identity are interwoven between the personal (N-Identity) and social (A-Identity). These perspectives help explain what it means to be recognized as a ‘certain kind of person’ (Gee, 2000-2001, p. 99). They provide an analytical lens to view the transformation of identity through institutions, organizations, and participation in communities of practice. Wenger’s (1998) community of practice model helps explain

how teachers become full participants in the journal club by developing their teacher identities. However, Gee (2000-2001) explains further how the teachers come to identify who they are as teachers through talk in the journal club. It is by participating in a community of practice that the teachers can consider new identities (Gee, 2000-2001).

Summary of Communities of Practice Framework

A community of practice allows divergent thinking and ideas to be heard through conversations or activities the community plans (Wenger et al., 2002). Wenger (1998) points out that it is through joint conversations that new insights are produced and adopted. I examined in this section the characteristics of a community of practice: mutual engagement, joint enterprise, and shared repertoire. These characteristics of communities are what helps participants become invested in the communities' learning (Wenger, 1998).

In the journal club, the structure is set-up so that the talk among teacher-to-teacher is where learning can develop. The responsibility for learning is with the teachers' reflections and talk about the research articles. Understanding the meaning of the article is not derived from the teacher educator's thoughts on the article. This is a departure from most learning situations in teacher education programs. The journal club places learning as the teachers' responsibility, and the teacher educator as the facilitator and guide through the learning process. It is important in journal clubs to have the preservice teachers be in their teaching practicum. In a journal club, the preservice teachers need to be in their practicum to understand the situated knowledge of teaching and have concerns and issues that derive from the practice of teaching.

Chapter Summary

I reviewed the research literature on journal clubs to understand how journal clubs can be used to help teachers collaboratively reflect on theory in relation to their teaching practice. The literature on journal clubs was mainly found in the medical and other health related fields. The studies showed that journal clubs provided professionals an opportunity to examine their practice and consider alternative ways of conducting practice (Doney & Stanton, 2003; Mazuryk et al., 2002). Journal clubs helped develop critical thinking skills for its participants that could provide the participants alternative viewpoints on practice (Newswander & Borrego; 2009; Price & Felix, 2008; Seymour et al., 2003) Journal clubs have been found to develop communities of practice (Price & Felix, 2008; Newswander & Borrego; 2009). When a journal club functioned as a community of practice, the participants felt they were in a safe environment where they were able to gain confidence in their knowledge and problem-solving skills (Newswander & Borrego, 2009).

Two studies have shown journal clubs incorporated in teacher education and professional development (Barak & Dori, 2009; Brill et al., 2003). The Brill et al. (2003) study demonstrated how teachers can learn to critically examine biology studies in a journal club, and then implement them in their classrooms. It did not examine how teachers critically look at science education studies. Barak and Dori (2009) looked at a hybrid on-line and face-to face journal club. However, in this study the teachers were not engaging in talk centered on the research articles' implications to their practice; instead the journal club was structured more on developing the higher order thinking skills to

critique a study. Neither study looked at preservice and inservice teachers learning side-by-side in the journal club.

My examination of reflective practice emphasized how uncertainty and confusion can be viewed as a source for knowledge and reflective practitioners can learn from this confusion (Schön, 1983). Collaborative reflective inquiry is a tool to be learned by engaging in inquiry-based conversations with other teachers (Yinger, 1990). There have been many models of collaborative peer reflection (e.g. learning circles, lesson study, and collaborative action research), and while these three models focus on reflection on practice, none of these models include reflection on education research studies.

To better understand how theory to practice is currently connected in teacher education, I examined three frameworks specifically designed to improve the theory/practice connection. These three programs blend educational theory and reflective practice, and aim to not separate the reading of educational theory from the practice of teaching, which is usually done in teacher education. The frameworks of Byman et al. (2009), Clough et al. (2008), and Hiebert et al. (2007) stress having the preservice teachers reflect on their teaching practice with the goal of improvement.

Both the Byman et al. (2009), inquiry-oriented framework, and Clough et al. (2008), decision-based framework, highlight the need for preservice teachers to be reading research based literature to examine alternative perspectives on teaching. However, neither program explained how the preservice teachers will learn to access and critique the research literature. In each framework, the research literature was provided by the teacher educator and the discussions were led by the teacher educator. A study of preservice teachers, in the inquiry-oriented program, found the preservice teachers were

not proficient in critically analyzing the research literature (Gitlin et al., 1999). Journal clubs incorporated into all three of these frameworks would strengthen them. Journal clubs would provide a place for the preservice teachers to learn how to access and critique research literature. It would also provide a space for the preservice teachers to develop skills to collaboratively problem-solve issues and concerns that arise during their practicum. Journal clubs would help preservice teachers connect what happens in their teaching to research based literature.

I explored the characteristics that make professional development most successful for teachers to better understand how practicing teachers construct their own knowledge on teaching. Bell and Gilbert (1994) state that teacher development should focus on teachers as learners, and not on programs that push them to change. They stress that when teachers purposefully inquire into their teaching in areas they see as problematic, then they will wish to change their practice. The journal club offers inservice teachers professional development that focuses on the teacher as learner. Journal clubs prompt teachers to see their practice as problematic, and then through the articles and talk, hear different viewpoints that may initiate change in practice.

Viewing a journal club through the lens of a sociocultural theory places the focus on how the teachers learn to use language and knowledge as tools for reflection. A journal club is not about self-reflection because the emphasis is on the conversations in the journal club, and the fellow participant's understandings of the tools used in the journal club. One of the goals of this study is to understand how in a journal club preservice and inservice teachers use language and knowledge, derived from the formal

theory of the research articles and the practical theories they hold about teaching, to connect theory and practice to bring about change in their teaching perspectives.

Wenger et al. (2002) state that in a community of practice members of a field generate knowledge that can be used by the participants. A community of practice also helps transform the identity of participants through their engagement with other members of their field. In a community of practice, participants begin to understand who they are and who they hope to be in the field. I will explore a journal club through these perspectives to understand if the science teachers generate a community of practice that creates new understandings about teaching and transforms who they are as science teachers.

CHAPTER 3

METHODOLOGY

In this chapter, I will examine the practical and theoretical considerations I made to conduct this study. This chapter includes the following: a description of the research approach; data gathering methods; recruitment of participants; researcher profile; role of the researcher; dilemmas associated with the role of the researcher; ethical considerations; data analysis; and trustworthiness of the study.

Description of Research Approach

This study was a qualitative case study. A case study provides a deeper understanding of the dynamics present in a situation (Eisenhardt, 2002). In this case study, I focused on a journal club of preservice and inservice science teachers. Case studies provide details of the complexity and multiple perspectives of phenomena, but because case studies are context-dependent, they are not always generalizable (Rossman & Rallis, 2003). A case study does provide, through multiple sources of data, an in-depth look at a new phenomenon, thus, offers readers enough detail to determine if the findings are applicable to their setting (Merriam, 2009). Case studies are also an excellent means for getting as close as possible to the subject of interest, and thus, direct observation is one of the primary sources of data.

Qualitative studies are often descriptive and exploratory (Marshall & Rossman, 1999). The studies provide rich descriptions of situations often unexplored in the literature. A case study, in particular, is useful for research that looks for insight and interpretation of phenomena and not hypothesis testing (Merriam, 2009). A characteristic of qualitative research “is that the researcher is the primary instrument for data collection

and analysis" (Merriam, 2009, p. 15). I was the primary instrument used to gather the data and analyze it. The theory I developed comes from the data I collected in the journal club and the knowledge I gained from readings and my own background (Merriam, 2009).

It is important in case studies to define the case or unit of analysis (Gay, Mills, & Airasian, 2009; Yin, 2014). The unit of analysis in this study is defined by the dynamics of the members in the journal club. For the purpose of this study, I observed and examined the group for the entire length of the journal club-seven months. I bound this case to determine the data I needed to collect for this study and what was external to the journal club (Yin, 2014). My main focus was with the data that helped me understand the workings of this group and how being in the journal club informed the teachers' practice. I looked at how the teachers functioned as a community to understand the role a journal club can have in teacher education and professional development. However, when examining how the journal club influenced the teachers' understanding of their teacher identities, I looked at the preservice and inservice teachers separately. This splitting of the group into preservice and inservice teachers occurred from analysis of the data that suggested the two groups of teachers were not affected by their experiences in a journal club in the same way.

In the next sections, I elaborate on my theoretical perspectives of my research approach. I will then discuss the data collection tools I used in this study. I will also explain my role as a researcher. Finally, I will explain how I transformed the data through analysis and interpretation.

Qualitative Paradigm

This study followed an interpretive (also referred to as constructivist) view of research (Merriam, 2009). This point of view claims that reality is socially constructed, and there is no one absolute reality (Merriam, 2009). My goal was not to test theory, but rather to understand the experience of my participants in the setting I studied. I conducted an observational case study where I was a participant. This means that a great deal of my data came from my observations of the members' actions at the journal club. I also supplemented my observations with interviews from the participants and a review of the documents derived from the journal club (Merriman, 2009). Therefore, I have had to be self-reflective of how I influenced the research process and how it influenced me (Corbin & Strauss, 2008). I will explain how I attempted to remain self-reflective in the sections at the end of this chapter.

The questions that guided this study were the following:

1) Is the journal club a working community of practice? If so, how is the journal club a working community of practice?
2) In what ways does community seem to affect the teachers' perception of teaching practice in the journal club, as experienced by them and manifested in their conversations?
3) How do the research articles inform the journal club discussions around practice?
4) How does talk facilitate the teachers' learning about a variety of research topics, and their implications to practice?

Data Gathering Methods

Case studies employ a variety of techniques to gain a rich description of the situation (Merriam, 2009). The primary methods I employed were: 1) participation observation in the journal club; 2) interviewing; 3) focus groups; 4) artifacts; and 5) research journal. The main sources of data included audio-recorded group meetings, field notes from journal club meetings, audio recorded semi-structured pre- and post-

interviews, audio-recorded focus groups (midway and final), supporting artifacts (e.g. journal articles, reflective paper, e-mail exchanges), and field notes from my research journal.

A case study improves when it is the compilation of multiple sources of data (Yin, 2014). The strength of a case study is in its detailed, complex look at a situation that uses many sources of data to provide multiple perspectives (Rossman & Rallis, 2003). In the next sections, I explain in more detail the primary methods I used to obtain the data. I also describe the importance of the data to the study.

Participant Observation

The data from the journal club meetings were obtained through participant observation (Yin, 2014). The data were gathered, not from my passive observations, but from my participation in the actions that I studied. Participant observation is commonly used in ethnographies. A major advantage of collecting data through participant observation is that I not only have access to the events of the group, but I also have an insider's view of the interpersonal behaviors and motives of a group (Yin, 2014). In addition, as a member of the journal club, I can "perceive reality from the viewpoint of someone 'inside' a case" (Yin, 2014, p. 117).

Participant observation also has many challenges that accompany it. As a member of the group my role: 1) may have to be as an advocate, which may contradict my study; 2) may lead to my support of the group, if it did not already exist; and 3) may interfere with my observer role by not allowing me time to take notes and raise questions (Yin, 2014). Wolcott (2005) stated that researchers not only need to analyze the situation, but be self-conscious of their role in the situation. I studied the journal club aware of the

many trade-offs my position as a participant observer created for me. I will explain the trade-offs in the section on dilemmas associated with my role.

My research activities were known to the group. I documented the observations by:

1. audio-recording thirteen journal club meetings;
2. taking notes during each journal club meeting;
3. transcribing the recording of each journal club meeting;
4. reviewing memos of audio-recordings from the meetings with group members.

After reviewing my field notes or listening to the meetings, I discussed findings with the teachers at the beginning of the meetings. This allowed me "to verify interpretations with participants" (Corbin & Strauss, 2008, p. 30). Reviewing the previous week's discussion also helped remind the teachers about the article we read the week before.

Interviews

Interviews are an important source of data in a case study (Yin, 2014). Merriam (2009) explains how interviewing is an essential method when the researcher wants to know participants' behavior and feelings of situations that cannot be observed. My interviews followed a semi-structured format, which meant I had a mixture of structured and unstructured questions (Merriam, 2009). I had specific questions I wanted the teachers to answer, but I wanted to remain open to emerging responses from my interviewees (Merriam, 2009). I wanted to remain fluid to the conversation I had with an individual teacher and not rigid (Rubin & Rubin, 2011), which means I needed to be free to deviate from the protocol when I wanted to help a teacher unpack his/her thinking. The

interviews I conducted were what Yin (2014) calls shorter case study interviews, meaning they were no more than an hour long. Both the initial interview and second interview ran from forty-five to sixty minutes each. Yin (2014) explains that shorter case study interviews "still remain open-ended and assume a conversational manner, but you are likely to follow your case study protocol more closely" (p. 111).

I interviewed each teacher individually on two separate occasions: at the beginning of the study and the end. Both interviews were audio-recorded and later transcribed. The first interview addressed : 1) the preservice and inservice teachers' personal interests and professional experiences in science; 2) why they became a teacher and any prior experience they had in the classroom; 3) their experiences reading science articles and education articles; 4) previous knowledge and experience with journal clubs and their expectations for being in a journal club; 5) information about their schooling and questions that provided insight into the participants self (Appendix A). I needed to understand the teachers' backgrounds as learners and teachers of science in order to gain a perspective of their thoughts after being in the journal club. The second interview focused on the teachers' experiences in the journal club and their reflections on their teaching in light of being in the journal club. Many of these questions were developed throughout the journal club. The second interview also followed a semi-structured format (Appendix B).

Focus Group

Focus groups derived from market research in the 1950's to understand consumers' perspectives of a particular product (Merriam, 2009). Now focus groups are an important interviewing technique when the researcher wants to understand the groups'

interactions within a specific topic (Rossman & Rallis, 2003). Focus groups follow a constructivist view of data gathering because the data are socially constructed (Merriam, 2009).

I conducted two focus groups. Halfway through the journal club, I conducted the first focus group to gain the members' perspectives on how the journal club was functioning so that I could make necessary modifications (Appendix C). The first focus group was fifteen minutes long. It helped me gather input from all the members of the journal club to create a community that worked best for everyone. The first focus group had four of the six members present. It took place at a meeting that had been rescheduled because of a snow day. Before the next meeting I asked Eliza and Mary, who missed the meeting, the same questions I asked everyone during the focus group.

The second focus group took place after the last journal club meeting (Appendix D). It lasted about forty minutes. Its purpose was to gain a perspective of the community's views on four main aspects of the journal club: 1) what the members learned; 2) what was valuable to their learning; 3) what they felt did not contribute to their learning; and 4) what their views were of research based literature in education. All six members were present. Both focus groups were audio-recorded and later transcribed.

Artifacts

I collected artifacts as part of my case study. I collected 1) the articles the participants chose, 2) the reflective paper on their favorite articles, and 3) structured and spontaneous e-mail exchanges that occurred. Merriam (2009) states that physical materials are useful data because they can show changes that occur for participants through their engagements in activities. Documents also can provide the stimulus for

further inquiry through an interview or focus group (Merriam, 2009). The reflective papers helped inform some of my final interview questions.

Research Journal

Research journals have a rich history of use in qualitative educational research (Altrichter, et al., 2008). Research journals are useful to write little notes from unstructured observations or to explain the context and conditions after an interview (Altrichter et al., 2008). A research journal during a qualitative study can have a similar purpose to a laboratory notebook in science in that it can offer a complete record of the study from research design to data analysis (Altritcher et al., 2008). In a research journal, there is also the opportunity to write down reflective notes and insights gathered during the study. These reflections and detailed observations kept in a research journal "ensure that data collection is not artificially separated from reflection and analysis" (Altritcher et al., 2008, p. 17). Altrichter et al. (2008) point out that when keeping a research journal, the practitioner does not separate the data collection from reflection and analysis or the actions of the practitioner. I kept a research journal to aid in my reflections on my role as a facilitator, but it also became another source to use for data and analysis.

I started a research journal at the beginning of the study. I wrote observations during the journal club conversations. I also wrote down any discussions I had with the teachers before or after the journal club, I marked down observations during interviews. I used it to reflect on the data collected. I jotted down notes after reviewing the audio recorded data. I shared my notes with the teachers at the next journal club meeting and wrote notes from these conversations.

Data Collection Plan

` The table below provides a summary of how I collected the data to answer my questions. My methods for answering my research questions are: participant observation, interviews, focus group, and artifacts.

Table 1. **Methods used to answer research questions**

Research Questions	**Data**	**How**
Question 1: Is the journal club a working community of practice?	Participant observation, post-interview, pre- and post-focus groups	Audio-recordings, field notes
Question 2: How does the community seem to affect the teachers' perception of their teaching practice in the journal club?	Participant observation, post interview, pre- and post-focus groups, artifacts	Audio-recordings, field notes, articles chosen, reflective paper
Question 3: How do the research articles inform the journal club discussions around practice?	Participant observation, pre- and post-interview, post-focus group, artifacts	Audio-recordings, field notes, articles, reflective paper
Question 4: How does talk facilitate the teachers' learning?	Participant observation, pre- and post-interview, post-focus group, artifacts	Audio-recordings, field notes, articles

Selection of Case

There are three types of case studies: intrinsic, instrumental, and collective. Intrinsic case studies concern one particular case or teacher (Stake, 1995). Collective case studies compare many cases together (Stake, 1995). The case study approach I used is instrumental case study. In instrumental case studies "the use of the case study is to understand something else" (Stake, 1995, p. 3). I am looking at science teachers in a journal club, but I am paying attention to how the teachers interact with each other in the journal club and how this affects their understanding of research-based theory, and thus their teaching. Patton (2002) states that it is important to choose cases that are central to the purpose of the study's inquiry. LeCompte and Preissle (1993) refer to a purposeful sample as a criterion-based selection and state that it is important to "create a list of the attributes essential" to the study (p. 70). Then the goal is to find units that match these criteria. Merriam (2009) explains how and why it is important in a case study to spell out the criterion for the units studied.

One criterion for my study was that the preservice science teachers be in a program that quickly placed them in a teaching apprenticeship position. A question guiding my study was how the research articles informed the discussions around practice. Thus, it was important for the preservice teachers to be in teaching positions. A second criterion was that the preservice and inservice teachers were science teachers. I wanted to examine how science teachers create a community among other science teachers while discussing research articles on science education. A third criterion was that the teachers represented many different science disciplines and that not all the teachers taught at the

same schools. I wanted to have the science teachers explore differences in science education in as many ways as possible.

Making Contact

The preservice teachers I invited to join the journal club were science (i.e. biology, physics, chemistry, earth science, and general science) teachers in middle and high schools. I searched for a science teacher program that incorporated graduate education courses with year-long teaching apprenticeships. I wanted preservice science teachers that had both experience with educational course work and experience at middle or high school as teachers. I found Dale University in western Massachusetts contained three programs that involved year-long apprenticeships with graduate courses: 1) 180 Days placed preservice science teachers immediately in urban schools; 2) Bridges immersed preservice science teachers in rural schools; 3) The National Science Foundation, NSF, funded NOYCE Scholarship program placed preservice science teachers in high needs districts.

I contacted the professor of the science methods course at Dale University and asked if I could meet the preservice teachers in his course. I attended his second class and presented the journal club to the eighteen preservice science teachers. In this presentation, I explained what a journal club was, and its purpose in other fields. I described the journal club that I was hoping to form and my affiliation with the club. I also explained a number of incentives for the preservice teachers such as being able to collaborate with fellow preservice teachers. I also explained that they would learn how to critique educational articles. Finally, I explained that they would be in charge of the topics read, and my role was more of facilitator than a teacher. I also stated there was a small

honorarium for their time. The honorarium served to recognize that the preservice teachers were busy students and that they had many expenses they were accruing as students. The small stipend was to support the time and expenses of going to the meetings and searching for the articles. I stayed after to talk to those interested in the club and answer any further questions they had. Once the preservice teachers signed up to join the journal club, I e-mailed them with more details and with a variety of dates and times to set-up a planning meeting. It was my goal to have five to ten members. The small group could provide more than one opportunity to present an article, greater flexibility for meeting times, and a greater level of unity among the participants.

I had three preservice science teachers join. I considered going to another university with preservice science teachers. I talked over the situation with Dr. Feldman, my advisor, and he suggested I look for inservice science teachers near Dale University. We weighed the goals of the journal club as a community of teachers talking about research and practice over the goals of just being a program of preservice science teachers. I received the contact information of eleven science teachers at surrounding schools from the office at the STEM Education Institute at Dale University. I sent an e-mail around to the teachers telling them about myself and the goals of the journal club. I also listed a number of incentives for joining: 1) the opportunity to collaborate with other science teachers and preservice teachers; 2) a small honorarium; and 3) an opportunity to earn professional development points. Funding was provided by Dr. Feldman. He supplied the funds from his overhead return account. Three inservice science teachers joined the journal club.

Role of the Researcher

A case researcher may play many roles, such as a teacher, a participant observer, an interviewer, and an interpreter (Stake, 1995). I carried many roles in this research study. I saw myself primarily as a participant, observer, facilitator, and researcher. To help me decipher these multiple roles I performed in the journal club, I borrowed my understanding of this role from the literature on action research, where Pedretti (1996) describes her role as a participant, observer, facilitator, and researcher in an action research group. I was cognizant of what Pedretti (1996) described through her participation in leading action research as "the subtle and sometimes problematic tensions of fulfilling many roles helped me to make sense of the action research group experience and design, and contributed substantially to my own professional growth" (p. 325). I, like Pedretti (1996), conducted a second-order inquiry into the design of the journal club and my facilitator role. I did this to develop a level of self-consciousness with my roles.

As facilitator, my role was to "create a preliminary design for the community" (Wenger et al., 2002, p. 79). I created a model of how the community could work. My guidelines and my modeling of the discussions in the journal club were detailed enough to introduce the teachers to the structure and function of this "helping community" whose purpose was to share informally ideas and solve problems (Wenger et al., 2002). However, the model I shared with the teachers was not so structured that it had no room for teachers to bring in their ideas and improvise as we went along in the club (Wenger et al, 2002). My role as facilitator was following the role of community coordinator as Wenger et al. (2002) describe it. I helped "plan and facilitate community events," informally link community members," and "help build the practice-including the

knowledge base, lessons learned, best practices, tools and methods, and learning events" (Wenger, et al., 2002, p. 80). According to Wenger et al. (2002), my primary role was to connect the teachers together, but not provide the answers. My role once connecting the members was to nurture them along to set-up trust so that they were comfortable sharing insights and providing useful advice to each other (Wenger et al., 2002).

My role of facilitator did not preclude my role as a researcher and learner in this journal club. In qualitative studies, the researcher is an instrument of the study (Rossman & Rallis, 2003). I was the one who conducted the interviews and observed the meetings. This means the role I played was that of interpreter. Thus, the data were filtered through my perspective of the world (Rossman & Rallis, 2003). My experience and knowledge in science teaching, research, and journal clubs shaped the project. While constructing and analyzing this study, I was continually aware that I have "built-in interests, biases, opinions, and prejudices" (Rossman & Rallis, 2003, 36), which I discussed in chapter one under my personal perspectives.

The role of learner helped me define my interactions with the teachers in the journal club. I was a full member in the journal club who read and discussed the articles, but I was also aware of my privileged position as facilitator. I would write in my research journal about my participation after a meeting occurred, and then I reviewed each audio-recording after a journal club meeting to further evaluate my role in the journal club. I would listen to my contributions and comments in the journal club to make sure I was not speaking from an authoritative position. I was aware that as facilitator, I may be seen as authoritative, and I consistently examined my interactions in the journal club with the teachers. For example, in my researcher journal on November 26, 2013, after reviewing

the audio-recording from the week before, I noted "the teachers were raising interesting questions and I wanted to probe them more, but I need to be careful not to push my research agenda." My constant reflection on e-mail exchanges and my reflective writings helped me recognize when I was no longer facilitating but instead speaking as the authoritative force in the journal club.

In the beginning, I stated to the teachers that I was a learner in the journal club. Critiquing and discussing research articles informed my own research and my teaching. For example, the article on, "The Politics of Public Discourse: Discourse, Identity, and African-Americans in Science Education" by Brown (2005) in *Negro Educational Review,* generated discussions on language and how science alienates students from learning it. This article and conversations prompted me to think of how educational articles use certain language and alienate teachers (research journal, 10/15/13). I then re-read '"This Is the Oppressor's Language/Yet I Need to Talk to You" Language a Place of Struggle' by Bell Hooks (1995) to inform my research on talk.

I remained flexible in my data gathering process. Rossman and Rallis (2003) point out that data collection is not a rigid or linear process. When I went into the field, I was just going to be working with preservice teachers, and I was going to have them evaluate each other's presentations to help them make improvements. However, once in the field, I added inservice teachers to the journal club. I now became cognizant of this new structure in the community created by having inservice and preservice teachers together. I was aware of the negative role evaluations may play with members who are not of the same professional standing in their practice. I read in the literature about issues of power in communities of practice (Wenger, et al., 2002), and I listened to the teachers

in the journal club discuss how free they felt in the journal club from their constantly evaluated days as teachers. Both preservice and inservice teachers saw the evaluations as negative and not positive reinforcements. Therefore, I decided against the evaluations, but urged the group to share their constructive criticism about another member's choice in an article or a teacher's summary of the article.

I also added reflective papers at the end of the study. I noticed toward the end of the year the teachers kept talking about their favorite articles. I read about reflective papers in the literature (Grimmett et al., 1990), and I thought that it would be helpful to my research questions to have the teachers' individual insights on the articles they felt affected their practice the most. I paid attention to my intuitive insight and remained adaptive to the study and the participants (Rossman & Rallis, 2003).

Dilemmas Associated with My Roles

The dilemmas I encountered were with more than just my role as facilitator of the group. I also was a participant observer, who was conducting this study for my dissertation. I faced a conflict as a doctoral student in that my participation in this project was not only informative but self-serving. I entered the journal club as an experienced teacher, an experienced researcher of science and education, an experienced participant in journal clubs, and an experienced leader of professional development. In the journal club, I attempted to establish professional relationships with the teachers to help gather their trust to engage in professional conversations. I tried to establish a collaborative relationship where I was never the only expert. I shared my skills of how to critique research, but I also recognized the skills many of the members had already learned as science researchers. Through professional discourse, we, as a group, worked to

incorporate the critical analysis skills needed to read an article into the conversations in the journal club.

One difficulty associated with this role was when the teachers were selecting articles. I wanted them to have the freedom to select, but I also wanted us to read strong research articles. I was often struggling with " a workable balance between participating and observing" (Wolcott, 2005, p. 89), For example, when Phil, a preservice teacher, once selected two articles to read one was an opinion piece article and the other a research article. He asked me which would be good to select. He was leaning towards the opinion article. I felt I had to address the differences with him. However, I did not want him to feel that I was telling him which article to choose, but rather I wanted to help him recognize the difference between the two types of articles. I noted in my researcher journal, "I always feel torn with my position. I do not want to tell the teachers what to do, but yet I want to model how to read and dissect the literature. Tricky! Modeling and showing without telling" (research journal, 1/28/13).

It turned out after discussing the differences with Phil that he wanted to present both of the articles (JC meeting, 1/28/13). He felt it was something he had not been aware of, and he wanted to share in the journal club these differences between the two articles. I realized afterwards as a facilitator I helped create a learning opportunity in the journal club, but in turn, I became a part of the research. I have, through my research journal and reflections on my dual role as a participant and observer, tried to be aware of the "interdependency between the observer and the observed may bring about changes in both parties" (Merriam, 2009, p. 127).

Ethical Considerations

I took the following steps to protect the rights of the preservice and inservice teachers whom I worked with in my study. First, I constructed an informed consent for my observations in the journal club, my interviews of the teachers, and my collection of artifacts (Appendix E). The informed consent included a brief description of me, the study's purpose, and how I would share the study. I told the teachers what the agreement to participate would entail and that they would be able to withdraw at any time without prejudice (Rossman & Rallis, 2003). Prior to the start of the study, I obtained formal approval of my study and plan for my participants by the Human Subjects Review Board at Dale University.

Before I began my study, I presented the informed consent and explained the informed consent to the teachers. I answered any questions or concerns they had about participating in the study. I also stressed to the teachers that my goal was to protect their rights as participants in this study. I provided each teacher with a copy of the informed consent form.

Although I cannot fully guarantee the participants' anonymity, I took the following steps to help ensure their identity was protected.

1. I will not identify the participants actual names or the university they are attending when I report on any data collected from this study with anyone with the exception of the chairperson and my dissertation committee, and then only if necessary.
2. Pseudonyms will be used for all the participants and the university. The audio-recordings will be stored on a flash drive and labeled only with the pseudonym. Names of participants will be removed from any documents provided by the participants.

This study was not focused on any one teacher but was more concerned with how a community of teachers learns and reflects on theory and practice together. I did my best to provide anonymity to all my participants.

Data Analysis

I conducted the analysis of my data knowing that I entered the field with perspectives, which were articulated in my framework. The theories that have informed my framework provided focus and potential categories and themes to my data (Rossman & Rallis, 2003). However, as a qualitative researcher, I will "remain open to the unexpected and let the analytic direction of the study emerge" (Rossman & Rallis, 2003, p. 274). My approach was based on grounded theory (Strauss & Corbin, 1998). I applied the techniques of grounded theory (Strauss & Corbin, 1998) to see what was in my data. Unlike grounded theory, I also used some preconceived categories that I created from the existing literature on journal clubs and communities of practice (Table 2). I tried maintaining an objective stance when applying grounded theory by setting my knowledge and experience aside to be open to new interpretations (Strauss & Corbin, 1998). I did this by thinking comparatively, gaining multiple viewpoints of the situation, and through gaining data on the same situation through different sources (Strauss & Corbin, 1998).

A general strategy to build theory in case studies is to overlap data analysis with data collection (Eisenhardt, 2002). I reflected upon the data, asked questions, and wrote descriptive and analytical memos throughout my study (Rossman & Rallis, 2003). After each journal club meeting, I reviewed the recordings for themes and then wrote memos. I also wrote memos on my role in the journal club. Memos provided preliminary

interpretations of data and helped me conceptualize the data (Lempert, 2011). I addressed major preliminary themes with the teachers at the next journal club meeting.

As I was transcribing my data, I started to "play" with my data (Yin, 2014). Yin describes this "as searching for patterns, insights, or concepts that seem promising" (p. 135). I started to put the data in different groups. I created a flowchart to examine the data. I shared the flowchart with a critical friend. Rossman and Rallis (2003) stress the importance of talking ideas through with people. I shared memos of my data with my critical friend throughout the analysis.

Once I had finished collecting my data, transcribing it, and conducting a preliminary analysis, I took all the data and expanded and extended it beyond a descriptive account (Coffey & Atkinson, 1996). Wolcott (1994) stresses a three-step approach to 'transforming data.' First, Wolcott (1994) states that the description should stay close to the data originally noted. Wolcott (1994) emphasizes that the data should speak for itself. He then advocates analysis which analytically extends the research beyond the descriptive account of the data. Finally, Wolcott (1994) speaks of transforming data by providing interpretation, which is the researcher's account of what the data and analysis mean. It is with interpretation "the researcher transcends factual data and cautious analyses and begins to probe into what is to be made of them" (Wolcott, 1994, p. 36).

I analyzed the data by first reading the transcripts from interviews, focus group, and journal club meetings, field notes from the meetings, and the reflective papers the teachers wrote. Corbin and Strauss (2008) feel it is important first to enter the lives of the participants without coding, in order to listen to what the members have to say. I also

read over memos I had written throughout the data collection process. After that, I went through and re-read using categories I had developed from my framework (Table 2). I went through the transcripts again this time using grounded theory (Corbin & Strauss, 2008). I coded anything that intuitively looked interesting and answered my research questions. After coding, I had twenty-one codes, including the ones I had found from my framework. During this coding phase, I kept continually relating concepts to each other, which Corbin and Strauss (2008) refer to as axial coding. Linking categories together helps elaborate the concept (Corbin & Strauss, 2008). As I was linking categories, I was asking questions and making comparisons. For example, I would often ask, "How do the teachers critique articles? How do the articles relate to the teachers' practice?" These types of questions helped me check out the relationships among the data and accept, discard, or modify new data I analyzed (Corbin & Strauss, 2008).

I then began to engage in comparative analysis (Corbin & Strauss, 2008). For example, I would compare a passage coded "accountability" with another passage coded "accountability". This helped me discover the properties and dimensions within this code (Corbin & Strauss, 2008). I also engaged in theoretical comparisons, which means when I was confused or stuck, I turned to literature that was similar to the phenomenon I was examining to explore the properties and dimensions of my incidents (Corbin & Strauss, 2008). Wolcott (1994) explains that these types of comparisons are "typically showing how something to be understood is similar to something already familiar" (p. 179).

I pieced together, line by line, the talk in the journal club. I built a matrix of the discourse noting the statement and the response to the statement (Meyer & Woodruff, 1997). I was looking to understand how the teachers acquired knowledge from the

articles and advanced the community's knowledge through talk. I noted similar patterns from, week to week , in the teachers talk. I turned to the literature to help explain the talk. I wrote theoretical memos to help elaborate on the themes I discovered (Rossman & Rallis, 2008). I examined, "What other theoretical perspectives might provide insight?" and "How does this theme link to a particular theory?" (Rossman & Rallis, 2008, p. 292).

Table 2. Partial coding scheme based on the literature of journal clubs and CoP's

Codes and Categories	Evidence Looking for
Collaboration	Working together to question each other and learn
Reflection	Weighing new perspectives
Community	Mutual engagement, joint enterprise, shared repertoire
Analytical thinking	Critically analyzing a journal article and members' perspectives
Humility	Feeling free to ask for help in teaching
Confidence	Asking questions of teaching and knowing how to problem solve

Note: These categories are based on the work of Wenger (1998), Newswander and Borrego (2009), and Tallman and Feldman (2012).

I wrote analysis to develop and explore my analytical ideas (Coffey & Atkinson, 1996). Coffey and Atkinson (1996) state that writing data allow new and different interpretations to come forth. At these various stages in the analysis, I consulted with my

critical friend (Rossman & Rallis, 2003). I shared my writings and my half-baked analysis with her to subject my work to scrutiny. We searched for alternative explanations (Rossman & Rallis, 2003) together.

Finally, I integrated the categories. I challenged my assumptions about the data by searching for missing pieces to further explain the phenomenon (Corbin & Strauss, 2008). I thought about my data and contemplated the main theme to explain the experiences of the teachers in the journal club and how they learned from each other. Mainly, I looked to understand how they learned as a community. Corbin and Strauss (2008) explain "The core concept and other concepts come from the data but "theory" doesn't just build itself; in the end, it is a construction built by the analyst from data provided by participants" (p. 266). I interacted with my data by asking questions and exploring viable explanations. I then walked away from my analysis and came back to it by re-reading and thinking of plausible alternatives to my data. I tried to allow time as Corbin and Strauss (2008) discuss for the "evolution of thought to take place" (p. 245).

Trustworthiness

Stake (2005) states "Qualitative researchers are guests in private spaces of the world. Their manners should be good and their code of ethics strict" (p. 459). It is up to the researcher to provide the reasons to trust a study's validity and quality (Feldman, 2003). Feldman (2003) suggests four steps to strengthening the validity of a study. The researcher should provide 1) clear and detailed descriptions of the data methods and what are considered data; 2) a clear and detailed description of how the data were transformed into its current representation; 3) why one representation of data was chosen over another; 4) evidence of the value of the study. The value of a study has implications to

case study as well as self-study, which Feldman was discussing. The value of a case is important to the credibility and quality of a study for the future readers of the study.

Agar (1986) states that qualitative research is not as much concerned with reliability and validity as it is with credibility, accuracy of representation, and authority of the writer. Credibility is strengthened with prolonged engagement (Lincoln & Guba, 1985). Prolonged engagement provides an understanding of an organization and the member's trust (Shenton, 2004), but it also requires the researcher to reflect on his/her role (Rossman & Rallis, 2008) because professional judgments need scrutiny after long term immersion in a culture (Shenton, 2004). Merriam (2009) explains that long term engagement is necessary until the point of saturation, meaning the researcher begins to hear and see the same findings over and over. Merriam (2009) also stresses the need to spend time "looking for variation in the understandings of the phenomenon" (p. 219).

In the data gathering methods and data analysis sections, I provided clear and detailed descriptions of what I considered data and how I transformed it. In terms of the category selection, I followed what Corbin and Strauss (2008) call filling in the core category. The core category was "scholarly community" and under this core category comes other major categories such as "the rhythm of the community" and "scholarly talk." I was trying to find as "many different perspectives on an issue or topic as feasible" (Corbin & Strauss, 2008, p. 273). In this case, I tried to describe the experiences of the teachers in the journal club. I looked for data that explained what the meetings of the journal club looked like and what they discussed in these meetings.

Triangulation helps establish trustworthiness by providing multiple sources of data, which can compensate for the limitations of any one source (Shenton, 2004). One

way to establish triangulation is to examine a finding across multiple perspectives of the same data (Rossman & Rallis, 2008). One participant's experiences can be corroborated by triangulation of data from other members in similar situations (Shenton, 2004). Yin (2014) explains how triangulation helps strengthen the construct validity of a case study by providing various measures of the same phenomenon. In this study, I used many sources of data: transcribed pre- and post-interviews, transcribed focus groups, thirteen transcribed journal club meetings, written reflective papers by teachers, artifacts, and my research notebook. When establishing each code, I used more than one source of data and looked to have participants collaborate with each other.

I engaged a critical friend to increase the trustworthiness of the study (Merriam, 2009). Peers can provide questions and feedback that can lead to a greater explanation of the research design and findings (Shenton, 2004). Trustworthiness is strengthened with member checks (Lincoln & Guba, 1985). I provided all the teachers the opportunity to examine the data that related to the study. This allowed me to examine whether my interpretation of the journal club ‘rings true’ with the teachers (Merriam, 2009). I also provided thick descriptions, which helps promote trustworthiness of the study because descriptions provide the context for a situation (Lincoln & Guba, 1985; Merriam, 2009; Shenton, 2004). I also examined previous research findings on this topic, which helps strengthen the validity of my study (Shenton, 2004). Qualitative research reliability, which usually refers to the extent to which findings can be replicated if the study is conducted again, is problematic in education because human behavior is rarely static (Merriam, 2009). Lincoln and Guba (1985) and Feldman (2003) stress that reliability in

qualitative research is based more on whether the data collected and the results given are consistent and dependable.

Summary

To obtain qualitative research standards of validity and reliability, I carried my research out with integrity and in an ethical manner. First, I spent an adequate time collecting the data. This allowed me to have enough time to know the participants and for them to feel comfortable and not feign behavior. It also allowed me to seek discrepant cases and reach a point of saturation (Merriam, 2009). I looked for variations in the telling of this phenomenon by exploring different angles, but I found no strong supporting evidence of such an explanation. Second, I collected data from multiple sources and examined my emerging findings from various perspectives to triangulate the data. Third, I enlisted a critical friend to discuss the process of the study and the emerging findings and tentative interpretations. Fourth, I maintained a record of my preliminary and ongoing interpretations in a personal reflective research journal. Fifth, I provided an audit trail (Lincoln & Guba, 1985) of how this study was conducted and the data were analyzed. In terms of transferability, I provided thick descriptions in the hope that my readers are able to determine for themselves if their situations match my research context, and whether they feel the findings are transferable to their situation.

CHAPTER 4

FORMING THE JOURNAL CLUB

Introduction

This study explores what the teachers in a journal club learn about teaching from reading science education research articles and discussing them together. I will begin by presenting the teachers in the journal club. Each teacher joined the journal club with his/her own prior experience as a student of science and a reader of research articles. In this chapter, I describe the logistics. Who are these particular teachers that ended up joining the journal club? Teachers' identities are based on what they determine are significant from their comprised past experiences in education and what they hope for their future as teachers (Wenger, 2010). Teachers' identities affect what they assign meaning to in social contexts and how they are transformed in social situations (Wenger, 1998). Thus, I examined the teachers' backgrounds and goals as students and teachers to better understand how the journal club changed their trajectory for teaching. First, I will begin with the preservice science teachers who joined. I present how the preservice science teachers joined the journal club. I also examine their past experiences as students and their reasons for becoming teachers. Then, I introduce the inservice science teachers and their experiences as students and goals as teachers. In this next chapter, I present the six teachers in the journal club through data collected at the start of the journal club, from an initial semi-structured interview (Appendix A). I also added relevant data that I gathered from conversations I had with the teachers throughout the year and recorded in my field notes.

Preservice Science Teachers

In the fall of 2012, I contacted the professor of the science methods course at a large university in Massachusetts, Dale University. I attended his second class and presented the journal club to the eighteen preservice science teachers. Three of the preservice teachers signed up to join the journal club. I then e-mailed them. We decided to meet the next week before their methods class where I could 1) introduce myself further; 2) share the guidelines I had established (Appendix F); 3) ask them to think of changes they would like to make to the guidelines; 4) share my research interests; and 5) establish a date for our next meeting, where I would present an article and lead the discussion.

At the first official meeting of the journal club, I modeled to the preservice teachers how to present an article by explaining my thought processes (Collins, Brown, & Hollum, 1991). I thought aloud so that the preservice teachers could build their own conceptual model as to how to lead a journal club meeting. I chose the article "Is Science Me? High School Students' Identities, Participation and Aspirations in Science, Engineering, and Medicine" by Aschbacher, Li, and Roth (2010) in the *Journal of Research in Science Teaching*. I selected this article because this article accentuated the need for teachers to make connections with students to help them form a science identity, and I wanted the teachers to think about their science and teacher identity.

I explicitly stated to the teachers that a goal of the journal club is to think about their students and classrooms as they read the articles. I followed the guided discovery approach that medical journal clubs have implemented (Khan & Gee, 1999). This approach to journal clubs was different from the traditional model where articles were

read for purely an academic exercise and not overtly tied to practice. Using a guided discovery approach to a journal club puts problems of practice in the context of the articles. It was developed to strengthen the connection between practice and theory (Khan & Gee, 1999).

I now introduce the three preservice teachers, who bravely took a chance and attended the first journal club meeting. The preservice teachers were all in Master's degree programs in secondary science education that immediately incorporated a teaching apprenticeship along with class work at Dale University. Two members, Phil and Jilly, were part of the same NSF funded NOYCE science education program with teaching apprenticeships in urban high schools. However, they were not teaching at the same urban school. Mary was enrolled in a program called Bridges at Dale University. Bridges included a teaching apprenticeship in a rural setting. All three were enrolled in the same science methods class at Dale University when I recruited them.

Phil

Phil was the outgoing, gregarious, idealistic member of the preservice science teachers. When I presented the journal club to the preservice teachers during their methods class, Phil was the preservice teacher who asked questions immediately, and it was he who looked at Jilly at the end and said let's do it. Phil is an African American male. He grew up going to the same urban school where he is conducting his teaching practicum. He has returned to his school with hope and pride. Phil graduated from Dale University with an astronomy major and education minor, and with endless experiences in volunteer centers helping students and adults learn. His goal is to be an urban high school physics teacher. His desire is to get a job in the same school system he attended as

a high school student, and where he is currently conducting his practicum. He hopes to one day become a leader in this school system.

He said that his mother, experiences as a Junior ROTC member, and a guidance counselor all helped him get to college. He said he had big dreams of Ivy League colleges, but ultimately ended up at Dale University. It took him five and half years to get through the university, which in his words "hurts." He worked throughout his time at the university through a program called Student Bridges that connects students with the community. He often worked two or three jobs as a tutor, a site coordinator for the program at the local schools, and then as an undergraduate coordinator for the whole program.

Phil wanted to be an astronomer. Phil stated, "Stars and galaxies were my hobby." He felt his background in science was not equivalent to the background of other students at Dale University. He stated that the students in his astronomy classes "would ask questions that I was like I don't know what you are talking about." He believed his advisor in college pushed him toward a BS in astronomy, which leads to a research track, and he wished he had pursued the BA in astronomy, which he felt suited his interests better. He said he learned the hard way, by failing, that he was not meant to be a researcher. I asked why he stuck it out in science. Phil stated,

> I don't know. I was just so upset. I felt none of my advisors were pushing me to graduate. That is how I felt. I was the only black man in the whole major, so I felt completely out of place. But I kept pushing myself to class, and the last semester I scraped by (pre-interview, 10/23/12).

His interest in being a teacher slowly developed at Dale University through his work with in the Student Bridges program. This program helped connect him to local communities and their schools. It was his experiences in Student Bridges that sustained

him through college. In this program, he found “it didn’t matter where you came from.” Also, many of the leaders of this program encouraged him to be a leader. He felt people were helping him to be a teacher and a community leader, but no one in science was helping him be a scientist. When asked why he wanted to be a science teacher, Phil said,

> I didn’t like the way it was taught. I didn’t like the way it was given to me. And looking back I have taught myself. I would go to lectures where you sit in a class with 50 kids. You do your homework and watch lectures. You try to go to office hours but you can’t because you have to work. But I knew science was my gateway to college… I know what students don’t understand. I know what has stopped them from being interested in science. I feel like I know (pre-interview, 10/23/12).

Phil said that his overarching goal for teaching is to “explore what students need to be reinvigorated in science and not made to feel stupid.” He strongly feels that students in high school are not able “to fill their intelligence confidence. They don’t know how to go home and say I don’t know how to do this, but I am not stupid, and I can learn this.”

Phil was looking forward to the journal club. He said, “I like hearing opposing opinions.” He also thought it would be “good to leverage myself with these authors and scholars.” Phil had become familiar with research articles during his year with AmeriCorps, which he did simultaneously while finishing up his final semester of college. In the AmeriCorps program, he worked in an urban city near Dale University and helped in the adult and family education center/GED program. He would look up articles mainly on urban education but never science education. Phil was concerned that teachers were being pushed away from being professionals. He said that professional development and department meetings spent time on small issues, such as “why do we have to stay after every Tuesday, things like that.” He explained, “The weight of administrations and districts is pushing teachers straight to the bottom, and the only thing under teachers is

students." He felt the best way to push back on administrative policies that were not working in a school was to be "aware of the best educational practices in the nation." He expressed that only then could he engage in a conversation with administrators.

Jilly

Jilly is a reserved, reflective, adventurous Asian American member of the preservice science teachers. Her goal was to be an urban high school chemistry teacher. She is from a large urban city in the mid-Atlantic. She attended a large urban public high school. She said that at her high school, no one encouraged her to leave the state. Most of the students in her class attended state universities. She said, "I always had the mentality I want to get out of this city. I want to see new things." Through the scholarship program Questbridge, she applied to several elite liberal arts colleges. She received aid at a small liberal arts college in Connecticut, and went sight unseen. At first she went home a lot, but by the second semester she started to make friends and got involved in the community. Jilly majored in biochemistry and environmental science. She started out on a pre-med track. She wanted to be a pediatrician. She became certified in EMT. She even attended medical conferences her freshman year in college. By her junior year in college she "realized there are so many things I want to do and that doesn't involve me sitting in class forever." She studied abroad in Singapore and Malaysia, and that helped her realize she enjoyed volunteering and helping people through service work. She said it "was very humbling experience to go to these poorer Asian communities." She volunteered to tutor and mentor students in a high needs area near her college.

Jilly said that she never thought of herself as a teacher, but when she was a senior looking for jobs she came across a flier for teaching fellows in the city where she grew

up. She applied to that program and then she saw the program at Dale University. She was accepted into both teaching fellow programs but chose Dale University. She said, "my mindset is there is so much to explore I don't need to be at home just yet."

When asked what her goals for teaching are she told me about an article she read. Jilly said,

> I read this article where a math teacher was so good at his teaching in an urban school, and so many of his students went on to be math majors and math teachers. It was exponential growth. And many of the country's mathematician stem from this one person. I would love it if my students ever came back and contacted me, and said I am going into this kind of science (pre-interview, 10/25/12).

Jilly hoped her teaching would have that same type of impact as this mathematician on her future students.

Jilly has experience working in research groups. As an undergraduate student she worked in a lab doing research. Jilly stated that she participated in an activity through the research group that was similar to a journal club. She said,

> When I was doing research as an undergraduate my professor would sometimes give me readings…then on Fridays we would talk about the research that got us to our research. We would have slide shows and different groups would share where they were in the research throughout the year. It was great because sometimes by presenting other professors in other labs would say, 'Hey, I know something about this let's talk sometime about this.' Then sometimes people would offer suggestions like you are having trouble with this part of your reaction have you tried this. It is good to collaborate…It was good to get feedback outside of your own little group (pre-interview, 10/25/12)

Jilly explained that she learned the value of group work in college where she realized the value of different perspectives.

Mary

Mary is a thoughtful, self-deprecating, hopeful white, first generation college student from a suburban community outside a large New England city. She attended Dale

University where she was a biology major. Mary is the first person from her family to attend college. She said she "felt it was important to choose a major that I was guaranteed some kind of a job or an outlet out of." She was very concerned about getting a job because of the large loans she had taken to get this education. Mary expressed how her parents were proud that she was a biology major. She has held various jobs throughout her entire college education, such as waitressing and many different on campus jobs through work study. Mary has continued to work throughout her graduate degree as a waitress on weekends. Mary said,

> I guess I was very naïve as to what biology really was. I thought, at 18 years old, I wanted to go into research, the medical field. That is what everybody that studies biology does. I like to read National Geographic a lot, but being from a small town, how do you even do that. That idea of being an ecologist or doing field research, I don't even know that route. None of those things seemed like a reality to me at the time. Those are lucky people that get those kinds of things. I think that I originally started out with this idea of research because I didn't realize what else there was to do with biology. Really, what other avenues you could go in to? I think why I steered away from research was throughout my four years of college I realized I didn't fall in love with one specific aspect of biology, like some people become all about molecular biology and that is all they want to do (pre-interview, 10/13/12).

Her spark in teaching came during her senior year of college. Mary stated,

> I started to come to the end of my undergrad career and [I was thinking] I loved being a mentor and Big Brothers/Big Sisters, and I loved science. Maybe I could do a couple of years of Teach for America, while I am young and have the energy to do it now. I started thinking about that and a friend told me about a class that she took at the university which is tutoring in schools, the Team's Program…The idea of it being actually in the school and the act of being a volunteer aspect of it is what caught my eye to it. I took that class and that was all it took. It was an awesome class. I took one education class in my four years and I was kicking myself as I should have minored in that (pre-interview, 10/13/12).

At the time of this journal club, Mary was in a Bridges program at Dale University. She was becoming a biology teacher. Mary told me her goal for teaching is:

> My goal is to get students to have greater interest at the end of the year than they had when they first came into it because I think it's important, especially with biology and the nitty-gritty details that come along with it. I feel biology is the first class kids take that is super detailed and nitty-gritty…I think it is important to show the real world application of that, and then the reality I think is that not everybody is going to love science like I love science. That was my favorite subject growing up. I hope that my class can interest and engage the kids, even the kids who say I love government and I love politics, to realize why you are forced to take the sciences because it is important (pre-interview, 10/13/12).

Mary added,

> I think I am very idealistic about education and progressive about some ideas, but I am also very naïve because I just kind of decided a year ago this is what I want to do…dedicate some serious time to this in my life, and dedicate my life to education policy in general (pre-interview, 10/13/12).

When I asked her why she chose to teach at a rural school she said that she wanted many different experiences as a teacher. She also felt intimidated by an urban high school and wanted to get experience teaching before she taught at one. However, her goal was to teach in an urban school because she ultimately envisions that she will live in a city. Mary said,

> I didn't feel ready like I have the classroom management skills to seriously be able step into an urban setting and do as well as I idealistically imagined that I wanted to do. So, I think the Bridges program is giving me a chance to be kind of experimental with things like Friday discussions (pre-interview, 10/13/12).

Mary also felt that in an urban environment a teacher has to have a better grasp of her content. She said that she was not "One hundred percent ready content-wise to be able to jump into an urban school where there are so many other factors." Mary said that she was looking forward to journal club because, "I am a big conversation person. I love working in groups. I really value other people's opinions. I especially like talking to people that don't agree with my opinions." Mary enjoyed doing group work and collaboratively working with other people on a project.

Summary

These three preservice teachers, who joined the journal club, were typical of the current demographics of students seeking degrees in education in that 60% of students in teacher education programs are under the age of twenty-five (Zumwalt & Craig, 2005) . The percentage of female to male preservice teachers in the program was consistent with current data that found that teacher education programs contain 67% women (Zumwalt & Craig, 2005). The type of institution the preservice teachers received their undergraduate degree from was similar to the national trend where three fourths have attended large public institutions (Zumwalt & Craig, 2005). The participants in the journal club varied with the national trend of preservice teachers, where currently, minority students make up only ten percent of the education degrees acquired (Haberman, 1989).

The preservice teachers were consistent with recent studies as to their motivation to teach. Recent studies show that people choose to teach because they have a desire to make a social contribution, shape the future, work with adolescents, and help adolescents succeed (Kyriacou & Coulthard, 2000; Richardson & Watt, 2006). Jilly expressed how she wanted to shape the future and Phil and Mary explained how they wanted to help adolescents succeed. Another factor as to why people chose to become a teacher is that they had positive prior experiences with teaching (Richardson & Watt, 2006). All three spoke of positive volunteer experiences with students while in college that helped lean them towards teaching instead of science research or medicine as a career.

Jilly was the only preservice teacher who had a background in working with a group on science research and reading science journals. Phil did have experience researching and reading educational studies from his work with AmeriCorps, but not in a

group situation. All the preservice teachers said that they valued learning by hearing different points of view. The preservice teachers were all very hopeful they could have an impact on their students. They viewed the journal club as an opportunity to learn "professional" knowledge that could aid them in their teaching.

Inservice Science Teachers

After meeting the three preservice teachers, I tried to recruit more preservice teachers to join, through the support of Jilly, Phil, Mary, and the methods teacher. Jilly explained that the other preservice teachers felt overwhelmed in their respective education programs, and they just felt they had too much work. I talked over the situation with Dr. Feldman, my advisor, and he suggested I look for inservice science teachers near Dale University.

I received the contact information of eleven science teachers at surrounding schools from the STEM Education Institute at Dale University. I sent an e-mail around to the teachers telling them about myself and the preservice teachers who had joined the journal club. I heard back from every teacher that they were interested but many said that they had no time in the fall. I explored if another day could work, but it was a time factor. Only two teachers, Eliza and Beth, expressed that they could come on the designated day and time. Eliza then e-mailed me that a teacher she mentored three years ago was interested in joining the journal club. Now the journal club consisted of Eliza and Beth, who taught at a high school in the same town as Dale University. David, the third inservice teacher to join, taught at a high school located in a nearby urban area.

In the first journal club meeting the inservice teachers attended, Phil led the presentation and discussion with his article on “The Politics of Public Discourse:

Discourse, Identity, and African-Americans in Science Education" by Brown (2005) in the *Negro Educational Review*. I gave the inservice teachers the first article the preservice teachers and I read and explained how at the first meeting I had modeled how to present. I also explained how this journal club was using a guided discovery approach (see Chapter 2), which may or may not be the same as prior journal clubs the teachers had been in as science students. Only Beth had never participated in a journal club (Appendix J).

Eliza

Eliza is a smart, reflective, middle-aged, Eurasian, female chemistry teacher at a suburban school. The high school is in the same town as Dale University. This town is known as a progressively liberal region in the country. Eliza originally came from the San Francisco Bay area. She attended a public suburban high school. She went to one of her home state's elite public institutions of higher education. She majored in chemistry. She said, "I was always interested in science. Chemistry was not a popular choice because I was a girl, it was the 70's, and girls didn't really do chemistry then. By the time I was in middle school, I really, really liked chemistry." Eliza said that she was the fifth of six kids in her family and the first to go to college. Her father had attended college, but never finished because he went to World War II, and then just never completed. Her mother was from Japan and did not even finish high school because her family needed her to work.

After graduating from college, Eliza entered a Ph.D. program at a large private institution in the Midwest, her major was inorganic chemistry. It was the first time she went far away from home, and she found "it was really hard." The program consisted of

about twenty-five percent women. She then completed a post doctorate at a large public university in the Midwest. She said that, during her post-doc, the only responsibilities she had was pure research. Eliza said, “It is like the most fun you have in your entire life.” Eliza stated that when she was an undergraduate, she thought that she did not want to teach. She said that, at graduate school, she enjoyed being a teaching assistant.

When she finished her post-doc, she married, and her husband’s job moved her to where she is now. When she first arrived in the Northeast, she took a second post-doc in polymer chemistry. However, funding problems occurred at the university and the job terminated before she even started. Eliza then took a temporary teaching position at a nearby top liberal arts college. She stayed at this position for nine years. The problem was the job never turned into a tenured position. Eliza said, “They had not tenured a woman there since 1931 in the chemistry department. My perception going into the job was that it was a revolving door position. They always had a woman, but she never got tenure.” Then she ended up at the Dale University in their STEM Education Institute. She worried the funding might dry up, and she thought she should become certified to teach high school. One day she received a call from the science department head, at what is now her current teaching position, to teach a high school chemistry class with three days’ notice. During that school year, she worked 60% at the high school and 40 % at the university and continued to finish her certification. Eliza said, “At the end of the year when they offered me a full-time job I had such a great time I took it and quit my job at the college.”

Eliza is very familiar with journal clubs. She was in journal clubs in graduate school, and while she was teaching at the liberal arts college. However, all the journal

clubs were in chemistry and certain branches of chemistry such as materials chemistry and physical chemistry. Teaching at the liberal arts college was the only time she read science educational research journals. She read the *Journal of Chemistry Education* to help her get ideas in classroom activities, demonstrations, and labs. She said she had no experience with pedagogical literature until she was getting her teacher certification. Eliza added,

> I find that social science is neither testable nor knowable as much as science. I believe that to be true but I find it irritating none the less. It is harder to figure out what to do. It is harder to do the experiments, harder to know what to grasp against what. I find that frustrating. So, when I read the papers it is more like it is not a set of directions like I sort of want. The answers aren't there (pre-interview, 10/24/12).

Despite, Eliza's reluctance to read educational articles, she was looking forward to meeting other teachers at the journal club.

Beth

Beth is an energetic, studious, thoughtful white, middle-aged, female biology teacher. She teaches at the same school as Eliza, but neither knew they were going to be in the journal club together. They both received the e-mail from me, but decided to join the journal club independent of each other.

Beth came originally from a mid-Atlantic state and attended a very small rural high school. It was a regional school; her town only had 2000 people in it. Beth said that she was the youngest of four children; her closest sibling was sixteen years older than her. Beth said,

> I was second in my class and so I had lots of options, but not really a lot of support at home and not really a lot of information about different schools and financial aid, so I was really on my own and my guidance counselor was useless. Eventually, the college I chose was the college that sounded good and I thought it would be reasonably priced (pre-interview, 10/24/12).

She attended her states flagship university. She said that she always knew she wanted to do something in science. She started out in medical technology, but then realized she "needed to spend a lot of time behind a microscope, and I was not thrilled about that." She then decided she wanted to be a science teacher. However, she began to question that choice when family discouraged her from pursuing teaching. Beth said,

> Most of the teachers in my family are science teachers: my brother, my brother-in-law. They said you don't want to be a teacher because there were no jobs, then in the early 1980's. This got me to thinking, well, there are some jobs. Somebody's is going to get hired. I did not get my teaching certificate then. I ended up graduating with a BS in psychology because I liked research, so I was doing experimental psychology (pre-interview, 10/24/12).

When she left college, she got a job in finance at Bank of America. Afterwards, she worked for the Red Cross in public safety education. She then stayed home to raise her two kids and worked part-time as a high school gymnastics coach. After a while, she felt she needed to make a career change. She decided to become a science teacher. It required her to get another bachelor's degree and a teaching certificate, and then finally a master's in science education. At the time of this study, she was in her thirteenth year of teaching. Beth said, "I am very happy with the choice I have made, one of the few choices I am really happy about." Beth explained what she liked most about teaching:

> I like the kids, I like the hours. I could never sit at a desk for eight hours. This is great; I can be on my feet all day. There is a lot of energy. You are always putting out fires and no day is the same two days in a row and I love the variety (pre-interview, 10/24/12).

Beth started her teaching career as an eighth grade physical science teacher in a public school. She then taught high school biology at a vocational school, and later moved to where she lives now, first teaching biology in a private high school and finally

getting the position at the high school where Dale University is located. She feels that she probably is not moving her job again "unless something happens."

Beth said that she regularly reads the *Science Teacher, American Biology Teacher,* and *Journal of Research and Science Teaching.* She is a member of NARST and NSTA. She got involved in these organizations through a school-wide meeting with the middle school teachers in the district. The middle school teachers had presented work at NARST. This prompted her to think about doing her own research. She also became motivated to read research and do her own research because of a new curriculum she developed with other teachers. Beth explained,

> A handful of teachers, myself included, we developed a new ninth grade curriculum for this school for ecology and environmental science class…Part of the demand of the community was that we need to see research on how this is working so we did a lot of work on this. We have been tracking students' progress and numbers of all sorts. We break down the data now looking at things 10 years ago how many girls were taking honors chemistry in eleventh grade vs. how many boys. Now, we track by gender, income, and ethnicity, and do all those breakdowns because we wanted to support the fact that we are doing a good job with this eighth grade class…(pre-interview, 10/24/12).

Beth felt that it is very important as a teacher to stay abreast of current research and examine her own practice. Beth said,

> It has to become a practice of the mind and then it is something that you end up incorporating and doing just like you would make lesson plans. It has to be always in your mind. You want to expand your curriculum as biology is always changing. I think to really understand that what you are doing is making a difference; you have to look at it systematically. You can't just rely on students' grades (pre-interview, 10/24/12).

Beth enjoyed working with other teachers she felt she gathered new ideas and feedback on her own ideas. She said that lunch is the only time she gets to talk about science teaching with her colleagues.

David

David is a quiet, attentive, curious, white, male chemistry teacher. He is in his third year of chemistry teaching. David attended a public suburban school in a mid-Atlantic state. He then attended a public university in his home state and was a day student. He majored in chemical engineering. He said "I like chemistry, science, and math. I wanted to do something difficult that I knew was flexible, so I just went with it."

Right after college he went to graduate school, at Dale University. He said he went to graduate school because "I really didn't know what I wanted to do." He received a Master's in chemical engineering, but did not stay to get his Ph.D. He worked as a teaching assistant in graduate school. David said,

> I always kind of liked teaching. I really didn't want to go into industry. I didn't have that personality. I like a lot of different types rather than focusing on one aspect. What I didn't like about graduate school was like you spend three years on a project and maybe 12 people were going to read it that actually care about it. With this, you can have exposure (pre-interview, 11/1/12).

David said that he realized that he wanted to focus more on teaching and less on research. He said "I like the research part of it [graduate school], but I didn't like fighting for all the money." David became certified at Dale University. He took one year of classes and did a practicum. He did his practicum with Eliza. They have since stayed friends and that is how he heard about the journal club.

David describes his goals for his students:

> I think a general goal should be learning how to learn. That is pretty much the only thing you are going to get from high school. You are going to forget a lot of these details. You will see it again and think, I kind of remember that. Really, being able to figure things out and where things should go (pre-interview, 11/1/12).

David finds the school system he is currently working in very different from where he did his practicum. He finds his current school "a bit more challenging. Students here are not as academically motivated as other students. They really don't see the value in it [school] because that is what the community is like." David added, "There are some amazing students here." However, he found it very difficult to teach with all the different student levels in one class. He felt there were many students "at the basic, basic level."

David said he always reads science journals because that is what he loves. He did not read education journals because he was unfamiliar with them. David said, "Education is a little bit more difficult because I am so new at this, I don't really know what is out there." David had been a part of journal clubs during his graduate school. He felt the journal clubs were good because when he reads by himself, "I always miss things." David said, "I will read something from my perspective and somebody from a different perspective will read it in a different way." In the journal club, David hoped to hear new perspectives on teaching. David said,

> My perspective, I am still coming from an engineering perspective, kind of moving more towards education but it is a transition. Hearing somebody that has a less science background but more of an education background, how they see it, is extremely valuable (pre-interview, 11/1/12).

David was very unsure of his future after this school year. His girlfriend was finishing her Ph.D. in chemical engineering this year, and they were both thinking of leaving the region. His plans for himself were up in the air. David was not sure whether he should go back to school for science or stay teaching.

Summary

The inservice and preservice science teachers did not decide to be teachers until the end of college or, in some cases, many years after college. My experience working

with science teachers supports this finding that a majority of science teachers did not set out from a young age to be teachers. From the high level of schooling the inservice teachers had achieved, they appeared to be of high ability. This is consistent with the data of late aspirant teachers (Hanushek & Pace, 1995). The inservice teachers were typical of most late aspirant teachers (71.9%) in that the majority was white (Hanushek & Pace, 1995).

I do not know whether the strong background in research and reading research of the inservice teachers are representative of all science teachers. However, three other inservice teachers that I recruited, who were not free to join the journal club, had expressed a familiarity with reading research articles in a science journal club. Perhaps, many of the teachers had familiarity with science journal clubs because they had been in graduate science programs. The high incidence of teachers with advanced science degrees could be because Dale University has many graduate science programs, which many teachers attend prior to becoming a teacher like David and Eliza.

Just like the preservice teachers, the inservice teachers were consistent with the general population of teachers as to why they went into teaching; they enjoyed shaping the lives of adolescents (Richardson & Watt, 2006). The inservice teachers having worked in other jobs prior to being teachers also noted that they went into teaching because of quality of life issues such as time for family and job security, which is also consistent with why people choose to become teachers (Watt & Richardson, 2007).

All three teachers were eager to read the articles and hear from other teachers. Eliza wished that more inservice teachers had joined the journal club. She was interested in hearing the perspectives of teachers from different schools than her own. The journal

club consisted of the seven members, including me as facilitator. The seven of us embarked on forming a community in the journal club. A community that read, discussed, inquired, reflected, examined problems, and re-imagined how teachers can learn from each other. I will explore over the next two chapters how this community developed.

CHAPTER 5

SCHOLARLY COMMUNITY

Introduction

In this chapter, I explore the characteristics of the journal club. Throughout this study, I searched to understand if the journal club was a working community of practice, and if so how was it one. This chapter is divided into two sections. In the first section, I describe the rhythm of the journal club and how that helped develop and contribute to its functioning as a community of practice for the teachers. I examine how the journal club operated and functioned. I provide a snapshot of the overall logistics of the journal club.

In the second section of this chapter, I examine the conversations in the journal club, which I call scholarly talk, to understand the role of talk in the journal club. A question guiding my study was "How does talk facilitate the teachers' learning about a variety of research topics, and their implications to practice?" Scholarly talk was detailed talk centered on the articles and classroom practices. The teachers often referred to the journal club as an opportunity "to be a scholar again" (Eliza, focus group, 4/22/13), and that the conversations were discussed "in a scholarly manner" (Mary, focus group, 4/22/13). In the scholarly talk section, I look at the modes of talk the teachers in the journal club engaged in together. The findings in this chapter come from the analysis of the audio-recordings of the thirteen journal club meetings, the final interviews with all the teachers, the final focus group, and my research notes.

The Rhythm of the Community

In this section, I examine the structure of the journal club, which I call the rhythm of the community based on Wenger's (1998) description of rhythm as the dynamic

process in which a community comes into forming. I also examine characteristics of the journal club that helped create unity among the teachers and contributed to its functioning as a community of practice. Then I look at the inquiring questions the teachers asked of each other when presenting and discussing the articles, and the role these questions played in creating a joint enterprise among the teachers in the journal club. I also examine how the teachers in the journal club held each other mutually accountable and how this accountability helped the teachers gain new understandings and knowledge about science teaching. Because the teachers also placed a great emphasis on being honest with one another during the journal club meetings, I examine how the teachers were open and honest with each other in the journal club. I then look at how the teachers, by being mutually accountable, asking inquiring questions, and honestly sharing who they are and want to be as teachers led to a community of practice with a common goal of learning from the articles and each other.

The Workings of the Journal Club

The teachers and I met at Dale University because it was convenient for all the participants. The three preservice teachers had a class after our journal club meeting at Dale University. Eliza and Beth taught in the same town as Dale University. David did not teach in the same town as Dale University, but he did live nearby. The group then agreed upon the guidelines, and we proceeded with all the teachers deciding upon the time, dates, and location to meet. The teachers came up with the sign-up schedule of presentations, and when a shift had to be made they took care of the change in presentations the week in advance. The journal club began meeting every other week, barring changes due to holidays, snow days, and school breaks. The goal was that each

member would present two articles. The preservice teachers led off the presentations, followed by the inservice teachers, and then the schedule repeated itself for another round of presentations. The journal club met on Tuesday's at 3:00 PM. Members would arrive between 3:00 and 3:10 PM. Then, we would start and go until 3:55 or so. Actual meeting time ran from forty-five to fifty minutes. The teachers who arrived at three o'clock would vary each week.

The teachers often engaged in conversations with each other before the meeting started. One week they talked about writing lab reports, which related to that week's article on scientific literacy. Another week, David informed everyone about the new science standards coming for the students called "The Next Generation Science Standards." Many of the teachers were not aware of the new standards. We often spoke about changes to the schedule because of upcoming holidays, or just their day at school. Often the preservice teachers arrived first because their school day ended earlier than the inservice teachers, and they would speak about the classes they were teaching and lessons they were trying and hoped would work.

Selection of Articles

The meetings began with presenters explaining how they picked the article. Then they would explain why they picked the article. When David presented an article on technology to enhance inquiry, he said that he chose this article because, "I am interested in using technology and making centers [on the computer in the classroom] and using things in different ways" (7th JC).

Sometimes the articles would come from a topic the preservice teachers were learning in their education classes, and they wanted to know more about it. Differentiated

learning was a very big topic at the journal club with the preservice teachers. Mary presented a study on engaging students with special needs in science classrooms. Mary said, “I wanted to explore differentiated learning because we are learning so much about it in all our education classes” (10th JC). Jilly also chose an article on differentiated learning.

Eliza wanted to present an article she obtained from an educational conference she attended. She had shared the articles with her colleague Beth, prior to the journal club, and they both presented articles from the conference because they wanted other teachers input on the studies (5th and 6th JC). Phil chose an article based on the study I presented on science identity. Phil said,

> When I read the article for the first week it was on science identity and that struck me as something very salient to me. For the last seven or so years of my professional education, I have been trying to figure out what my science identity is (2nd JC).

Jilly also presented an article based on a conversation we had in the journal club. Jilly said when presenting her piece, “I was interested in the conversation we had last week in how we foster that interest in science outside the classroom. So, I was looking at what resources students have that may keep their science interest up” (3rd JC).

Selecting articles to read was not a problem for the group. Eliza explained, “I had no difficulty coming up with many problems or issues” (final interview, 5/1/13). Mary echoed that when selecting an article “the difficulty was trying to narrow it down” (final interview, 5/1/13). Overall the teachers chose topics that they wanted to learn more about. Jilly stated she choose articles because, “I wanted to explore more of an issue” (final interview, 5/2/13) or as Beth said, “I went about thinking of a topic I was interested in exploring” (final interview, 5/1/13). Eliza contemplated how the group would discuss the

article; therefore, she did not choose articles that were “too specific to chemistry”. She wanted articles that could be generalized to all areas of science because as she said, “I wanted to take advantage of the community” (final interview, 5/1/13). Eliza stated, “In a sense, I was less selfish in terms of picking the exact article, but more selfish in terms of the fact that I am trying to get the most out of other people’s thoughts” (final interview, 5/1/13).

It was not so much the article that got most of the other teachers thinking of the community of teachers, but rather, it was the questions they asked of each other. Mary said that she thought about “What can I ask the veteran teachers or other first year people how they are dealing with this problem, if they even see this problem, or is it an individual something that I am doing” (final interview, 5/9/13). The teachers thought of the community of teachers when they chose an article or came up with questions to ask; they were aware of the resource they were to each other.

The routine of the journal club continued every other week throughout the school year, October to April. In every meeting the teachers became more and more familiar with the routine. We sat around an oval table. No one sat in the same seat each week, except for me, who sat near the side table where I kept extra food. I provided the food every week; I would bring fresh fruit or vegetables. I made cookies or breads, and there would be chips and dip. They offered to bring food by the third week, but I said that I would bring it as my contribution to the meetings each week. The teachers appreciated the food, as the teachers came at 3:00 P.M. very hungry. They said they often have lunch at 10:30 A.M. at their school, and were very hungry by the afternoon. Every week some member or two would thank me for bringing the food. At the focus group, everyone said,

“Thanks for the food.” Phil added, “Consistent comfort. If I can go and eat, I will go!” Jilly added, “Food makes it comforting.”

By the fourth journal club meeting, I noticed the discussion was ending without a wrap-up. This prompted me to introduce a wrap-up time in the last five minutes of the journal club. I started to ask for any last remarks on the strengths and weaknesses of the study. This began to be included in the repertoire. However, sometimes wrap-up generated a further discussion on the weakness or strength of this study. The preservice teachers with a class at 4:00 P.M. would have to go running out and leave the conversation, but the inservice teachers would linger a bit talking about the research topic further.

The repertoire of presenting an article then summarizing the main points and asking questions was such a part of the fabric of the journal club that once when Phil, a preservice teacher, came late to the meeting because of traffic, Beth, an inservice teacher, stepped in and reviewed the study before Phil arrived. The two had never spoken about this before, but Beth knew how to present and had read the article. Beth not only went on and summarized the article, but she also kept personalizing the article to her practice even though she had not chosen it. When Phil came in the room, Beth explained that she began summarizing without him for time’s sake, and then Phil, without missing a beat, jumped right in explaining why he chose this article.

Every week that we met, the group became more and more familiar with presenting, discussing, and sharing. Jilly said that prior to the journal club, “I didn’t know there were so many educational journals out there” (focus group, 4/22/13). Each week the teachers became more familiar with educational studies. Words such as peer- reviewed,

qualitative studies, and mixed methods were terminology many of the teachers were unfamiliar using. Before the journal club began Phil said, “I didn’t even know what a scholarly article was like” (focus group, 4/22/13). The teachers each week were learning the language of the educational community.

In the final interview, Phil explained what it meant to him to know how to read and critique a research study. Phil said,

> When you can identify a research article or scholarly work that is the reason behind something I do in my classroom every day, it will help like the reason I give you guys quizzes and you are allowed to re-submit your quizzes. Not because it is a good idea, but because it has been shown that students will most times do better (final interview, 5/6/13).

Phil began the journal club not even knowing what a scholarly article was and by the end of the journal club, Phil knew how to connect the theory from an article with his classroom teaching.

Inquiring Questions

Asking inquiring questions of each other became part of the regiment of the journal club. The questions were modeled to them in the guidelines and through me, the facilitator at the first meeting. These inquiring questions encouraged peer interactions and reflection on the articles’ connection to their classrooms. All the teachers asked questions when they presented an article and these questions aimed at having the community co-construct knowledge (Wells, 1999) based on each other’s teaching experiences as they related to the study. The guidelines were based on a previous study conducted on a medical journal club (Tallman & Feldman, 2012). The guidelines in the medical journal club “helped set-up the journal club as a place for dialogic discourse centered on solving clinical case problems about a patient using an article that would inform the problem

solving" (Tallman & Feldman, 2012, p. 9). In this study, the guidelines helped teachers to ask their fellow teachers specifically to refer to their classroom when discussing the article.

The guideline sample questions provided examples that demonstrated inquiring questions: "Have you ever witnessed descriptive feedback in a classroom situation?" or "How do you envision descriptive feedback would look like in the classroom," and avoid vague questions like "Would someone like to comment on descriptive feedback?" (Appendix F). These examples were intended to get the teachers to view the article through the perspective of their teaching, and not as an abstract text without any connection to their teaching practice. Although the guideline questions were reified aspects of this community they were not integrated as such into the journal club. It was the teachers in the journal club who incorporated them into the journal club as they saw fit. Beth stated how she "developed some questions based on the things that jumped out at me [in the article]" (final interview, 5/1/13). However, the guidelines helped the teachers incorporate their teaching practice into their question formation. Mary said,

> As I am reading it [the article] the first time, some things I highlighted and would star, I would write questions. Then I would try to reflect on my own classroom teaching and say okay this is what I am doing as a first year person (final interview, 5/9/13).

Mary then was interested in knowing what other teachers were doing in their classrooms.

The inquiring questions stressed to the teachers in the guidelines were interpreted "reified aspects of accountability" and helped integrate the teachers into the journal club (Wenger, 1998, p. 82). The teachers, as Wenger (1998) explains, were able to make a distinction "between reified standards and competent engagement in practice" (p. 82). The practice I am referring to here is the journal club and the reified standards are the

guidelines. However, inquiring questions became a part of the journal club routine because the guidelines were broad enough to be enacted by the teachers into the journal club. Beth explained the difference between the guidelines of the journal club and other professional developments she had participated in. Beth said, “A lot of professional development is trying to get you to do something, so this was more open-ended, more theoretical” (final interview, 5/1/13). David felt the set-up of the journal club was structured as “here is what you want to accomplish and here are some ideas in accomplishing it” (final interview, 5/8/13). David expressed how, “it makes us feel like adults again instead of being told to do all these things” (final interview, 5/8/13). In the journal club, the teachers asked inquiring questions to each other about the article and their teaching practice, after they summarized an article, like the guidelines suggested.

Eliza asked after her summary of bias in student evaluations, “What are the implications of this to your practice?” (6th JC). Beth asked the teachers a two-fold question after summarizing diversity in science learning. Beth said, “ Is this a way of looking at science that you think is valuable for future classes, and is it something you could do throughout the year?” (12th JC). Mary read a quote from the article, and then asked a question that connected the article to the teachers’ students and curriculum. Mary read, “The notion that school science is too abstract, difficult, and irrelevant are familiar criticisms of science education…” (Villanueva & Hand, 2011, p. 233). Mary then asked, “Do we feel that some of the standards in our topics are too difficult for students to reach, or do we feel that it is manageable for our students in regards to what we are required to teach them? And how so?” (10th JC). By the tenth journal club meeting, Mary not only asked a question about the text, but she also implied that they were a community by

saying “we.” The use of "we" demonstrated how the teachers were beginning to see themselves as a community making shared inquiries into curriculum issues.

The teachers used inquiring questions to gain an understanding of what a concept looked like in practice. Jilly asked after summarizing her article on inquiry-based instruction, “What types of differentiation have you tried in your classrooms, and which have you found to be effective?” (9th JC) These questions asked right in the beginning of the journal club set the stage for a reflective community, which examined the articles meaning in relation to their teaching situation.

The teachers continued to ask questions throughout the meeting. The article on the divergent views of college and high school science teachers prompted the teachers to reflect on their curriculums. Beth wondered if, “professors were bringing up the depth vs. breadth issue. They also wanted math using real world examples. But trying to do that and get students ready for [state] tests. Should we just get rid of these tests?” (5th JC). This question invoked a discussion about whether they were sacrificing teaching essential skills needed in college in order to prepare them for state tests.

Sometimes articles from the journal club connected to articles the preservice teachers read in their education classes. The conversation of the study on special needs students in science classrooms caused Jilly to pose a question from a related article she read in her education class. Jilly said,

> I guess this brings to mind one of the readings we had to do for our other courses on formative assessment. I know reading and writing may be a barrier for them [special needs students]; but, do you have other ways for them to be assessed? (4th JC).

Jilly was now using the community as a resource for finding ways to assess student learning.

As facilitator, I posed questions to the teachers during the journal club meetings to prompt reflection on their students and classrooms. I often asked, “Why do you think that?” The study on inquiry learning for special needs students brought up mnemonic strategies and reading strategies. I said, “Have any of you tried these types of strategies. If so, how did it help the students?” (9th JC) I was always aware my role as facilitator was to help orchestrate the discourse in the journal club around “asking questions and posing problems” (Grossman et al., 2009, p. 281). These questions were asked to have the teachers reflect on the theory from the article in relation to their practice and to co-construct new knowledge in the community. This community focused on questions from the text to ignite discussions that could lead to problem-solving. David stated during his final interview, “Even though it might not have been the article itself; the article might have sparked some discussion about an issue they had in the classroom and how they solved it. We can use that in the classroom in some way” (final interview, 5/8/13). David recognized the articles and the discussion were tools to help solve problems in his teaching practice.

The inquiring questions that were fostered by me as facilitator but adopted by the teachers each week created a reflective teacher community. Jilly said, “I just feel a lot more informed as a teacher and I feel like it’s making me a lot more reflective than I would be” (final interview, 5/2/13). The structure of the journal club allowed all the teachers, including myself, to be equal participants. Beth said in the journal club, “You felt like you were equally involved…” (final interview, 5/1/13) Almost from the start of the journal club reified characteristics such as accountability and honesty developed, perhaps because all the teachers felt that they had a voice in the journal club which

helped create a community focused on learning. I will further explore these characteristics in the sections below.

Summary

The rhythm of the journal club helped create a shared repertoire among the teachers that became a point of community unity (Wenger, 1998). The routine of the meetings, the presentation of articles, and the inquiring questions became an important consistency and repertoire of the journal club. “The repertoire of a community of practice includes routines, words, tools, ways of doing things…, and which have become a part of its practice. The repertoire combines both reificative and participative aspects” (Wenger, 1998, p. 83). In the sections below, I examine some of the reified aspects of the journal club produced by the members of the journal club, for example, accountability. I also examine the participative aspect of the journal club under scholarly talk and how these contributed to creating a community of practice.

Accountability

In communities of practice, it is the regiment of accountability that “allows participants to negotiate the appropriateness of what they do” (Wenger, 1998, p. 81). This regiment of accountability becomes an important aspect of a community even though it may not be easily articulated by members of a community (Wenger, 1998). It is the teachers’ negotiated response to be accountable to each other that created ‘community coherence’ around the enterprise of the journal club (Wenger, 1998, p. 77). The teachers in the journal club did not easily know why they felt they had to come to each journal club meeting and read the articles but they knew they felt a responsibility to the other

teachers to come. The teachers at the final focus group discussed how they felt this need to be at the journal club each week that they just could not explain. Phil said,

> I don't know the pull. I don't know if it was the consistency. It was the way it was organized. It was something in my schedule. I put it in my schedule. I once tried to do a book club with friends on inspiring books, and we all never went. Maybe it was because this wasn't friendly. This was professional comfort (focus group, 4/22/13).

Mary added, "It was like I have someone counting on me to be there…Here you feel bad for letting people down" (focus group, 4/22/13). Beth explained, "I also think it was manageable chunks. A book is daunting. You get into it then you put it aside. This is manageable" (focus group, 4/22/13). The teachers all pointed to some intangible connection they felt to each other.

Accountability is important to a community because it lets members in a community know what matters to this community and what is not important to the group (Wenger, 1998). In order to be accountable to each other, the teachers had to take responsibility for their own actions. The teachers took responsibility on their own to: 1) attend the meetings; 2) be prepared for each meeting, which means reading everyone's article before arriving at the meeting; and 3) show respect for each other. These three factors became an integral part of the regiment of the journal club, which helped define the community (Wenger, 1998).

Attendance

The members of the journal club stressed how attending the meetings was very important to them. The teachers showed up every week for fourteen weeks. These were the only journal club meetings missed: 1) The seventh journal club two people missed. This journal club meeting had not been an original date. We had to rearrange the date

from a snow date. Eliza missed because she had a doctor's appointment and could not rearrange it, and Mary had to miss because she had already been scheduled to work at her job as a waitress that she did on top of her schooling. 2) The ninth journal club was a snowy day but the university where we met was meeting, so we met, but Beth, an inservice teacher, missed because her school had a snow day and she lived far from where we held the journal club meetings. 3) Beth also missed the thirteenth journal club because she had a meeting as a mentor teacher at her school that had not been scheduled when we set the dates. 4) Jilly, a preservice teacher, missed the twelfth journal club meeting because her mentor teacher was out of school that day. Usually she left the school earlier to come to journal club, but she was in charge of the class that day and had to stay until 2:50. Other than those five misses everyone showed up and read and discussed the article every week (Table 3).

Responsibility

The members of the journal club felt responsible to each other to read and discuss the article. Phil said,

> I was not going to walk in there and not read a bit of the article, like skipping an article. It would be a waste of time. I signed up for this and did my best, even if it meant reading the article literally on the way there (final interview, 5/6/13).

The group wanted to be professional for each other. David explained why he kept coming and doing the reading,

> Part of it was you don't want to disappoint everybody else. You don't want to look foolish, obviously. Another part was just feeling like a responsible adult and saying I'm going to do something and doing it. The third thing would be I like reading these things and seeing what people are saying and what they think is important (final interview, 5/8/13).

There was something about the journal club that led to this intrinsic motivation. It might have been that it was voluntary as Eliza pointed out, or that the topics interested them every week. Eliza said that she "certainly got the sense that everyone felt accountable" to each other. Eliza expressed,

> Maybe because you didn't have to go. There was no reason to go, plus, if there were forty people, you might think, maybe you didn't have to read the article, but with only six you sure have to. I will learn from other people, and they will not learn from me that is not fair…Every single week it was something I was interested in (final interview, 5/1/13).

She also stated "it was the setting" that could have led to the members to come every week. Eliza explained, "It was totally voluntary. Nobody has to be here if you don't want to be here, you wouldn't come." Mary elaborated on the importance of choosing your own topics in the journal club. Mary said,

> I think it was that we were all doing this in our spare time. We are all leading busy lives and maybe we all knew we had to present an article. So I didn't want to be not reading anyone's article and not having at least some small opinion about the piece. That could come back to haunt me when it is my article (final interview, 5/9/13).

Jilly explained that by choosing your own articles the teachers all had a stake in the journal club and the discussions. Jilly said, "We have more of an investment into it. These were articles that we personally were interested in. And we wanted to get feedback from other teachers about our teaching" (final interview, 5/2/13).

Wenger (1998) explains that accountability by a community is not conformity but more what pushes the activity forward and gives its' social energy. If these teachers did not all feel they needed to be prepared and attend as many meetings as they could, the journal club would not have been as productive or become a community of practice. Each teacher in the journal club wanted input from the other participants on their article and

problems encountered in teaching so that they knew they needed to provide the same professionalism to their fellow colleagues.

Table 3. Teacher attendance at journal club meetings

Week of meeting	Attended	Missed	Reason for Miss
10/1/12	3 preservice teachers	3 inservice teachers	The inservice teachers had not yet been invited to the journal club.
10/15/12	3 preservice and 3 inservice teachers	no one missed	
10/22/12	3 preservice and 3 inservice teachers	no one missed	
11/5/12	3 preservice and 3 inservice teachers	no one missed	
11/28/12	3 preservice and 3 inservice teachers	no one missed	
12/3/12	3 preservice and 3 inservice teachers	no one missed	
1/14/13	2 preservice and 2 inservice teachers	1 preservice and 1 inservice teacher	Rescheduled meeting from original date. Mary scheduled to work at her part-time job as waitress. Eliza had a doctor's appointment scheduled.
1/28/13	3 preservice and 3 inservice teachers	no one missed	
2/11/13	3 preservice and 2 inservice teachers	1 inservice teacher	Snow day: public school canceled. Beth had school canceled and lived far from Dale University.
2/25/13	3 preservice and 3 inservice teachers	no one missed	
3/4/13	3 preservice and 3 inservice teachers	no one missed	
3/25/13	2 preservice and 3 inservice teachers	1 preservice teacher	Jilly subbed for mentor teacher and could not leave on time to make it to meeting.
4/1/13	3 preservice and 2 inservice teachers	1 inservice teacher	Meeting at school as a mentor teacher not previously scheduled.

Honesty

The teachers placed a great emphasis on being honest and truthful to each other about what they did and did not understand in the article or about their teaching practice. Honesty in the journal club concerns teachers who are open and share their fears and imperfections. For the teachers in the journal club, they felt it was important to say I do not understand what a graph means or how best to implement differentiation in a classroom. The teachers valued that the participants in the journal club were honest and open about their struggles understanding the articles and being a teacher. Eliza said at the journal club, “Nobody was pretending to know what they were doing while not knowing” (final interview, 5/1/13). Honesty was valued in two ways in the journal club: 1) through discussions of the articles and 2) through sharing of teaching practices.

Discussion of the Articles

The teachers felt it was important during the journal club for teachers to be honest about what they did and did not understand about an article. All the teachers experienced being a novice when critically analyzing the text. Eliza, an experienced chemistry researcher and teacher, admitted at an early journal club meeting that the science education articles posed a challenge to her when analyzing them. Eliza said, “That was a little abstract for me, so I wanted to know if anyone else understood that and saw the social inequality side of science education and different cultures of students” (2nd JC).

Hearing an inservice teacher express she did not understand all aspects of an article helped reassure the preservice teachers that they could be forthright about their lack of skill in analyzing and interpreting the articles. The preservice teachers were a little anxious at first when the inservice teachers joined the journal club. Mary said, “I

think I felt intimidated, naturally. I am young, new to this, and I don't consider myself by any means an expert, and I don't know much, so that was intimidating in that sense, but I always felt respected" (final interview, 5/9/13).

The respect the teachers showed to each other allowed all the teachers to freely discuss the articles and acknowledge those parts of the article that they did not understand. For example, an article was presented that had several graphs in it when Phil said, "I wish I could understand the data better." Jilly added in "Yea, the graphs better" (9th JC). In addition, sometimes the terminology used in the articles was not something the teachers were familiar with, and they had no problem admitting to the group they were not sure the meaning of this terminology. Phil stated during an article discussion, "I was unsure what heuristic meant" (10th JC). By having the teachers freely state they did not understand an aspect of the article, the discussions in the journal club were able to go in depth into an article's meaning and not have a cursory discussion of an article. Phil stated in the journal club, "We got comfortable with each other and talked about articles in depth" (final interview, 5/6/13).

Honestly sharing misunderstandings of an article also allowed the teachers to support each other in their learning how to critique an article. When Phil and Jilly struggled with the graphs from an article, David, an inservice teacher with a strong background in quantitative studies, said to them, "Don't worry I don't think it was your fault. It was the article's fault because it didn't make sense." Eliza added, "The writing wasn't good" (9th JC). This honest environment allowed the teachers to learn from each other and learn how to critique the research articles. Mary stated, during the final interview, that she sometimes struggled when critically analyzing articles, but "I think

you and the other veteran's helped me." I will explore how the attributes of the journal club helped the teachers learn to critique research articles further under the section of scholarly talk.

Sharing Teaching Experiences

The teachers in the journal club also valued everyone sharing their own teaching experiences with honesty and openness. The sincerity the teachers shared with each other allowed the teachers to be validated for their feelings. For example, Jilly, a preservice teacher shared, while presenting an article on differentiating in the classroom, her lack of confidence in the field of special education," Lately, I have just been trying to wrap my head around differentiating in a science classroom. As much as I try, I feel I always fall short somewhere" (9th JC). Eliza, an inservice teacher, added, "You said you were worried about wrapping your head around differentiating and losing some students, and boy I feel the same way" (9th JC). This exchange highlights how the teachers supported each other through their directness about their struggles in teaching. This honesty was particularly helpful for the preservice teachers.

Mary stated at the focus group,

> Hearing from the veterans teaching that are still struggling is so hopeful for me that I am not going to have to be perfect. I am not going to go into my first job next year and think I have to be perfect that I have to have it all figured out (focus group, 4/22/13).

The honest open sharing of struggles by the inservice teachers in the journal club helped the preservice teachers learn they did not have to be flawless. They were free to not always have all the answers as a teacher.

The teachers in the journal club were not afraid to admit what they needed to learn more about in education. The frankness the teachers' shared about their teaching

struggles helped provide support to each other. It was the honesty each member showed that helped real classroom experiences be shared among the teachers. Eliza stated, "I thought it was nice to know we are all struggling…that I am not the only one that has a hard time with certain issues" (focus group, 4/22/13). These experiences allowed the members to learn from each other and learn that all teachers struggle at times. Having a safe and trusting environment for colleagues is critical for learning in communities of practice because it allows teachers' vulnerability to be reduced and promotes a group to publically engage in problem-solving (Stoll, Balm, McMahon, Wallace, & Thomas, 2006).

In the journal club, the teachers felt free to participate in the discussions about teaching. Jilly said, "I felt like I could always contribute my thoughts" (final interview, 5/2/13). Beth expressed how the community was considerate of each other and their ideas. Beth said, "I think everybody respected what people had to say, and were willing to listen" (final interview, 5/1/13). David stated, "I was never nervous or shy or worried about what they [the other teachers] were thinking; because I knew they were just trying to discuss and learn too" (final interview, 5/8/13). The teachers at the journal club shared a common goal-that of communication in the hopes of learning from each other. Each member seemed to recognize that being honest and truthful was paramount to learning from each other. Wenger (2002) explains, "The trust community members need is not simply the result of a decision to trust each other personally. It emerges from understanding each other" (p. 85). By the teachers being honest and open about their concerns in the articles and with their teaching practice they were exposing who they

were and what they hoped to learn. I will explore these concerns the teachers had with the articles and their practice further in the section on scholarly talk.

Summary

Wenger (1998) defines three main characteristics of communities of practice: Mutual engagement, joint enterprise, and a shared repertoire. Mutual engagement is defined by the community's members and is viewed as an essential aspect of belonging to the groups' practice (Wenger, 1998). Mutual engagement "draws on what we do and what we know, as well as our ability to connect meaningfully to what we don't do and what we don't know-that is the contributions and knowledge of others" (Wenger, 1998, p. 76). It was the teachers' honest discussions around the articles that helped them connect to each other and form a relationship around the practice of teaching. When the teachers honestly shared what they felt they fell short of in their practice and what they wished they knew to help them, they were helping create meaningful connections with each other. By also engaging in sincere discussions that exposed what they did and did not understand from the article and/or its connection to practice they were opening themselves up to learn from their fellow teachers.

The science teachers came each week to the journal club because, by their own account, they felt accountable to attend and participate in the meetings. Wenger (1998) explains that mutual accountability is not a stated goal of a community, but it does become integral to the function of a community of practice, in this case the practice of the journal club. Through the teachers' mutual accountability to participate in the journal club, the teachers went about creating a joint enterprise around science teaching. They searched for articles that helped them understand problems and concerns they had

concerning science teaching. They asked inquiring questions of each other hoping to add new meaning to their understanding of being science teachers. Wenger (1998) said that engagement does not require "homogeneity" (p. 78). The teachers did not choose the same articles. They stated that they choose articles that interested them or they wanted to learn more about the topic of the article. The negotiated enterprise of this community was knowledge about teaching.

Wenger (1998) explains how a joint enterprise is a shared experience that is a resource to a community. In the journal club, the enterprise of the meetings was the teachers exploring new ideas about science teaching and reflecting on the meaning of these thoughts to their practice. When the teachers chose articles, asked questions, and shared stories, it helped them interpret and understand what being a professional science teacher meant to them. The finding and sharing of articles in the journal club and creating discussions centered on topics from the article became the shared repertoire of the teachers. The routines created by the teachers, where they became mutually accountable to each other to learn, are what defined this journal club and this community of teachers. It also allowed the teachers to "express their forms of membership and their identities as members" (Wenger, 1998, p. 83). It is in the discourse that I describe below as scholarly talk that the teachers created "meaningful statements about the world" (Wenger, 1998, p. 83) and their teaching practice that allowed them to transform their view of themselves as professional science teachers.

Scholarly Talk

In the journal club, talk centered on the formal theories from the articles and the practical theories that the teachers held. The journal club became a mini-world where the

language and theories of the scholarly educational community and the language and theories of the specific K-12 teaching community mixed. First, I will explore how the teachers learned to communicate in the language and theories of the scholarly educational community through critiquing research articles. Then, I will explore how the teachers shared anecdotes from their teaching experiences in classrooms to make sense of a theoretical idea from the article. Sharing anecdotes in this community helped connect the language of the article with the language of teaching and offered a way for teachers to make sense and explain further the articles use to them. Finally, I will examine how the teachers also engaged in exploratory talk, which is inquiry-based. These inquiry-based conversations encouraged the teachers to hear different perspectives from the article and each other, but it also helped them assess the quality of that knowledge. In the journal club, these modes of talk helped the teachers become scholars of educational research and learn and understand the use and purpose of research to their teaching.

Critiquing Research Articles

Every meeting of the journal club began with one of the teachers presenting an article he/she chose and then leading and guiding the conversation through analytical questions about the study. The conversations entailed carefully breaking down the article into parts to assess the study's validity and meaning. The critique of the articles helped the teachers evaluate the purpose of the research and the implications these studies could have for their practice, even if not always directly applicable. These conversations helped the teachers see the broader implications of the research to education and learn about what the scholarly educational community deemed important to teaching.

The teachers were becoming scholars of educational literature and learning, as a group, the language and complexities associated with this type of inquiry. Critiquing research articles helped them learn norms, values, and purposes of educational research (Golde, 2007). In the journal club, the teachers were learning how to look at research and think about it in relation to their work. Critiquing research articles helped the teachers learn what is known in the field, develop the skills to determine what a high quality study looks like compared to a mediocre study, and how to extract useful information from these types of studies (Golde, 2007). By learning to critique research studies, the teachers were discovering how to use theoretical concepts for their own use, and they were not relying on the interpretation of a teacher educator to tell them the articles' purpose and use.

Phil explained that when analyzing articles in the past, he never understood how to find the purpose of research and the point of an article. He felt educational research was only applicable to the case it examined. Phil said prior to the journal club, "I wouldn't realize that those articles were created to connect the broader topics and points" (final interview, 5/6/13). Many of the articles did not have a direct correlation to the teachers' practice; therefore, the teachers provided the connections for each other through their talk. In this section, I will examine: 1) how the teachers critiqued the articles; 2) what they learned by critiquing the articles; and 3) how they learned to critique the articles.

How the Teachers Critiqued

Every presentation of an article would begin with an analysis of the methods used. This example shows how the teachers carefully examined the methods used by the study,

and the data generated. They then worked together to gain an understanding of the methods used and the data produced. For example, as seen below, the teachers carefully examined the instruments used in the study that Jilly presented on inquiry-based instruction for students with learning disabilities. They also scrutinized the language used in the article. Unfamiliar vocabulary prompted them to work together to understand these terms.

> Jilly: This study had five students at elementary level using this kit supporting inquiry. Learning with a pre-test then 6 weeks later a post-test to see how much information was retained.
> Eliza: They talked about many sessions in the article.
> Jilly: That was one of the limitations of the study.
> Karen: How many did they have?
> Phil: Thirty sessions total.
> Eliza: They never said how long this study was, but there was a total of thirty sessions.
> Phil: And each session was 50 minute class with 20 minute quiz. Start of each session with 20 minute quiz (9th JC).

The review then moved to the graphs.

> Phil: I think they were using psychology terms not something a guidance counselor could use, definitely not a teacher.
> Eliza: Yea what is the difference between scientific attitudes and attitudes toward science?
> Jilly: I think one was about what they thought about science, and the other was what they thought of themselves in science (9th JC).

In the next example, the teachers examined a graph from the article on using video media to boost student achievement and attitude in science. The teachers challenged the instruments used in the study and the study's interpretation of the results. Notice Eliza begins the discussion sharing a characteristic of this community, honesty, when she states "again being clueless." Eliza is not pretending to understand everything presented in the article.

Eliza: It says looking at the effect of the teacher was something they did that other studies had not done. I have a question. I understood what they were getting at, but once again being clueless. What is the graph on page 625 with no labels?
Beth: They would get so marked down in my class for doing this.
Phil: It was a test of logical thinking.
David: They are showing the more gain from the higher logical thinking students.
Eliza: Is the bottom curve the control group and the dotted line the treatment group?
David and Karen: Yes, I assume so.
Eliza: Where are they breaking it off?
David: I don't know. It was some logical thinking test, and I am not sure how they scored that.
Phil: TLT is a 20 minute paper and pencil assessment test.
Eliza: It seems to me that while 450 students is a lot of students it is not a significant number statistically.
Beth: Sorry if I am finally getting it. They are correlating their achievement test scores with their ability to logically think.
Eliza: Yes, and they are saying to score better on this the students learn proportionally more than the students who did worse on that [test].
David: Wouldn't that happen if you did anything with them?
Karen: Do you mean any intervention?
David: Not just intervention, but anything.
Eliza: The control group seemed to imply no.
David: OK, I see what you are saying.
Eliza: They said both groups improved their learning, so that is what made me unsure what this graph was [about]. The higher logical thinking just increased more [on the graph].
David: So, it is like control and non-control group. I see.
Eliza: Yea, but then it made me unclear. The bottom line [of the graph] (11th JC).

Phil then explains that this graph does make sense by explaining the purpose of the study. The purpose of the study was what the teachers all were struggling to understand.

> If the students are higher in logical thinking then they are just missing the next step of models and practical application seen in different parts of chemistry [that] they can't see (11th JC).

The teachers together examined the purpose and strength of each article.

The teachers also critiqued the statistical tests used in a study. The article on science camps used pre- and post- surveys, and then statistically compared the responses.

When analyzing these results, Phil openly shared his unfamiliarity with the statistical test used by the study.

> Phil: The before and after survey, I don't know a p-value.
> Jilly: A p-test tells whether there is a significant difference. A value of greater than five, no significant difference.
> Mary and Eliza: .05
> Phil: Greater than .05?
> David: It depends on your tolerance level, and what you want to decide is significant. [It] depends how they measure (3rd JC).

This example demonstrates how the characteristics of the journal club helped the teachers learn from each other. Phil demonstrated honesty when he did not pretend to understand p-values. In the journal club, the teachers valued honesty in the hope of learning from each other, and faking knowledge would have run counter to the goals the teachers had in the journal club. This attribute of the community helped, not just Phil, but everyone in the journal club, learn the knowledge and skills needed to critique research articles.

The next example explains how statistical expertise was not the only skill valued in the journal club, but skill in interpreting the language of the study was necessary. The article on science for all had Phil confused about how they defined scientific literacy.

> Phil: Scientific literacy to me dictates that they see that something is scientific, and then they could learn more about it now they had the choice (10^{th} JC).

The teachers then explored how nonscientific fields use science and how that constitutes scientific literacy.

> Jilly: I think ultimately being scientifically literate just makes you an informed citizen; particularly, we need to think critically about our decisions and how they work to society by just being a smarter person (10^{th} JC).

Phil still struggled with a meaning to scientific literacy

> Phil: Is it common sense we are teaching?

> Beth: I think it feels like that, but I don't think it is…The note I wrote about scientific literacy was just the ability to discern legitimate sources of data and the ability to compare (10th JC).

The teachers seemed to like this definition, but continued to fine tune it through examples.

By critiquing the strengths and weaknesses of an article, the teachers learned the language of educational research. The teachers learned there is no single answer to their concerns. They also found out that research varies in its quality; and that studies must be read critically.

What was Learned by Critiquing

The following examples show what the teachers learned by critiquing research articles. During the focus group, Phil explained what critiquing articles taught him. Phil said, "I had never known you could specify peer reviewed articles. I had never looked this much at scholarly work" (focus group, 4/22/13). He explained further in the final interview what he learned by looking critically at the articles.

> What I realized is that there is a scale. I would think that only the best articles ever were published, but then thinking of peer review and all that stuff, you realize that some people have different opinions, and things get out that aren't going to give the direct, or right information. If I am looking at research articles for information, I am going to get varying sources. I am going to get varying levels of thoroughness. I am going to get general studies, objective studies, and subjective studies, and things like that. That is something I didn't understand, so it was very interesting. It definitely helps, when looking at articles now (final interview, 5/6/13).

Phil also felt that his skills of analyzing were emerging over the year in the journal club. Phil said,

> I remember reading some articles and wondering is that the best approach to the research that they did? I remember case studies where there would be a couple of students that they would work with and track these students over a long period of

> time. I would question the methodology of it, but that was stuff that was emerging through the year (final interview, 5/8/13).

Mary explained how the journal club helped her examine an article's purpose and data. Mary said,

> I think it [the journal club] helps me look more closely at what the article's purpose was and is there ending evidence supporting that… It is not just about casually reading the article. It is kind of like, does this article make sense. Any writer can word something wonderfully so that it sounds nice, but I think it is important to look at the data: look at the class size, look at who they were looking at, where they were looking, and were the results reflective of their purpose and the study they set out to accomplish (final interview. 5/9/13).

For teachers who had a strong background in reading science research, they were often skeptical of educational research, which they viewed as less stringent. They learned in the journal club educational research had a purpose and place in teaching. David, who had participated in a journal club in engineering, felt with education articles "you have to be more lenient because it is a social science" (final interview, 5/8/13). However, in the journal club David did learn the purpose of educational research.

> It got me back into reading research articles and thinking about things like that, and thinking of how research governs applications. Just looking at things more carefully wondering does this makes sense, and this doesn't make sense, this seems reasonable, and this doesn't seem reasonable, and why. Looking at things like that was useful… It is surprising that this hardly ever happens (final interview, 5/8/13).

In the journal club, the teachers were learning how to critically examine theories in education articles. The teachers were learning how to examine data and think about it globally and outside the context of the study. They were also learning what the field of education is currently most concerned about through the topics chosen. The inservice teachers felt being with the preservice teachers helped them understand the current issues

of education. They stated that they learned what the current trend was in educational research just through the topics the preservice teachers chose to read. Beth explained,

> It [the articles] gives us a sense of what they are teaching now in teacher training, so clearly they [the preservice teachers] are picking articles they feel are relevant to what they are doing in their work to get ready for teaching. So, it is kind of interesting now to see what the "buzz" is in teacher education. Some of it is like okay this is what is coming down the pike, so we get mentally ready because in two or three years down the road, we are going to be asked to do this (final interview, 5/1/13).

David echoed how just the topic of an article could provide a learning moment for what is seen as important in education.

> Everybody had kind of a different topic, nothing was repeated too much, so you had a nice kind of snapshot of the current situation…You can see what people think is important and what they are striving for. This is the meaning of teaching for them, at least in some respect, and I could see how it relates to what I think about teaching and kind of see where they meet up (final interview, 5/8/13).

Eliza summarized what the preservice teachers' choice of articles provided the inservice teachers.

> I feel the preservice teachers are all enmeshed in the classroom…They were dealing with research in education all the time in their classrooms. That is the part of teaching that I have gotten too far away from and I suspect I am not very different from my very busy colleagues… It was very appealing to me having preservice teachers, who were dealing with research in education all the time (final interview, 5/1/13).

This discourse around an article, through critiquing or just through the choice of the article, provided learning opportunities to everyone in the journal club.

How the Teachers Became Skilled in Critiquing

The criteria needed to critique the articles arose each week from the study being reviewed. Instructional steps were not overtly stated, as a step-by-step process to follow, instead the skills required when critiquing an article came from the actual group process of analyzing an article. In this way, the journal club was functioning as a community of

practice, where the skills needed to critique research articles were learned in the process of performing the tasks of the club (Lave & Wenger, 1991).

The teachers all brought their own expertise to the work of the journal club. The preservice teachers were up on the latest issues and concerns in education. Many of the inservice teachers had skills to analytically dissect a research article, which was also found in Jilly who had a strong background in science. Teachers with the strongest background in critiquing research articles often led the critique of the articles, but through the discussions analyzing the articles, all members were learning how to critique a research article.

The practice in the journal club was not that of science teaching but rather critiquing scholarly research articles to understand their validity and meaning to science teaching. Just because the teachers were all trained or becoming trained as science teachers they did not all know how to research and critique articles. It was through the practice of the journal club the teachers learned. Phil stated in the section above that it was over time the skills for analyzing were emerging. Each teacher, through what Lave and Wenger (1991) describe as legitimate peripheral participation, was gaining the knowledge to participate fully in the journal club. It was in the journal club by learning how to make meaning out of the articles that the teachers were transforming their identity as teachers. The practice they were learning to become full members of was the community of research education.

In the journal club, the teachers were not just learning how to research and critique articles; they were also learning how to take abstract representations and use them for a specific situation in their practice (Lave & Wenger, 1998). They were doing

this by sharing stories in the form of an anecdote. Lave and Wenger (1998) explain "…stories can be so powerful in conveying ideas, often more so than an articulation of the idea itself" (p. 34). In the journal club, the teachers were learning that sharing anecdotes helped them acquire the knowledge from an abstract theory and understand its implications to their practice. I will, in the section below, explore sharing anecdotes further.

Sharing Anecdotes

Often when the teachers were unsure of the meaning of a concept or needed further clarification, they would share a teaching experience, in the form of an anecdote, to provide a practical example of a theoretical concept from the article. I am borrowing the definition of an anecdote from Feldman (1996). He defines it as "the oral exchange and generation of knowledge and understanding by recounting and questioning of some teaching event or explanation of one's understanding to others" (p. 522). Feldman (1996) distinguishes it from story-telling and narrative because an anecdote does not necessarily have the structure of a story such as a crisis that is to be resolved, a plot, or time sequencing of an event. The anecdote-telling Feldman (1996) observed usually began with an "I tried…" or "I have seen…", or "It kind of reminds me of …" statement.

In the journal club, anecdotes began with these same kinds of statements. The use of an anecdote provided a way to see how a new idea from an article could be incorporated into practice or validated their practice as being similar to the study. Sharing anecdotes was a way to connect theory with practice because the anecdotes often initiated from an article. The anecdote provided an additional way to explain a topic in the article, a way grounded in practice.

The following example shows how anecdotes provided practical examples of a theoretical idea from the article. The study on differentiated learning prompted Phil to wonder what a comprehensive strategy of differentiation looks like in the classroom. Phil said, "I have never tried differentiated instruction as a full plan. I have tried to add it in, and was wary of it…" Mary replied,

> At my school, my mentor teacher and **I have tried** a layered curriculum approach. We kick it off with an introduction type video with cell biology. Then the students work on projects for two weeks, and they move up from C level work. We try to make it really diverse. [There are] a lot of options of doing an assignment. There is a lot of ways you can show us you understand mitochondria: video on you-tube, write a paper, a poster. That is left open, but they have to come and talk to us. It isn't like here is my video, and I am going away now. They have to explain what it means…The layered approach has been helpful in differentiating the way kids show the work (9th JC).

In Feldman's (1996) work, he identified three types of responses to the telling of an anecdote: 1) another anecdote; 2) questions about the details of what was described or explained in the anecdote; and 3) critical questions that ask why as well as what, where, how, and when. The following exchange illustrates the second type of response to an anecdote: asking for more details from an anecdote.

> Jilly: Do you get different products from each kid?
> Mary: Yes, remember in class when we spoke about portfolios. On a single block day, I let them work on their project, but on double block I do a lab with them. I try to break up one or two lessons through the week where they are not on their own in a free fall, all because that can be disastrous too.

Eliza then asked a second type of response below when she was looking for more details to explain the grading system.

> Eliza: When you said C level work, do you mean this is what you have to do to get a C?
> Mary: Yes, and if you want a B you come first and check with us to get 75 for C. Then you move on to B assignment, and you must check in with us every other day. [It] stops everybody coming in all at once because it takes 20 minutes to go through the assignments with me (9th JC).

Through this anecdote and questions the teachers asked about the anecdote, the teachers were beginning to understand how a layered curriculum works, and also a way to implement differentiated learning in the classroom.

Affective Response

This next example is of an action that Mary tried in her class that was similar to the topic of the article being discussed. The article on writing in science looked at peer teaching and peer editing by the students; but, many of the teachers were wondering where they had time to try it in the classroom. Mary explained how she used peer editing in the classroom through an anecdote, but, unfortunately, her attempt at peer editing failed.

> Mary: **I tried** to do this in the beginning of the year. I was unprepared for high school. Of course, I came from college and thought that would be great. Boy did that blow up in my face.
> Eliza: The question is what you do with students who don't bring in their work.
> Mary: I tried with honors kids first hoping I wouldn't have the problem of not bringing it in. I ran into the trouble of students pairing with friends.
> Jilly: Ah! A social thing.
> Beth: This is great you did a great job.
> Mary: I provided them with points to critique, but I haven't done it since because it bombed (8^{th} JC).

The anecdote showed how applications of new ideas sometimes fail. However, the teachers did not dismiss the notion of peer editing because of the failed attempt; instead Mary was supported for trying a new idea in her classroom. The addition of support to an anecdote is a new fourth type of response to an anecdote that was evidenced in the journal club, but not in Feldman's (1996) work. Perhaps, this fourth type of response to an anecdote is a result of the honest and supportive community of practice the teachers in the journal club created. A study by Stoll et al. (2006) found that mutual trust,

respect, and support are important characteristics found in learning communities. All three of these characteristics were witnessed or stated by the teachers in the journal club.

This fourth type of response to the anecdote was a more emotional response and less technical then the responses found in Feldman's (1996) work. Notice when Eliza responded using Feldman's third type of response to an anecdote, Eliza said, "The question is what you do with students who didn't bring their work" that she is looking for an explanation for how to technically implement peer editing into her classroom. Whereas, when Beth responds to the anecdote with the response of support, Beth said, "This is great you did a great job" she is offering support and encouragement on trying to implement peer editing in the classroom. This response of Beth's prompted Mary to share more about her goals for her students, which led to a more immediate concern of Mary's that of helping students learn writing skills.

Mary explained that she was not dropping the idea of peer editing and that she was looking for ways to improve her students' writing for open responses. Mary said,

> One of my goals is to work more on writing with the students…I started off strong, but then fizzled. I did another writing project with them. I will get back to you on how it goes. Another question I have, in high school should they be writing for an open response type question in the sciences just like in their social studies [classes]? (8^{th} JC)

David, an experienced teacher, added his view of open response writing for the state science tests from his own experience. David said, "Yes, totally. You don't have to have them use complete sentences. You can draw graphs. You can use equations." (8^{th} JC). Phil, a preservice teacher, used the recommendations from the article to answer how to write for open responses. Phil said, "You will see in this article the intro should be two to three paragraphs…" (8^{th} JC).

Mary's attempt to implement a theory mentioned in the article was met with support and clarifying questions. Mary, in turn, shared her goals and desire to keep trying, and now she felt comfortable asking for help with open response questions on MCAS tests. The teachers then discussed their thoughts of what the open response answers should look like; they used both the article and the teachers' perspectives on open responses in their discussion.

Many of the anecdotes in the journal club were greeted with this fourth type of response of support. Support was shown in an exchange that occurred after Phil presented an article on African-American science identity. After discussing the study for a while, Phil asked for help on a topic raised in the article on getting to students to express themselves in nontraditional ways. Phil asked, "Does anybody have any suggestions for the discourse angle?" All the teachers mentioned they welcomed having students express themselves in other ways.

> Jilly: Are you thinking outside of science?
> Phil: No, I am thinking inside my class what I can do to be more inviting to students who are used to a less dry discourse and having different ways of communicating.
> Mary: Tap into the creativity side of things (2nd JC).

Mary then provided an anecdote.

> **I have tried** to do this as we are doing a lesson on nerve signals, and I had my honors kids break into groups and act it out and create skits. At first there was some dragging of feet, and they were like I don't like this (2nd JC).

Mary said that by the end of the lesson, many of the students had enjoyed it. Mary stated that the students said,

> I didn't think I would like it, but I do feel like I had to talk to my classmates and we had to act it out. So I do feel I had a better understanding of it than if you had just lectured it and had us write notes (2nd JC).

Mary added that she had also tried getting the students to become experts and use classroom resources.

> I have been trying things like that, but I am only a month in so who knows. So far it seems to be working. There are a couple of kids in my class that I know are struggling academically but big in drama (2nd JC).

Eliza, an experienced teacher, now offered support for Mary's new explorations in different ways of communicating with students. Eliza said, "I think that it is great; it is allowing the knowledge to bounce around their mind and giving them any method or channel or vessel" (2nd JC). This affective response helped Mary feel that as a preservice teacher she too had knowledge to share with inservice teachers. Mary in the final interview said,

> Sometimes the inservice teachers might look at a preservice teacher, and say I never thought of it that way. It always felt good to be kind of like helping each other. We [preservice teachers] were kind of looking at things with a fresh pair of eyes (final interview, 5/9/13).

Anecdotes Connecting Theory to Practice

Anecdotes in the journal club also helped tie the teachers' experiences back to the article. A study using technology to enhance inquiry found that students from a young age are taught to provide only the right answer to a question. The teachers had a big discussion about how they were now being told to bring the students as Beth said "back to what they were in kindergarten, which is wonderful curious kids about everything and just ready to dive in."

> Karen: Has anyone ever thought of having labs, but not giving the labs a grade. How would it work?
> Beth: Good question (7^{th} JC).

Jilly responded with an anecdote from her experience.

> Jilly: **I kind of did** a lab that I wanted to be an inquiry lab overall. So I did a lab that then went into a lesson, and I didn't grade the lab, but they had to have their answers with them the next day. They came up with their answers and then I validated it the next day. Then I led into it, but I am not sure how much it helped because they all seemed confused (7^{th} JC).

Phil and David now replied to Jilly's anecdote using the fourth type of response, support.

> Phil: Confusion is great. I like when they are confused.
> David: You want a little bit of confusion, but not too much (7^{th} JC).

This then led to a discussion of inquiry and how students need to make inquiries more and not always be given the right answer, which the study advocated. They also examined the role technology can plan in supporting such inquiry, which the article examined. These conversations helped the teacher understand a failed attempt at a new pedagogical approach could be a positive experience and now they as a group were exploring ways through the article and their experiences to improve upon inquiry labs.

Anecdotes also prompted discussions on global issues in education. The teachers started to discuss debates because the article on science for all brought them up as a tool to use. Mary said that she often heard about debates in her teaching classes, and it could be worthwhile, but she felt it took too much prep time to prepare a debate. Beth said,

> **I have done** debates on ethical issues in biology; there are stem cells or genetic engineering and that sort of thing. Usually, it is with upper honor classes because they have a better sense of the kind of information to bring; but it is definitely something you have to teach (10^{th} JC).

Mary connected debates to interdisciplinary work.

> Mary: It reminds me of the need for interdisciplinary work.
> Eliza: I have spent time over the last week looking for articles on interdisciplinary issues [for the next journal club], but I haven't found anything yet.
> David: The new standards are calling for interdisciplinary work, so it is not a crazy idea (10^{th} JC).

The teachers then continued to discuss interdisciplinary work.

The teachers were sharing anecdotes from practice with each other. If a teacher was not familiar or able to understand the meaning of the article then an anecdote helped provide the acquisition of the idea to their teaching. Wenger (1998) explains that providing personal experience for meaning helps add to the collective production of meaning of a community. Sharing personal experiences helps members take ownership for the learning in the community (Wenger, 1998). These personal stories as Wenger (1998) explains are more powerful than reified information. Thus, the concepts from an article are better understood with the sharing of a personal anecdote.

As I highlighted, sometimes an anecdote described a situation that did not work in the classroom, but that did not diminish the review of the idea as a valid thought and worthy of consideration in the classroom. Topics in the article could also, through sharing anecdotes, be tied to analogous topics from the article such as interdisciplinary work. The anecdote provided real teaching applications of scholarly talk on educational science theory. The anecdotes offered a glimpse into what theory looks like in the classroom, and how in some cases it can be implemented even with limitations.

The anecdotes provided a way for the teachers to make sense of the articles. "Telling anecdotes is an everyday way to make sense of our experiences to ourselves or to add sense to things that have happened to us" (Bell, 1994, p. 575). Bell (1994) stresses that anecdotes provide an equal voice to a novice and an expert and by doing so empower all participants within the social interaction to feel like contributors to the new knowledge in the group. All the teachers were able to share anecdotes and as Mary said sharing anecdotes made her feel like she was helping other teachers learn by examining a situation from a new perspective.

Exploratory Talk

The final mode of talk central to the conversations in the journal club that helped members connect theory to practice was exploratory talk. I am defining this using the dialogic theoretical framework of Wegerif and Mercer (1997) on the types of talk likely to arise in small group work that is task-based. These modes represent the way participants in talk orient themselves towards each other. They define talk as being of three modes: disputational, cumulative, and exploratory. Disputational talk is more likely when the participants in the talk are not looking to share knowledge. Cumulative talk is defined more as accumulations of knowledge without the goal of critically examining the knowledge's worth. Exploratory talk is defined by peers in the talk critically examining knowledge and weighing the quality of the knowledge. With exploratory talk, participants are open to alternative perspectives brought forth while talking with peers. I define these three modes of talk further in chapter two of this paper. Disputational and cumulative talks were not present in the journal club. Exploratory talk was the mode of talk used by the teachers.

Wegerif et al. (1999) suggested exploratory talk is very common in the activities of science, law, and business negotiations. Wegerif et al. (1999) found in their empirical study of an intervention program to coach exploratory talk, that with exploratory talk participants have long turns at talk in the discussion. They also found that partners in the talk will use "think" or "I think" to put forward reasons. In addition, they found in this study "I think" link to claims with "because", "would," "could," "should," and "might." They also concluded that "Why?" is necessary in exploratory talk when partners in the talk ask each other what they think.

Exploratory talk as Wegerif et al. (1999) explain it, allows alternatives to be carefully weighed because claims are given and challenges are offered with explicit reasons. Exploratory talk encourages teachers to share their perspectives and engage in each other's, and this, in turn, helps them understand these varying perspectives (Wells, 1999). In the journal club, exploratory talk enabled the teachers to search for their own solutions as a community when solutions were not readily found in the article.

For example, the teachers often at the end of the journal club, during the time devoted to wrap up, looked for solutions to the problems not addressed in the article. The article on African-Americans' science identity brought up a search for solutions.

> Phil: This article didn't have a lot of solutions. **I think** that is a problem with a lot of literature. People are afraid to put solutions on paper because people will then say that didn't work for me. (Everyone laughing). One solution I can think of is constantly making the class more relevant. When I hear of students who are good at sports and terrible at academics, I want to make that connection [between sports and academics] for them. So that they can accept that they can be part of this community as well (2nd JC).

Phil used many "I think" phrases to point out his reasoning of this issue. Jilly then explains her reasoning and provides evidence for it based on her own experiences.

> Jilly: **I think** relevance, but I also think making science more accessible. I think programs like even outside of school. **Because** I don't think I would be here if it weren't for a high school program that I was part of that stemmed out of the Academy for Natural Sciences in Philadelphia (2nd JC).

All the teachers then explored how these programs like the one Jilly mentioned help urban city students get to college and hooked on the sciences. The articles were focusing them on global issues and concerns in education. The articles provided a framework for new ideas, but not always direct solutions to their problems and it was here they began to discover, through exploratory talk, that they were a resource to each

other to find solutions. Talk that was exploratory focused the teachers on problem-solving or troubleshooting that helped them connect theory to practice.

Troubleshooting

In this next example, exploratory talk helped the teachers troubleshoot a concept they often struggled to understand. In the journal club, we had spoken often of science inquiry, and then David presented an article on using technology to enhance inquiry. David stressed that all the articles and all the teaching standards never specify what inquiry looks like when done well. David said referring to the article, "I found that interesting that there are all these rules for teachers, and things you can do [for inquiry], but no one is specifying what it should look like, or what does good inquiry look like?" (7th JC). He went on to say the article had no comment on what good inquiry with technology looks like. He then engaged everyone in exploratory talk when he asked them "What are your comments on what it looks like?" Jilly replied using a reasoning statement "I think" followed by evidence with a "should" statement.

> Jilly: **I think** inquiry in itself **should** be someone asking a question finding an answer to that and then asking another question from what they find and building on that. If we are trying to teach through inquiry, we are going to teach a lesson, and you are going to inquire about that, and then we are going to teach another lesson and then you can inquire about that. They don't have any flow, and I think that is why they don't have any comment on that because inquiry it doesn't follow the flow of a classroom.
> Karen: Are you saying we have to restructure the classroom?
> Jilly: I would think so (7th JC).

David then responds with his reasoning statement.

> David: I was thinking about teaching inquiry and you can't patchwork in you have to build them up. Like start writing these sentences and by the end it is this beautiful journal (Everyone agreed to that statement) (7th JC).

Phil then referred back to the study and pointed out that this article does provide answers for what inquiry looks like. Phil used a reasoning statement, "I think" and followed it with an evidence claim "should" this time using data from the study.

> Phil: **I think** macro text is the one that we **should** highlight that is where these type of articles can make a lot of change. In the classroom, they talk about these metacognitive scaffolds. I think we are trying to get our students to be very aggressive learners because they are not. (Laughing) Our students are passive some are aggressive anti-learners. Look at page 1014 (7th JC).

The conversation continued with the teachers still searching to explain what inquiry looks like. This example of exploratory talk demonstrates how the conversations in the journal club at times were inquiry based. The teachers through this type of talk were evaluating and weighing different perspectives. In this instance, the perspective from the article of what inquiry looks like was part of the reasoning the teachers weighed.

Searching for Relevance

The following example demonstrated how exploratory talk allowed the teachers to examine relevant information, and even investigate evidence from prior conversations. The example was from an article Jilly presented on inquiry-based instruction for learning disability students. Jilly said,

> This study was done at the elementary level because that is where they said they needed to capture the kids, but we are getting them where they do not have this new inquiry or a love for science. So in the middle of reading this, **I was thinking** 'Oh I wish this and I wish that' I don't know how this **could** work. Having a mini-conference where elementary and upper school teachers talk trying to figure how to better distribute science to our students because if we are going to get them at the high school level there must be something we can do at the elementary level to capture them (9^{th} JC).

Mary then heard this reasoning of Jilly's and added to it from her personal experiences. Mary said,

> My roommate is becoming an elementary school teacher and she said the science is what always gets cut. [It is] right at the end of the day or before lunch, and that always gets cut…So, I know that teachers are not spending time doing something inquiry based, and if you can define all the planets you get an A. But I think just the opposite elementary should be more inquiry (9th JC).

Jilly then provided evidence from the article to support her claim. Jilly stated,

> It says under implications [in the article] one of the reasons elementary teachers do not teach science is they lack content knowledge (9th JC).

Phil backed up Jilly's explanation of why elementary teachers do not teach science.

> Phil: That was cited.

Jilly proposed a concept spoken about in the first two journal clubs, science identity, as a solution.

> Jilly: Yes, so have the elementary teachers finding a science identity. That was my thought.
> Mary agreed. (9th JC).

Jilly synthesized past articles to find a solution to a problem she found with inquiry based education. Jilly was able, with the help of Phil and Mary, to explore her hypothetical thoughts and reasons for getting students to love science at an early age. This exploratory talk made Jilly's reasoning more visible and her knowledge more publically accountable (Wegeriff, & Mercer, 1997). It also allowed her thoughts to become incorporated by other members of the community through their understanding of her reasoning.

Exploratory talk helped bring about the elucidation of concepts from the articles that now provided the teachers a better understanding of their students and how they learn. The article on rethinking diversity explored science vocabulary and how some languages do not possess some of the words that are used in science. Phil spoke about finding a way to get students to understand scientific terminology in layman's terms.

Beth referred to the article to provide an explanation and provided her reason why this was a problem for students. Beth said,

> **I think** they did get into this a little bit when they were talking about growing and developing, and really getting the kids to come up with their own words. I think that is a way of getting kids to accept scientific language. **Because** once you make your own meaning of the words using common words in a descriptive precise way then you can go on to using more precise words like metamorphosis or lava… I think part of that is our own fault for the language, and if you don't understand these words then, sorry, you don't get it. I think it is important for us to keep in mind in the classroom so that you aren't off-putting to students (12th JC).

Phil provided his understanding of the language issue in the classroom, and further explained his reasoning for how scientific language can be detrimental to learning. Phil stated,

> …**I think** this article represents the cultural factor in teaching and that is difficult for a lot of us to handle. I still don't understand how I can teach students from urban backgrounds that probably in their time being in school haven't had the proper exposure to science…(12th JC).

The study prompted the teachers to reflect on this subject of cultural differences in language in a new way. Through talk, the teachers connected these reflections to new ways of working with their students in the classroom.

> Eliza: I always thought when people talked about the achievement gap in terms of students whose first language isn't English, it always thought it was the difficulty associated with learning a topic in a language that was less familiar to you, like making it over in vernacular English, but in scientific terms they were still learning the language. I always thought of it being a language difficulty. I hadn't realized that there were a few with certain languages and cultures that didn't have the capacity for scientific discourse. I guess I didn't realize like that. I thought of it as just a language discourse (12th JC).

> Mary: I thought the same thing reading this. My thoughts shifted to this idea of, wow, are we looking down at these kids, who are ELL learners because we think culturally they can't learn science... (12th JC).

This type of exchange went on for a while, each teacher building upon the other teacher's thoughts, and then Eliza offered a way to solve the disconnect science language can create for students studying science.

> Eliza: **I think** that is really part of the take home message. Instead of thinking I have to do this, maybe **I could** make it more open to the student's perceptions, point of view, and the way they talk about things. That might not take more time. In fact, that might take less time because I wasn't trying to twist everything to my perspective all the time.
> Mary: I agree. Maybe I should take a step back and it doesn't have to be written one exact way and such certain terms. Maybe I should take their perspectives on things and go with their perspectives more (12^{th} JC).

The group then came to consensus and examined how to look at topics from students' perspectives. This conversation exhibits how the teachers shared relevant information from the article. They provided reasons for their thoughts. The teachers explored all alternatives of a discussion before summarizing the concepts' importance to their classroom. All members of the journal club welcomed and encouraged each other to speak on the topic. These steps are all necessary in exploratory talk, according to Wegerif, et al. (1999), in creating collaborative learning environments that use problem-solving skills. The teachers were able to generate new knowledge through the talk in the journal club that could help them reconcile problems and issues in the classroom that they had not thought about before. In the journal club, the articles could bring forth teaching experiences that were examined in a new way, which could help lead to solutions.

Through exploratory talk that connected the article to practice, the teachers began to understand the general purpose these articles had to their classrooms. Phil, during his final interview, expanded upon what he learned about research from analyzing studies in the journal club. He said that before the journal club he was not sure how to identify what a research paper looked like. He was not sure he would be able to explain the purpose of

the article. Phil learned that the articles did not have to talk about his specific situation to have applications to his classroom or school. Phil said,

> What I was frustrated about was I was looking for stuff about the area [his community]. I always wondered why I couldn't type in Riverside, Massachusetts and find an article. I guess I should have kind of broadened my opinion about what research is about before I did stuff like that, because it was frustrating…When I backed off of that, I realized that even the articles that would present similar topics from different settings, like international students or international schools, or schools from different areas or regions in America, and you would see science education within an urban environment or approaches to teaching clean energy in urban school districts in Detroit, Michigan.…What I realized as the journal club went on was that the purpose of these is to establish the overlying concepts that affect us all…That was an interesting piece of it (final interview, 5/6/13).

Exploratory talk in the journal club helped the world of scholarly journals seem more pertinent and accessible to the teachers' practice.

Connecting All Modes of Scholarly Talk

The following examples show the fluid nature of the scholarly talk. In this example, Eliza critically analyzed the article, and then the teachers, through exploratory talk, examined how to apply this concept to their situations, and in the process they worked at designing a more valid study than the study they read.

An article on informal science settings had Eliza unsure of its application to anything outside of the data; she felt the study was too specific to a particular setting. Eliza said,

> I don't think there is a lot of stuff in the literature about outside the classroom science. So, I thought it was useful to have someone do that, but I felt this study was so very specific. That it would be hard to abstract much except looking at it more. A particular population, small number of participants, spread in ages 7-17, one week study. Hard to take things I can use except it is worth pursuing… (3rd JC).

Even in a situation where the teachers questioned the study; the concept of the article still was considered for its general implications to education. Eliza said about the previous mentioned article, “I don’t think it was a good model for anything practical, but I found it was interesting because somebody is finally discussing extra-curricular science” (3rd JC). This led the group to discuss the role of extra-curricular science and summer science programs and explore how to implement an extra-curricular program in an urban center. David, Phil, and Jilly collectively searched for solutions to problems they felt the article did not address about their situation.

A problem the teachers had with the study was the large age range, and that it involved concepts that only required lower level thinking. The teachers now explored how they could take these ideas and apply them to an urban setting, for high school students, with higher order thinking involved.

> Phil: I wonder how this study would be different if done in an urban setting. I kept thinking all these opportunities. So cool. But **I think** urban settings could be good. Use engineering applications. I don’t know.
>
> David: In an urban setting instead of looking at fish you could be sensing pollution levels like carbon dioxide, sulfur dioxide, water quality, and environmental quality. Take your group out and see if the water is fit to drink. Measuring oxygen levels in local ponds. You don’t have to go to the Bahamas to do it. With high school kids could do way more, but range makes this difficult. But I would focus on one thing like water quality and do many things with that. Something more specific (3rd JC).

After the conversation shifted back to how the sample size in the study was too small, and the range of kids too large, the conversation between David and Phil came back to problem-solving how to implement this in an urban center, but better than the article. Phil began by using an anecdote from his community work.

> Phil: I feel I have learned the biggest thing from my community work is that a program shouldn't pop in and pop out. It should be sustainable and allow members to come back and be mentors.
>
> David: Keep track of air quality over time. You could have students compare results with students from lasts years' camp. [They] can be expecting it every year. Excited about it.
>
> Jilly, then chimed in, at the camp, she went to as a high school student, "The older girls came and mentored it" (3rd JC).

By using the many modes of scholarly talk such as critiquing the article, and engaging in exploratory talk, and using an anecdote from experience, the teachers began to understand how a particular article could apply to their situation. These conversations allowed the teachers to interact with the article, and 'to try it on' and 'see what it looks like' under their circumstances. Wenger (1998) discusses the importance of education to provide students with "a sense of the possible trajectories available in various communities" (p. 272). Wenger (1998) refers to these trajectories as educational imagination. He states that educational imagination, "is daring to try on something really different, to open new trajectories, to seek different experiences, and to conceive a different future" (p. 273). The journal club was providing a locus for the teachers to explore new trajectories. They are able to examine new options for their teaching without the constraints of having to change. Wenger (1998) stresses that when members transform in a community it is a choice, and not a dictate.

The teachers, in the journal club, were learning how to anticipate problems and barriers that may be encountered from implementing theoretical concepts in the classroom. A discussion on an article on integrating technology in the classroom divided the group over the role of technology in classrooms. The veteran teachers who had not used it throughout their teaching career were uncertain of the usefulness of technology in

their classes. Jilly, a preservice teacher provided an anecdote from her own experience to help explain how teachers may view technology.

> **It reminds** me over the summer we were introduced to Tinker plots. Some program that shows you how to plot data and you can use it in math and science. We had less than half a day to play around with it, and I feel by the end we didn't know what we were using it for. Something like that I think would cause teachers not to want to use it. The teachers haven't had the training, and they don't have the time to explore it (13th JC).

Right after she provided an anecdote from her experiences to explain some teachers' attitudes towards technology; she added in her own rationale and why this story was applicable. The teachers then continued to explore ways to get teachers to use new technology in their classrooms. David, who was a teacher only in his third year of practice, offered his rationale for how to get less technologically savvy teachers using technology.

> It can't just be general. If you are teaching chemistry how is this program going to be used in the class, not just this new program and finish it out. **I think** if teachers understand the general program teachers are generally smart, and they are able to say, 'Oh, if it works here maybe I can try it over here'…but you need a really solid concrete beginning that is easy to understand and consistent (13th JC).

By sharing anecdotes and engaging in exploratory talk, the newer teachers were collaboratively exploring ways to address the barriers the article noted and a veteran teacher shared. The more technologically skilled teachers searched for solutions to problems they were anticipating for their fellow teachers who did not have strong technology skills. The more technologically skilled teachers were trying to help the less technological teachers share their vision for technology in the classroom. They were trying to negotiate a shared domain of the role of technology in teaching (Wenger et al., 2002). They were trying to nurture a shared vision (Wenger et al. 2002), for the community by sharing an anecdote that supports the difficulties of learning new skills

and by exploring a solution to address the perceived problem. In a community of practice, Wenger et al. (2002) stressed how the strong commitment members have to each other can drive members to consider new innovation with confidence.

The teachers in the journal club through scholarly talk that included critiquing and analyzing science educational research articles, sharing anecdotal experiences from their classrooms, and exploratory talk were building a community of scholars and professionals. In the journal club, the teachers had "freedom to ask for candid advice, share their opinions, and try their half-baked ideas without repercussion" (Wenger et al., 2002, p. 61). Beth in the final interview expressed how the journal club was a comfortable community where she could examine different perspectives and explore ideas that informed her teaching goals.

> I would just say it [the journal club] is a good way to be in a very relaxed, open atmosphere where you can start to explore bigger ideas and hear other people's opinions on those ideas, and start to inform your broader perspective on what education is and what you want to do as a teacher for students. In a bigger picture, not like what am I going to do tomorrow, but how do I want to shape what I do in the big picture to do a better job for students (final interview, 5/1/13).

Wenger et al. (2002) explained that in vibrant and comfortable communities new ideas can flourish, because the members in these types of communities can reflect and think and even explore ideas that did not seem plausible in the workplace. The journal club was such a community.

Conclusion

The journal club was becoming a community of inquiry (Wells, 1999). A community of inquiry based on Wells (1999) is a particular type of community of practice (Lave & Wenger, 1991). Wells (1999) explains that a community of inquiry is more appropriate for educational communities than a community of learners, which

places the object of the communities practice on learning. However, in communities of practice "the necessary skills and knowledge are learned as mediating means for and in achieving the object of the activity" (Wells. 1999, p. 123). This does not mean that knowledge and skills are not learned in a community of practice, but they are learned in order to engage in the activity of the community. The teachers in the journal club were learning to analyze a research article and critically think, but these skills were learned to help mediate connections between the article and their practice not as a directly learned skilled.

It was the inquiring questions the teachers asked of each other after presenting the article that set the stage for examining questions or problems from their teaching practice. In the journal club, the teachers were able to challenge the study and critique its purpose and validity. The guidelines and the modeling of inquiring that I did in the beginning of the journal club helped prompt this community of inquiry. However, week after week, it was not me leading the investigations into the articles and the connections to the teachers' practice. It was all of us collaboratively working to critically examine an article and question its implications to practice. I was learning beside the teachers. I too inquired into my own practice and would critically think of how the article connected to my experiences.

The set-up with each teacher presenting helped create an atmosphere where all the teachers were sharing the responsibility for the content of the journal club, and all the teachers had experiences listening and inquiring. The teachers all mentioned how they felt accountable to show up at each meeting and do the reading because they knew they would be presenting soon and they wanted the other teachers to take their work seriously.

Each meeting, the teachers were learning "evolving forms of mutual engagement" (Wenger, 1998, p. 95). Meaning they were discovering who knew how to read graphs well, who knew educational language, and who even asked good inquiring questions after presenting. They were learning the varying resources each teacher shared with everyone in the journal club.

I wanted to know "How does talk facilitate the teachers' learning about a variety of research topics, and their implications to practice?" Talk became the vehicle that connected theory to practice for the teachers. When the conversations were centered on dissecting the purpose and validity of a study, the teachers were learning how this article could be connected to their teaching situation. Talk that focused on sharing anecdotes helped teachers connect their practical stories of teaching to the theory from the article. The anecdotes became a bridge between the experiences teachers have in the classroom and the ideas put forth by an article. Exploratory talks allowed the teachers to weigh perspectives from the article and teaching experiences and use this information to problem-solve and imagine a new direction for their teaching. This talk in the journal club grew from the teachers' mutual engagement to critique research articles and reflect on their teaching practice (Wenger, 1998). The teachers respected each other's teaching experience and desire to learn and improve his/her practice.

Wenger (1998) states, "learning transforms our identities" (p. 227). In the journal club the teachers were transforming their view of themselves as teachers. Eliza mentioned, after the discussion on the article on technology, that she vowed to not become that older less tech savvy teacher who did not bring about changes in her classroom because of her lack of skill. Eliza was explaining how her view of herself as a

teacher had changed due to the conversation in the journal club. The talk and the interactions the teachers had with each other, and even the article, helped transform how the teachers viewed themselves and their practice. I will explore how these experiences in the journal club changed the teachers in the next chapter.

CHAPTER 6

TRANSFORMING PROFESSIONAL SCIENCE TEACHER IDENTITY

I wanted to understand how being in a journal club affected the teachers' perceptions of their teaching practice. I examined the interviews, the focus group, and the teachers' reflective papers to understand how the teachers perceived the journal club influencing their understanding of teaching. Both the preservice and inservice teachers spoke about how the community and the articles altered their understanding of themselves as science teachers. In this chapter, I changed the unit of analysis in this case study from the group as a whole to the group of preservice science teachers, and then, inservice science teachers because the findings indicate that participating in the journal club impacted both the preservice and inservice teachers, but not in the same way. Professional teacher identity refers to "what it is to 'be' a teacher" (Mockler, 2011, p. 517). I looked at what factors influenced their changing identities. These factors were the articles read and the discussions within the journal club. Throughout this chapter, I will look first at how the journal club affected the preservice teachers, and then the inservice teachers. This separation of analysis into the preservice and inservice science teachers is because their teacher identities were not affected by the journal club in the same way.

Professional Science Teacher Identity

There were two factors affecting the changing identities of the teachers: the articles read and discussions with fellow teachers in the journal club. These two factors helped both the preservice and inservice teachers reflect on their views and thoughts of being a teacher. However, the articles and conversations in the journal club did not impact the teachers' identity in exactly the same way. The preservice teachers were

affected the most by being in the journal club, and not surprisingly, the inservice teachers, while transforming their identity, changed to a lesser degree. Many studies have highlighted teacher preparation as a time to develop a professional identity (Cattley, 2007; Chong, Low, & Goh, 2011; Joseph & Heading, 2010; Luehmann, 2007). Britzman (2003) wrote that teacher education is a "time of formation and transformation, of scrutiny of what one is doing and who one can become" (p. 31). Teacher preparation may be an excellent place to develop teacher identity, but that does not preclude that teachers' identities are constantly developing and changing throughout their careers (Beijaard, Meijer, & Verloop, 2004). In the journal club, both preservice and inservice teachers were transforming their identity. I will examine in the sections below how the articles and the discussions brought about changes for these two groups.

Research Articles' Influence on Professional Identity

The research articles influenced both the preservice and inservice teachers' awareness of their teacher identity in two ways. First, the articles helped the teachers reflect on themselves as teachers. Second the articles connected the teachers, particularly the preservice teachers, to the larger community of education. In this section, I examine the two ways the articles made an impact on the teachers' identities. I examined the transformation of the preservice teachers first, and then the inservice teachers.

Preservice Teachers

Reading and critiquing research articles helped the preservice teachers feel as though they were not just learning the skills needed to become a teacher as many of their fellow classmates that were not in the journal club, but rather in the journal club, they

were learning how to assess what being a teacher means. In the final interview, Jilly stated,

> I feel like I am so much more aware than the other people in my program. I think this especially when I talk with other people in my program. When they say something, I say I read that recently. I feel like I am a lot more informed and a lot more aware of myself as a preservice teacher because of the things that I have read which we haven't been exposed to in the program. In our program, right now, we are just learning the skills of a beginning teacher. We haven't had the time to evaluate them (final interview, 5/2/13).

Jilly felt by being in the journal club she was more informed in educational language and knowledge than her classmates in the education program. When Jilly read the articles for the journal club, she started to realize the articles related to her practice. Jilly said,

> I was in the classroom and I was going through the motions every day practicing the art of teaching, and then reading an article like this and thinking that it is somehow incorporated in things I taught that day (final interview, 5/2/13).

The articles read in the journal club helped Jilly become aware that her teaching was tied to educational theory. Jilly now connected theory with practice and realized the actions that she took in the classroom may have a theory behind them. These connections enlightened Jilly as a teacher. Jilly said,

> In the classes that we take as part of the program, it's a lot of the stuff that we have to do now like lesson planning and just reflecting on classroom behavior and things like that. I feel like this gets into more of science teaching, because there is focus around that, and the other things that play into being a science teacher outside of all the things we are learning right now as new teachers. It plays into, in a way, social justice and all things outside of our program (final interview, 5/2/13).

Jilly contemplated how reading science articles helped her reflect more on herself as a science teacher, and not just a new teacher. In the journal club, Jilly viewed herself as a science teacher thinking of global issues that affected her teaching. Jilly stated,

> Of all the different articles, there were some of them that I had never really thought of. That just made me more aware of all the things we could look at as science teachers and there are just so many things to work on and we have to start somewhere (final interview, 5/2/13).

Jilly connected the articles read to the broader issues of science teaching and reflected on how she incorporates these issues into her classroom.

Mary too thought after reading the articles of what kind of teacher she wanted to become. Mary stated,

> I think that they [the articles] were helpful to me in the sense of building my philosophy, like who am I going to be as a teacher and what kind of teacher am I going to be. Am I going to be the type of teacher who is always looking to be involved in groups like this and do outside mini PD, like just casual professional development? (final interview, 5/9/13)

Mary began to consider how she continues to learn throughout her career as a teacher. She now included involvement outside of school and in professional ways as a component of being a teacher. Mary and Jilly are beginning to understand that they will need to continually learn to become the teacher they want to become. Mary and Jilly are thinking of the articles and groups like the journal club as a way to be an informed professional teacher.

Phil, after reading the articles, felt empowered to participate with the educational community as a knowledgeable member.

> With teaching as a career, I hope to be an active educator by keeping the progressive mind of thought open. Like, when teachers and I are in a conversation, bring up the fact that I read this article recently that said that students study better when they are in an environment that they are not afraid to fail in (final interview, 5/6/13).

Phil was connecting theory with practice. In the journal club, Phil learned that being informed by educational studies helped him feel more confident as a teacher.

Phil explained how the articles were becoming tools for him to use in his teaching.

> I think what I have seen from these articles is that there are so many tools out there that are readily available for teachers to access. One of these articles gave me an idea for my class and how to check their understanding of the terminology of science. That's a big thing. What does it mean to say greater or smaller? (final interview, 5/6/13)

Phil connected to the community of education by using an article as a tool. Phil explained in the focus group that he never understood the differences between a scholarly article, a practitioner's article, and an article in a newspaper. Phil explained, "I never knew there was a difference. I feel like I can be part of a community of higher education. This is the practice, I feel like it is not foreign to me" (focus group, 4/22/13). By reading scholarly articles, Phil felt like he was now connecting to the community of higher education that read scholarly articles.

Jilly said at the focus group that she too was unaware of the depth and scope of the academic scholarly work in education. Now after being in the journal club, she was able to be a part of this scholarly academic community and use this knowledge as part of her identity as a teacher.

> I feel like if I hadn't been a part of this, I really wouldn't have gone and looked for them and be able to discuss it with people. I think just in general, in classes and things I refer back to the articles we talk about because it is so relevant (focus group, 4/22/13).

Jilly explained how the articles helped her feel confident to teach in many different school locations because now her knowledge was not just based on a specific classroom. Through reading the research articles, she felt she had teaching knowledge that could help her in many different teaching situations. Jilly said,

> Some of the articles gave me a calling. Because I don't know what type of school I will be in next year. But by reading these articles, I have these tools in my tool belt that I can use. And I am kind of informed versus going into a classroom and

> saying what do I do with it…So, I felt like that is how it informed my teaching now as well as my future teaching (focus group, 4/22/13).

The articles also became tools that helped her re-imagine her role as a science teacher in the community of education. Jilly stated,

> There are a lot of different parts of being a science teacher that I had never thought about. In reading these articles, they made me aware and I guess I've been reflecting on what I can do being as a new science teacher to influence science teaching in general (final interview, 5/2/13).

Gee (2000-2001) refers to this view of identity as an affinity perspective. Gee (2000-2001) explains, "What people in the group share, and must share to constitute an affinity group, is allegiance to, access to, and participation in specific practices that provide each of the group's members the requisite experiences" (p. 105).

This outlook on identity is centered more on affiliation with a group than on a particular institution (Gee, 2000-2001). Phil and Jilly gained, by reading research articles, a kinship with the educational community. I am defining educational community using Gore and Gitlin's (2004) definition of it as academics and teachers. An affiliation with both the academic and a teacher community at the same time is not always apparent; instead, a divide usually exists between the two fractions of the educational community (Gore & Gitlin, 2004). Jilly and Phil explained how they were not aware of the articles as tools prior to the journal club. After the journal club, they both felt the articles informed their teaching and connected them to the educational community. Through Gee's (2000-2001) lens of identity, the preservice teachers in the journal club now feel more aligned with the academic educational community, and this helps them recognize a new professional identity for themselves as teachers.

Inservice teachers

The inservice teachers spoke of how the articles made them more reflective and helped them reconsider their teaching and students' learning. The inservice teachers felt the articles helped them re-examine who they were as teachers. Beth explained how the article on African-American identity helped her understand how to address the achievement gap better in her classroom. Beth said,

> It is certainly an issue I am aware of but have little information or experience in how to address it. It [the article] opened my awareness about specifically addressing how to be more welcoming, inclusive, and showing students they are valuable members of the class (Beth reflective paper artifact, 4/21/13).

The study prompted Beth to reflect on how she could improve her teaching by re-evaluating her teacher identity. Beth had been aware before that she was not adequately addressing the achievement gap between students in her class, but now this article allowed her think of solutions and ways to incorporate changes in her classroom to help her with this problem.

Eliza explained how the article on diversity in learning science both confirmed her thought on making science accessible for all students, but also made her more cognizant of barriers that may be present in her teaching practice. Eliza said, "Some of it is just thinking about the things I am saying in class. From that article about language, I have been trying to be much more thoughtful by not using language so sciencey. It could be off-putting" (final interview, 5/1/13). Eliza and Beth examined what characteristics about them as teachers may be having a negative impact in their classrooms.

This viewpoint of identity formation, Gee (2000-2001) refers to as a nature perspective that is influenced by an institutional perspective. He explains a nature perspective of identity is that we are who we are in part due to nature. However, Gee

(2000-2001) explains that natural identities only become an identity because it is recognized by other forces of identity such as institutions, discourse, or affinity groups. Eliza by nature may have always used large words. However, Eliza has a doctorate in chemistry and her vocabulary was probably rewarded in the chemistry world. Now through the article she reflected on how her large vocabulary may affect her teacher identity. She felt the students may see this large science vocabulary as off-putting. Eliza was contemplating on how something that she prided herself on may not be needed or welcomed in her current position, and how it may be affecting the students' views of chemistry. Eliza's recognition of her vocabulary that made her successful in science but was not helpful in teaching allowed Eliza to imagine a new teacher identity for herself. Using Gee (2000-2001) explains how reflecting on the articles and discussions in the journal club led Eliza to a new teacher identity. Through participation in the journal club, Eliza was able to reflect on her natural identity and make a change to it.

> The article on student bias in teacher evaluations influenced David. He said,
>
> > Before reading this article, I have never considered the effect of student bias on teacher perception and its dependence on both the student and teacher being male or female. After reading this, I began to think back to how I perceived all my teachers/professors and how I can avoid furthering this bias (David reflective paper artifact, 4/21/13).

David reflected, just like Beth and Eliza, not just on his teaching, but how he could make changes to stop propagating behavior that was creating a barrier in his classroom for students to learn.

The inservice teachers were articulating their professional science teacher identity by making links between their own moral purpose and their understanding of their professional practice (Mockler, 2011). Mockler (2011) explains that professional identity

is about developing a personal philosophy about teaching that grows from who the person is at his/her inner core. She explains that teachers throughout their careers either lose this vision they have or let go of it due to the socialization they go through as a beginning teacher. In the journal club, the articles helped the inservice teachers reflect back on what they envisioned equitable classrooms look like. From the articles, the inservice teachers gained new ideas to help them reconfigure their teaching to overcome the barriers that have hindered them from creating the classrooms they sought.

Reading the articles in the journal club also started the teachers to think about their practice more academically. Eliza said.

> Teaching, while certainly very challenging, is not always intellectually challenging, so for me the journal club and the articles that we read and the conversations we had made me approach the practice of teaching more intellectually (final interview, 5/1/13).

Eliza explained how reading the articles helped her think scholarly about teaching. Eliza stated,

> It [the articles] made me think about what is the best way that utilizes the way the students are thinking, to say things that mean the most to them and to avoid saying things that will either eat up time unnecessarily or actually make them think they may not want to study chemistry any further (final interview, 5/1/13).

Eliza was reflecting on her teacher identity and how that plays into her teaching. Eliza was moving beyond thinking about 'what works' in teaching to articulating an understanding of her purpose as a teacher (Mockler, 2011, p. 525). The articles helped Eliza imagine her classroom in a broad generalized way that allowed her to evaluate the curriculum and pedagogy she implemented. Mockler (2011) states the development of a teacher professional identity can help teachers "theorize their practice and consider their

own place within the practice" (p. 523). Eliza, through reading the articles, began to examine her place in the classroom and how she affected it.

The Effect of Talk on Professional Identity

The conversations in the journal club provided new perspectives to both the preservice and inservice teachers. Both groups felt they gained new insights into teaching from talking with fellow teachers. What varied between the preservice and inservice teachers is how these new perspectives affected their understanding of their professional science teacher identity. For the preservice teachers, these conversations with inservice teachers in the journal club were empowering. It helped them view teaching with a new lens. The inservice teachers found the conversations with the preservice teachers rejuvenating, and it gave them hope in teaching.

Preservice Teachers

The preservice teachers felt the discourse in the journal club with fellow teachers offered them new perspectives to consider in their teaching practice. Jilly said,

> The discussions around the articles I feel gave me a different point of view because sometimes I would read the article one way and then someone would bring up a point I had never even realized when I was reading the article. I feel like the discussions were really helpful because they got me to think about my own points of view and then to see someone else's. Sometimes I got ideas off of the discussion, even thinking about how to incorporate certain things into my curriculum. It also was good in helping me develop my own ideas (final interview, 5/2/13).

The discussions offered the preservice teachers an opportunity to hear aspects of the article that they might not have considered when reading it on their own. The conversation not only provided the teachers a different viewpoint, but the new views prompted reflection on the teachers' perspectives of the article and their teaching. Phil added that reading an article by himself can provide him understanding but it does not

necessarily challenge his view. It is by hearing other teachers' thoughts that Phil began to reflect on his own viewpoints. Phil said,

> I can read the article and I can get a better understanding of it, but someone else's opinion can be wholly different from mine or can supplement my opinion. It makes a huge difference because now I am able to churn through the information (final interview, 5/6/13).

Wenger (1998) explains that "understanding something new is not just a local act of learning" (p. 155). Instead, understanding provides meaning to the identity participants are developing in a community of practice (Wenger, 1998). The preservice teachers are not just gaining new perspectives to aid in their classroom, but they are gaining new points of view to ponder their philosophy of teaching.

The preservice teachers learned by being with the inservice teachers that a teacher was always seeking new knowledge to aid their teaching. Mary explained that it reassured her to know she was not the only teacher that felt overwhelmed. Mary felt insecure about her teaching. She found being with the inservice teachers and knowing they do not always feel confident helped her know questioning her practice was a part of being a teacher.

> I think it was just helpful to know that all of us from different places had similar ideas and similar worries. I think it was comforting to know that I am feeling overwhelmed at times and all teachers are feeling overwhelmed at times…Also, I am feeling like I need to learn more and do more, and other teachers who have been doing it for years are still feeling that there is more to learn and more to do in the classroom, better ways to serve students. I feel like the discussion was good for me (final interview, 5/9/13).

Wenger (1998) states, "Multi-membership is the living experience of boundaries" (p. 161). Mary is connecting her role as a new teacher with the role of experienced teachers and this "dual relation between identities" (Wenger, 1998, p. 161) is helping shape her understanding of teachers as continual learners. This new understanding of

teachers as learners helped Mary connect with the teaching profession and understand that she is not alone in her quest to improve upon her practice. Mary said, "I think the journal club gives us a chance to be empowered and the fact that there are other teachers out there…We want to improve our craft" (final interview, 5/9/13).

The preservice teachers felt the conversations with inservice teachers helped them reflect on the articles meaning not just to their classroom but school wide. Jilly said,

> I enjoyed talking to veteran teachers as well as new teachers to get their insight on the different articles. With all the different aspects that go into teaching science, no matter the setting, I have come to realize how many things I need to keep my eye on while fulfilling my main duties as a teacher. Some articles have gotten me to think about how I can contribute to science learning through the whole educational system and how I can start at the level of my school (reflective paper artifact, 4/22/13).

Wenger (1998) said that imagination is an important component of a community of practice. Imagination is the "process of expanding our self by transcending our time and space and creating new images of the world and ourselves" (Wenger, 1998, p. 176). Jilly's participation in the journal club helped her create a new image of herself as a teacher. This image she created focused on a larger view of education than just her classroom.

By being in the journal club, Phil understood it was collaboration that helped him reflect on his educational practice, and inquire into solutions to issues of concern. Phil also recognized that he would need to continue to do this throughout his career. Phil said,

> I think as a science teacher, I can't do this alone. I would be crazy if I tried. It would be wild of me not to connect what happened in this room to the larger world of teaching and education (final interview, 5/6/13).

He added,

> That door should be open. If my door isn't open, I feel like as a science teacher I am going to lead myself into that place where I hate teaching. I want to love my

> job in ten years. In order to do that, I need to be on top of my game as far as interacting with other teachers, interacting with the major thoughts and ideas behind teaching at the time, and also looking at the foundations of where our educational pedagogy has come from, like our practice itself in science (final interview, 5/6/13).

Wenger (1998) said, "Imagination is anchored in social interactions and communal experiences" (p. 178). Phil expanded his "scope of reality and identity" (p. 178) by recognizing the experiences and interactions with other teachers in the journal club connected to his future teaching.

The inservice teachers helped the preservice teachers re-imagine the role of a teacher. Phil had never really thought of teachers as thinkers and intellectuals. Phil said at the focus group,

> It was great to see public school teachers are still scholars. I have this fear that the longer you teach you get weighed down. I worry that as I teach longer I will lose my ability to get new information and retain new information. Because I don't see that at my school's professional development. All I see are the PD's are district pushed (focus group, 4/22/13).

Even though Phil hoped to be a professional teacher, he was afraid from his prior experiences in schools that this goal was not attainable. In the journal club, he realized that his views of teachers were incorrect. He began to re-examine teachers as professionals and see his goal as a professional teacher as achievable. Phil explained,

> The fact that they were coming every single time with great ideas and information, that they found time to read the articles. It makes me realize that I can look at any teacher in this building and relook at them again, and say what do you do on the side? What do you do after school? What do you contribute to your students? (final interview, 5/6/13)

Phil gained a new understanding of teachers by talking with experienced teachers in a scholarly way. The inservice teachers Phil met in the journal club were offering him a new trajectory for his career path (Wenger, 2010). He feared that maintaining himself

as a professional teacher was not an option once he became immersed in a school. The inservice teachers provided Phil a trajectory in teaching that he had not witnessed in his own schooling. Wenger (2010) explained that experienced peers in a community "are living testimonies to what is possible, expected, desirable" (p. 135). The journal club was helping Phil reconceptualize his previously held view of teachers.

The mutual discourse around science education topics with experienced teachers was helping transform the thoughts and ideas of the preservice teachers. The preservice teachers, through these experiences in the journal club, understood that they needed to continue to learn and collaborate to become the professional teachers they hoped to be. The talk with other teachers in the journal club empowered the preservice teachers to feel they could shape their own identity of teaching by gaining new viewpoints. The new teachers began to envision how their teaching could affect their students and the educational community. Mary stated that in the journal club, after reading an article and discussing it, she often thought of "big picture things like what can I get across to students and what is my role as a high school teacher" (focus group, 4/22/13). The preservice teachers were seeing a professional identity as an ongoing practice that alters through reading articles and inquiring with colleagues.

Inservice Teachers

The inservice teachers emphasized how valuable it was to hear from other teachers in the journal club. During the final interview, Beth explained that hearing other teachers' viewpoints helped her learn in the journal club. She said, "What is most helpful is other people's perspective" (final interview, 5/1/13). Beth expressed that being with the preservice teachers led her to reflect on her growth as a teacher. Beth said,

> It's always fun to see what they are doing and also kind of reflecting how far you've come, even though on any given day you think I'm no better of a teacher than I was ten years ago. Then you kind of reflect back on the kind of struggles that you have now completely forgotten or just missed because it was a difficult time and you realized, oh yeah, I have improved. I do have skills that now I take for granted or don't think about because they are just part of what I do (final interview, 5/1/13).

Wenger (2010) said, "learning in practice is negotiating an identity" (p. 136). This identity is incorporating the histories of newcomers and old-timers (Wenger, 1998). Beth was afforded a new look at herself as a teacher from conversations with the preservice teachers. For Beth, sharing her skills and experience with the preservice teachers helped her understand that she possessed such knowledge of practice.

Eliza highlighted how the preservice teachers added a new perspective to the conversations because their schooling was probably different from hers. Eliza said,

> There was a constant affirmation of problems that weren't uniquely mine. Different approaches to the same problems and maybe we didn't have complete success, but just get different ideas. It was just sort of nice to hear younger people's ideas about things as I went to school at a different time (final interview, 5/1/13).

David also commented on how the preservice teachers added a new point of view, one that was more idealistic. David said, "I like their ideas. They are very lofty and full of energy, which is great, because that doesn't always get maintained the longer you teach" (final interview, 5/8/13). The preservice teachers offered a different point of view than what the teachers heard in their schools. Perhaps it was because, as Eliza stated, that the preservice teachers went to school at a different point in time than the inservice teachers, and, therefore, offered different perspectives of schooling. However, David was not as removed from schooling as Eliza and Beth and he too felt the preservice teachers offered new perspectives about teaching. Conceivably current school systems are not offering

teachers a means for new ideas to flourish, and that the journal club provided, through talk, a pathway for new ideas from the teachers to be heard.

Wenger (2010) explains that newcomers (preservice teachers) offer old-timers (inservice teachers) "new potentials" because the newcomers are less beholden to the history of practice at a school. The discussions between the inservice and preservice teachers in the journal club helped them define new trajectories for their identity as a teacher (Wenger, 2010). The preservice teachers began to think about the scope of their teaching beyond their immediate classroom situation. While the inservice teachers started to re-awake their ideals and beliefs in teaching.

David stated how discussions sparked by the articles helped both the preservice and inservice teachers share their teaching knowledge, which helped the teachers solve problems in the classroom. David said,

> The article acts as catalysts for different discussions, which is really good. You can kind of see your faults and what you do well, and what your faults are, especially for the newer teachers because we have all of these kinds of new ideas. For the teachers who have been teaching much longer than me, you can kind of see what they run into in the classroom and how they have gotten past it (final interview, 5/8/13).

The teachers' collective sharing of personal practical knowledge initiated by the articles helped the teachers attain new understandings of their teaching practice. Wenger (1998) states the new meanings of practice attained in communities "can be integrated into our identities and remembered as personal experiences, rather than as mere reification" (p. 203). The stories and teaching experiences of the teachers in the journal club were becoming a part of each teacher's experiences that could be used by him/her in the classroom.

Beth said that the journal club was an "open atmosphere where you can start to explore bigger ideas and hear other people's opinions on those ideas and start to inform your broader perspective on what education is and what you want to do as a teacher" (final interview, 5/1/13). Beth felt the journal club was an environment that allowed for the free exchange of ideas. Beth said,

> Everybody was on the same playing field instead of somebody coming in and telling you how to do something or this is the program we have invested in so we're doing this" (final interview, 5/1/13).

Wenger (1998) suggests that a student's resistance to learning or even lack of learning may be a result of learning that does not incorporate a path for the student to change their identity and have an ownership in the learning. Beth explained in the quotes above that she had a stake in the learning in the journal club and the conversations offered perspectives where she could examine a new course for her teaching.

Eliza explained how the journal club rejuvenated her teaching. Eliza said,

> I really enjoyed the conversations we had…I just felt more lively in the classroom, like I had more ideas and more things to think about. We are academics because we are into learning…so it was a chance to get back to that analyzing it critically (final interview, 5/1/13).

Eliza added, "I guess my goals have become a little loftier, but there is no 180 degree switch or anything like that. I have been more hopeful and more thoughtful and hoping that makes some difference. I think it is safe to say that I put more time into my daily classroom preparation" (final interview, 5/1/13). Beth felt that being in the journal club renewed her as a teacher and helped free her from becoming stagnant. Beth said,

> It is a way to kind of shake you up. I don't want to be the sort of teacher who ten years down the road has these binders, and you do the same thing year after year and don't change your ideas about teaching. This kind of helps you stay away from that (final interview, 5/1/13).

The journal club helped the inservice teachers rejuvenate their teaching and reflect more on who they were as teachers. The inservice teachers had a view of teaching that they wanted to live up to being. Beth did not want to become a teacher who would not change her pedagogy, and Eliza considered intellectual pursuits in teaching an important component to her practice. David was happy to have lofty ideals as a teacher like he had when he entered teaching. Each teacher had their own image of a teacher, and in the journal club, because of the ownership they had in what was learned, they were able to actualize their view of a teacher.

Discussions with the preservice teachers provided the inservice teachers a rejuvenated view of themselves as teachers. It helped the inservice teachers look at problems they were having in the classroom with a new lens that often helped them critically examine their teaching. Sometimes these discussions led to solutions to problems the teachers were having in class, but most often the discussions resulted in reflection on varying perspectives. A professional identity is fostered through an understanding and reflection on teaching practice, classrooms, and students (Mockler, 2011). The journal club provided the inservice teachers an opportunity as Eliza stated, "to be a scholar again" (focus group, 4/22/13).

The discussions the inservice teachers had with preservice teachers prompted the inservice teachers to examine their hopes and aspirations as teachers. Beth said that in the journal club she started

> …to explore bigger ideas and hear other people's opinions on those ideas, and start to inform your broader perspective on what education is and what you want to do as a teacher for students. In a bigger picture, not like what am I going to do tomorrow, but how do I want to shape what I do in the big picture to do a better job for students (final interview, 5/1/13).

Beth was contemplating the local and global interplay of professional identity (Wenger, 1998). The journal club, configured as a community of practice, created "a picture of the broader context in which its practice is located" (Wenger, 1998, p. 162). The conversations with the preservice teachers in the journal club helped the inservice teachers identify with multiple levels of teachers in the profession (Wenger, 2010). This exploration of the many levels of the profession helps to form the identity of the teacher in the landscape of the teaching profession (Wenger, 2010). Eliza stated, "I am leaving feeling hopeful about the future of our profession because I have really appreciated the input from these young teachers" (focus group, 4/22/13). The preservice teachers were providing a context for the inservice teachers to re-connect with their ideals for the teaching profession.

Conclusion

An understanding of identity helps teachers explore 'why I am here' more than 'what I do' and it helps them have a strong sense of purpose as to why they are teachers (Mockler, 2011, p. 525). Wenger (1998) explains how identity is an on-going process that is informed through communication in social contexts. The journal club provided the social contexts for teachers to define their identity. The articles read and the conversations prompted by the articles helped the teachers explore their purpose as a teacher. The teachers were not fixated during their conversations on the state tests the students had to take. Instead, the teachers focused more on understanding their students and the best ways to teach them. The preservice and inservice science teachers were also able to identify the characteristics about themselves that play into their teacher identities,

and through participation in the journal club, they were able to consider new teacher identities (Gee, 2000-2001).

In the journal club, it was the articles and conversations that helped the preservice teachers think more globally about their teaching. They felt by being in the journal club that they had moved beyond learning the technical aspects of teaching. Now the preservice teachers felt they were contemplating about how their teaching could have an impact on their students and the schools they would enter. The inservice teachers found being in the journal club helped them become more cognizant of themselves as teachers. The journal club also made the inservice teachers less complacent in their teaching and helped them examine their practice in a more intellectual way.

It was important that the preservice teachers were practicing in the classroom during the journal club because it helped the preservice and inservice teachers, together, explore new ideas and perspectives on teaching. The preservice teachers were not weighed down yet by the constraints of school systems and state tests, which helped the inservice teachers explore new ideas for teaching that they had, perhaps, lost sight of by being in the classroom. The inservice teachers showed the preservice teachers the professional side of teachers. The inservice teachers in the journal club were devoted to improving their craft, and the journal club provided an opportunity for the preservice teachers to learn how inservice teachers critically examine their practice. The articles and the conversations helped the preservice teachers frame their view of "what it is to 'be' a teacher" (Mockler, 2011, p. 517). At the same time, the journal club helped the inservice teachers re-frame their understanding of themselves as teachers.

CHAPTER 7

PRESERVICE AND INSERVICE TEACHERS IN A JOURNAL CLUB

Introduction

In this chapter, I return to my research questions and summarize my findings. I state what I have learned from this study and examine the implications of this work for science teacher education and professional development. I will also present recommendations for further research in science teacher education and professional development. The research questions I explored in this study were

1) Is the journal club a working community of practice? If so, how is the journal club a working community of practice?
2) In what ways does community seem to affect the teachers' perception of teaching practice in the journal club, as experienced by them and manifested in their conversations?
3) How do the research articles inform the journal club discussions about practice?
4) How does talk facilitate the teachers' learning about a variety of research topics and their implications to practice?

I begin by examining if the journal club functioned as a community of practice, and what defined this community.

Discussion

Community of Inquiry

In the journal club, the preservice and inservice science teachers bonded together over science education research articles. The articles became the tool that led to an inquiry into the teachers' practice, and who they are as teachers. The journal club functioned as a community of practice with a focus on the research articles implications to the teachers' practice. This focus on the educational research prompted the science teachers to reflect on their practice and examine it with a new understanding. In the journal club, the teachers, to become a part of this community, had to learn how to:

search for and critique research articles; engage in discussions that examined the implications of the educational theory to their practice; and imagine the implementation of the different perspectives to their practice.

The journal club incorporated the three characteristics of a community of practice (Wenger, 1998) into its functioning. The first characteristic is mutual engagement, which provides the coherence of a group. Coming to the journal club and reading the articles were an important attribute of being in the journal club. The teachers stated how they felt they had to read all the articles presented because they did not want to let the group down. The teachers also thought it was important to participate in the conversations over the articles. In the journal club, the teachers created this unspoken accountability to each other. The teachers felt they were giving up an hour of their time every other week, and they wanted it to have meaning for their teaching practice. The teachers in the journal club held each other mutually accountable. They were not accountable to some outside reified standard, such as the Massachusetts Comprehensive Assessment System, (MCAS) tests. It was their own standards that drove them to keep coming to the journal club and seek to understand how to improve their practice.

The second characteristic of a community of practice is the creation of a joint enterprise. Wenger (1998) stated that a joint enterprise is the participants "negotiated response to their situation, and thus belongs to them in a profound sense, in spite of all the forces and influences that are beyond their control" (p. 77). The joint enterprise the science teachers shared was the search for new understandings and solutions to problems and concerns in their teaching practice. In the journal club, the teachers did not necessarily find solutions to all their problems, but did learn to inquire further into what it

means to be a science teacher and examine their students' understandings of science. The new insights they gained of themselves as teachers, and the new ideas they imagined incorporating into their classrooms are what Wenger (1998) views "as a local collective creation of the community" (p. 80). It is this joint venture that helps the teachers create new knowledge of teaching. Wenger (1998) states that the accountability that members of a community feel to an enterprise is what makes them personable, and desire to share information, and make each other's lives easier. In the journal club, the teachers felt being honest and supportive were important when discussing the articles. The teachers valued sharing sincerely their understanding of the article and their honest accounts of successes and failings from their teaching practice; this in turn led to new insights and knowledge about teaching.

The third characteristic of a community of practice is a shared repertoire. The shared repertoire refers to the routines, structures, words, and unique functioning of a community of practice. There was a rhythm to the journal club that helped the teachers mutually engage around the joint enterprise of reading, critiquing, and understanding the research articles with the goal of improving practice. The presentations of the articles became such a part of the routine of the journal club that when Phil was late to a meeting, Beth, who was not presenting the article, quickly was able to present Phil's article on his behalf. When Phil arrived at the meeting late he did not need to inquire with what had occurred; he knew the organization of the meetings and jumped right into the discussion. This repertoire was unique to this journal club, and an outsider would have been unfamiliar with the structure.

The teachers asked each other inquiring questions, which became a shared repertoire of the journal club. These questions helped the teachers connect the articles to their teaching practice. The questions helped create talk about the articles and what they look like or could look like in practice. Wenger (1998) explains that a shared repertoire "includes the discourse by which the members create meaningful statements about the world, as well as the styles by which they express their forms of membership and their identities as members" (p. 83). The talk in the journal club helped the teachers meaningfully understand their classroom and teaching practice and transform who they are and hope to be as science teachers. The talk of the journal club brought to life the possibilities in their classrooms and as a science teacher.

How was the teachers' perception of their teaching practice affected by being in a community of practice? It was because the journal club was a functioning community of practice that their awareness of their teaching changed. The preservice science teachers felt the conversations in the journal club helped them gain new perspectives on teaching. Phil had commented on how hearing other teachers' viewpoints challenged his own. The preservice science teachers also felt that they learned by seeing the inservice teachers struggle with their teaching. In addition, by watching the inservice teachers choose an article, regularly attend the journal club, and inquire into their teaching practice, the preservice teachers witnessed teachers as continual learners. Teachers as continual learners were a new concept for the preservice science teachers. They now began to contemplate how they become continual learners and active professionals in their future teaching practice.

The preservice science teachers felt that being in the journal club moved them beyond just thinking about how to survive as a new teacher, to instead reflecting more on who they hope to be as science teachers. For these preservice science teachers, discussing scholarly articles with fellow teachers sparked a desire to be leaders in science teaching and their future schools. They felt they now understood how to use educational theory to connect with the higher education community and think globally about their teaching.

The perspectives of the inservice science teachers varied from the preservice teachers, but the inservice teachers did express the journal club helped them become more reflective teachers. The inservice teachers said that the articles helped them rethink their teaching and their students' learning in their classrooms. The articles did not create an instant solution to their teaching situation, which at first frustrated the inservice teachers at the meetings. Eliza said, during the wrap-up discussion of the article, that again the article did not provide any answers. However, as the journal club went on, the inservice teachers learned to deal with this uncertainty in teaching and the lack of hard fast solutions. Beth stated in her final interview, "We go with what we know today and tomorrow we'll have more information, and we'll revise what we do because we have more information" (final interview, 5/1/13). The articles helped them re-evaluate their perspectives, and the conversations helped them hear varying viewpoints from other teachers having similar problems to what they were encountering in practice. Eliza said, "They were articles that I read that were real eye-opening…there was a constant affirmation of problems that weren't uniquely mine. Different approaches to the same problems and maybe we didn't have complete success, but just getting different ideas" (final interview, 5/1/13).

In the journal club, the inservice teachers were learning to view their teaching with a new lens. The inservice teachers were beginning to re-imagine how they envisioned their classrooms to function. In the journal club, the inservice teachers particularly, from conversations with the preservice teachers, were reflecting back on their moral purpose for being science teachers. The conversations and articles in the journal club helped the teachers envision more equitable classrooms for their students.

The relationships formed in this community of practice between the preservice and inservice teachers helped both sets of teachers re-imagine what being a teacher meant to them. The preservice teachers now viewed teaching as a continual learning process and the inservice teachers began to envision the equitable classrooms they once sought to create. It was the journal club functioning as a community of practice that helped the teachers gain knowledge from one another. In communities of practice, there is a "negotiated character of these relative values" (Wenger, 1998, p. 199). In the journal club, the ideals of the preservice teachers became negotiated into the values of the inservice teachers. Meanwhile, the inservice teachers desire to examine their teaching became incorporated into the preservice teachers' views of being a teacher. This new negotiation of being a teacher was a product of the journal club functioning as a community of practice, because in the community of practice, the relationships among the teachers garnered trust, openness, and honesty. The teachers also, as Wenger (1998) experienced with claims processors, "had come to trust that I was, somewhat to their surprise, genuinely interested in their own meanings" (p. 199). The teachers understood that I valued the meaning they assigned to the article and to the discussion as well as their views on teaching.

Wenger (1998) did a yearlong ethnographic study of a medical claims processing center at a large U.S. insurance company. In his study, he found that claims processors have very limited control over the institutional conditions of their work. The job of a claims processor is to review the insurance claims that are placed when a patient on this insurance goes to a doctor or gets treated for an alignment. The claims processors follow a protocol worksheet established by the insurance institution with no input from them. The claims processors also take calls from customers asking for information on reimbursements and coverage. When the claims processors answer the phone, they must follow a nationwide coordination of benefits worksheet. The claims processors often feel uncomfortable on the phone with customers because they are not sure of the meaning of everything on the form that they are following. Specialists have designed this form and the claims processors adopted it. Claims processors engage together to provide meaning and understanding to their work in what Wenger (1998) calls a community of practice.

I feel that being a science teacher increasingly has outside frameworks and stipulations that science teachers most implement and understand. Teachers, like claims processors, have been kept from the source of the development of these frameworks, and yet, it is up to the science teachers to adopt and put them into practice. However, many science teachers, like claims processors, may struggle to provide the meaning and understanding necessary for them to implement these frameworks into their practice. Science teachers are increasingly losing control over their institutional work conditions too. Wenger's (1998) study highlights the need for science teachers to form a community of practice with other science teachers in order to do their job well and get satisfaction from it. A community of practice offered claim processors in Wenger's (1998) study an

opportunity to express and negotiate and make sense of their work. I argue that by the journal club functioning as a community of practice, the experienced and inexperienced science teachers had the opportunity to express their views and hopes for teaching, and thus, were able to make sense of their teaching and how to re-imagine it to function better.

Formal Theory Informing Talk

I examined in this study, "How do the research articles inform the journal club discussions about practice?" The research articles become as David said the "catalysts for different discussions" (final interview, 5/8/13). The teachers engaged in three main modes of communication that helped them connect the theory from the articles with the practical theories that they held: critiquing research articles, sharing anecdotes, and exploratory talk. Critiquing the research articles helped the teachers evaluate the design of the research and its implications to teaching situations. Through critiquing research articles, the teachers learned that educational research has a purpose and place in teaching. They learned how to critically think about data from a study. They learned how to make data from a study applicable to their teaching situations. The teachers also learned what the educational research community values. Beth explained, in her final interview, that the articles helped her get "mentally ready" for the changes that may be coming in a few years to her classroom.

The second way the teachers engaged in talk that connected theory and practice were by sharing anecdotes. These anecdotes helped the teachers connect ideas conveyed in the article with their real teaching experiences. Anecdotes grounded the formal theory to the teachers' practical theory. Deng (2004) states that a teacher preparation should be a

time for teachers to engage with theory that will broaden their perspectives and understanding of teaching. In the journal club, the articles broadened the teachers' perspectives, but sharing anecdotes helped the teachers make sense of the articles and examine the concept in a study from a practical perspective.

The final mode of talk the teachers communicated in at the journal club was exploratory talk. In the journal club, the preservice and inservice science teachers did not just broaden their perspectives from reading the research articles, but they also engaged in exploratory talk, which allowed them to weigh these new perspectives and ideas on teaching. Exploratory talk helped the teachers seriously consider alternative claims in teaching by weighing and considering their implementation in their classrooms. Exploratory talk also helped teachers collaboratively problem-solve. The articles were not always readily applicable to their context, but exploratory talk helped the teachers re-imagine the article to their situation. In the journal club, by reasoning and weighing perspectives as a community, the teachers were able to contemplate solutions they might not have recognized alone.

In the journal club, the teachers engaged in intellectual work about teaching. I am borrowing my definition of intellectual work from Resnick (1987), who stated that intellectual work "…engages reflection and reasoning. At its best such work steps back from the everyday world in order to consider and evaluate it, yet is involved with the world as an object of reflection and reasoning" (p. 19). The teachers in the journal club stepped back from the daily routine and pace of their days to explore, reflect, and reason with science educational ideas for their teaching. Their practice was the object of their reflection, but this reflection and learning about teaching was done among peers from

different science subjects, most at different schools, and with many different levels of teaching experience.

The teachers felt in the journal club they were able to think about teaching in an intellectual way that they did not get to do often in their practice. Eliza said, “The articles that we read and the conversations we had made me approach the practice of teaching more intellectually” (final interview, 5/1/13). This intellectual work helped the teachers consider new understandings about teaching and interactions with fellow teachers. Phil stated, in his final interview, that he hoped to use articles to back up his perspectives when conversing with other teachers at his future school. Jilly said that the articles helped her to consider not just her teaching interests, but also how to create equity within her classroom and the school she hoped to teach at one day. The research articles also affected the inservice teachers’ thoughts on equitable classrooms. Eliza reflected on her own language and how it could be creating barriers to learning science in her classroom. The inservice teachers were more concerned with how they could affect change in their classroom not necessarily to the overall field of teaching; perhaps, because their immediate concerns in their classrooms outweighed the time needed to reflect on the bigger changes in education.

I also examined “How does talk facilitate the teachers’ learning about a variety of research topics, and their implications to practice?” When the preservice and inservice teachers were dissecting the purpose and validity of the study, they were using talk as a vehicle to critique the article and its context. By sharing anecdotes from practice that related to the concepts in the study, the teachers were using talk to help them connect the formal theory of the articles to their practical theories on teaching. When the teachers

engaged in exploratory talk, they were participating in reasoned discourse that offered them a way to connect educational theory to their practice and gain new perspectives on teaching. These conversations in the journal club helped the teachers learn about their practice and reflect on how to bring changes to their practice based on all the new perspectives.

The Benefits of a Journal Club

I previously examined the literature on collaborative reflective practice in teacher education and professional development (i.e. learning circles, lesson study, and collaborative action research). I found that learning circles do not highlight using research articles to address problems teachers encounter in their classrooms, but rather the teachers offer support through sharing teaching stories. The purpose of lesson study is for a group to observe, critique, and plan a lesson with the goal of improving teaching. A problem with lesson study is that the teachers do not learn how to critique and analyze educational theory. In lesson study, teachers effectively use educational theory to develop a lesson, but often struggle when interpreting how the educational theory used in the lesson impacts their teaching and students' learning (Saito et al., 2010). Collaborative action research also does not help the teachers learn how to assess and evaluate educational research. As a result, the teachers never learn how to place their studies within the context of the academic educational research studies which leads to a separation between the teachers' research and the academic community's research.

Journal clubs provide all of the benefits of these three collaborative reflective practices and more. In a journal club, the teachers present problems in teaching through the selection of the article. Through sharing anecdotes, the group supports each other as

in learning circles. However, in the journal club the anecdotes are grounded to the theory from the educational study. The teachers in a journal club examine educational theory as it pertains to a lesson, like in lesson study; however, in a journal club, through exploratory talk, the teachers also reason and weigh how using the educational theory in their lesson will affect their teaching and students learning. In a journal club, unlike collaborative action research, the teachers will be able to connect the practical theories of their classroom with the educational research because they will be given the skills to evaluate the educational studies critically and how these studies inform their teaching. An understanding of how to critique research articles will help the teachers, as seen in this study, to feel connected to the larger educational community and empowered to engage in the discourse of the academic community. Perhaps then, the studies produced from collaborative action research can have more weight in the academic community.

Summary

The teachers in the journal club incorporated the three characteristics of communities of practice: mutual engagement, joint enterprise, and shared repertoire. The teachers explored the practice of teaching as a community of inquiry. The reading and discussing of the research article led the teachers to examine and reason through their own teaching practice and their function as teachers in their classrooms. The teachers felt mutually accountable to each other to participate in the journal club. They felt it was important to inquire into the research they read to gain a better understanding of their teaching practice and to find solutions to problems they had encountered in teaching. While the articles might not have always provided the teachers the solutions they were

looking for, the talk about the studies helped them re-examine their teaching practice and reflect on themselves as science teachers.

In the journal club, the preservice and inservice teachers were learning to view teaching with a new perspective. The preservice teachers began to understand their actions in the classroom had theory behind them. The preservice teachers were also moving beyond survival mode as new teachers to thinking of who they want to become as science teachers. The inservice teachers were learning to be more reflective teachers, who were beginning to re-imagine their purpose and function as teachers. It was from the journal club functioning as a community of practice that the science teachers were all learning to negotiate a new understanding of teaching.

It was the talk in the journal club that helped the teachers connect theory to practice. Through critiquing research articles together, the teachers learned to critically examine research data and critically understand the theory that informs their practice. They shared anecdotes from their teaching to make sense of the article and examine the articles' meaning from a practical perspective. Sharing anecdotes also allowed the teachers as a community to support and encourage each other to try new ideas in practice, even if they sometimes failed. It was through exploratory talk that the teachers were able to seriously examine the claims from the articles and consider them in their teaching practice.

The journal club offered the teachers an opportunity to develop a community of practice. In the journal club, the teachers were able to critically think about their teaching and the practice of teaching. They were able to weigh new perspectives and understand their implications to their teaching. The teachers were able to explore intellectual

thoughts about teaching through problem-solving and envisioning themselves as the teachers they wanted to be or become.

Implications

For Science Teacher Educators

The science teacher education curriculum aims to incorporate research theory into its curricula, but the future teachers still seem to value the advice of teachers in the field over the educational research (Britzman, 2003). We have all heard, as teacher educators, teachers say, "that the article does not apply to me and my classroom." Journal clubs provide a new tool to invite teachers to explore the educational research that interests and affects them. Journal clubs welcome teachers to be equal participants in the critiquing and translation of the studies. Gore and Gitlin (2004) found that teachers were often wondering when given an article to read, "But will it work in my class?" (p. 40). Journal clubs offer teachers an opportunity, through talk, to inquire into whether a concept will work in their classroom by critically thinking about the idea and its claims and applications, and by hearing anecdotes from teachers who have tried the concepts in their classrooms, or even through envisioning with other colleagues what the ideas would look like in the classroom.

Gore and Gitlin (2004) in their study on teachers' views of research found teachers often wondered "How am I supposed to use research, anyway?" (p. 43). Journal clubs expose teachers to the language and the world of research education. It provides teachers information on how to access, critique, and examine the validity of articles to them. It helps break the academic-teacher struggles over power that Gore and Gitlin (2004) highlight exist. Science teachers often think their way of knowing about practice

is not valued, and science educators often feel they have the 'authority' on academic knowledge (Gore & Gitlin, 2004). Journal clubs mitigate these struggles for power by using an academic study as a source to critically examine. The article may have authority behind it, but in the journal club, the teachers learn to question that authority and understand it through their experience of practice. Phil said during the focus group, "This was one of my first opportunities to have a critical eye about something we are learning from…Usually we are given an article, and we are told it is the best article out there" (focus group, 4/22/13). Many of the teachers at the focus group agreed with Phil's statement. By developing a critical eye, teachers in the journal club learned to understand the uncertainty, but yet, potential of educational theory.

Our role as teacher educators should be to give teachers the intellectual tools and ways of knowing and reflecting that aid their teaching throughout their career. In a journal club, the teachers collaboratively learned to critically think. The definition of critical thinking I am using is that of Ennis (1989) where critical thinking is "reasonable reflective thinking focused on deciding what to believe or do" (p. 4). The teachers in the journal club used new data to critically reflect on their own practice, and they used their own relevant experience from practice to critically examine the article. The teachers learned tools that helped them decide who they are as science teachers and what they want to do in their classrooms. Journal clubs help teachers gain autonomy over decision-making by becoming critical thinkers and consumers of theoretical knowledge.

For Science Teachers

The findings in this study show that the teachers are able to access and critique educational research. The teachers were committed to reading educational studies with

the hope of understanding and improving their teaching. The teachers held each other accountable to a high standard of attendance and participation. They created a community of inquiry that extended far beyond the unelaborated language Chernobolisky et al. (2004) referred to where teachers do not engage in discussions using new knowledge. The teachers in the journal club often spoke using exploratory communication, which means using new information and ideas from the readings and past information that was relevant (Chernobolisky et al., 2004).

The teachers embraced the educational theory in the journal club because they were able to explore and choose the research themselves. Beth said that in the journal club "It was nice to just pick-up the thread and go wherever it took us. Everything is always driven by what we are trying to get done" (focus group, 4/22/13). Eliza stated "I really appreciated the opportunity to be a scholar again" (focus group, 4/22/13). In a journal club, teacher educators are inviting teachers into the world of theory: the language, the methods, the context, and analysis that are used to generate theory. A journal club welcomes teachers into the educational research community. The Australian Council of Deans of Education, as noted by Gore and Giltin (2004), said that graduates of teacher education programs "should have an active sense of themselves as part of the education research community" (p. 51). The Australian Council of Deans of Education supported teachers as teacher-researcher. I agree that a teacher-researcher should be a regular part of a teacher's practice; in addition, I believe understanding how to utilize the educational theory that informs a teacher's class and own research would strengthen the teacher as researcher.

The findings from this study showed that the teachers valued forming a professional network between inexperienced and experienced science teachers. Mary stated, “It was helpful in a sense to network and meet more teachers, to again hear what their classrooms are like compared with my classroom because they are in different places” (final interview, 5/9/13). Networking helped these teachers not only meet new teachers but begin to understand how other classrooms operate and function in different schools and towns. This information helps teachers learn that they are not alone in their struggles, and it also helps them learn of successes different structures have created. Many of the teachers were excited by Jilly’s experiences in an expeditionary school, and how the teachers created a more equitable community at her school. These experiences helped the teachers collaboratively problem-solve with other teachers and gain new understandings about teaching that help them re-imagine their classroom and schools.

Possibilities for Further Research

In this section, I will examine some of the possibilities for further research that developed from this study. The first possibility I explore is how to implement journal clubs in teacher education and development. Journal clubs could be established as professional development at schools, and then led by the teachers themselves. A teacher educator could be a facilitator, and help the teachers learn how to access the literature and inquire critically into the educational theory and their practical theory. Journal clubs also can easily be incorporated into science teacher education as a complement to the program. A journal club could be a seminar in a teacher education program and used to cultivate a community of practice with the teacher educator as a facilitator.

A journal club in teacher education would provide preservice science teachers an opportunity to form bonds with fellow teachers in a scholarly manner, but yet not be like a classroom where the objectives of the course are often pre-determined. A journal club is also advantageous in teacher education because the preservice teachers learn to speak and guide questions in front of a group. These are skills the future teachers will need to know in their classrooms. In addition, journal clubs can be created the way this journal was by combining preservice and inservice science teachers reading together. All of these scenarios provide preservice and inservice science teachers the opportunity to be leaders and create professional networks.

There are also many ways to expand journal clubs in teacher education. Seminars and courses could be connected where preservice teachers pursue educational literature in a journal club, and then use this literature to conduct an action research in their classrooms. In this way, the formal theory of education becomes accessed, evaluated and reconfigured to the teacher's classroom while in the journal club. Then, the preservice teacher explores in his/her classroom the implementation of the new concepts, and studies how it impacts his/her classroom. The journal club becomes the bridge that connects educational research to teacher research.

This study did not examine how the teachers implemented the theory into their classrooms. Further research could examine how a journal club functioning as a community of practice supports and helps teachers put into practice the concepts developed in the journal club. A long-term study of a journal club in science education could also look at how a journal club sustains teachers as cutting edge professionals, which it does in other professional fields. Also, how do journal clubs of just experienced

teachers look different than journal clubs with only inexperienced teachers or experienced and inexperienced teachers together? Educational leadership programs could implement journal clubs to understand how formal theory can foster leadership. There are many promising possibilities to incorporate journal clubs in science teacher development. There are also many collaborative opportunities for teachers and researchers to explore how journal clubs can help re-imagine researcher-teacher relationships.

Concluding Remarks

The teachers, when talking about the journal club, used words like empowered, motivated, rejuvenated, a calling because that is what intellectual knowledge does for someone. Theory is often seen as alien from teachers' experiences because teachers have not examined how theory is derived from teachers' practices (Smagarinsky et al., 2003). Freire (2000) explained that when teachers and students are in dialogue with each, neither are passive listeners, but rather they become critical joint investigators where new understandings and new commitments are made to the challenges ahead.

In the journal club, I joined the preservice and inservice science teachers in critical explorations on theoretical constructs of teaching, and I watched them tie these theories to their teaching situations. I saw them learn from each other and listen to each other. The findings suggest that, in a journal club, the teachers began to understand how teaching is an ever-changing field, and they continually need to keep up with the information generated. In addition, many of the teachers were beginning to understand they needed to contribute to the spreading of this knowledge among their colleagues. In the journal club, many of the teachers expressed how they began to think more globally

about their teaching. Global thinking can bring teachers away from the immediate fixes and to longer lasting transformation.

For too long, teachers have been kept from engaging in intellectual meandering. The teachers in the journal club had the freedom to explore ideas about science teaching, and try them on and see what they would look like in their practice. In the journal club, through talk, the teachers were able to make sense of educational theory. It is time we provided teachers with the tools to engage with intellectual concepts. When teachers begin to understand all facets of the educational landscape, then they may become empowered to take part in leading the changes in our schools. Perhaps the tools learned in a journal club will help the teachers re-imagine future classrooms.

APPENDIX A

INTERVIEW 1

At the beginning of the journal club

Turn on recorder and state date and name of interviewer.
Note: These are possible questions. This will be a semi-formal interview.

Section 1: Educational/personal background

1. Did you attend public, private, or parochial school for high school?

2. Describe the location of the middle/high school you attended as a teenager? Rural, suburban, or urban?

3. Did you attend public, private, or religiously affiliated college? Why did you choose this college? Did you live on campus?

4. What did you major in at college? Why did you choose this major?

5. Do you currently work? Part-time or full-time? Explain.

6. Do you do volunteer work? Please describe.

Section 2: Being a science teacher.

I will be talking to you about why you want to become a science teacher.

1. When did you decide to become a science teacher?

2. Why do you want to be a science teacher?
   a) What are your goals for teaching science?

3. What science discipline do you hope to teach?

4. Have you ever held a teaching job? What did you teach?

5. Have you have coached, tutored, been a camp counselor, or worked with students in anyway? Explain.

Section 2: Science Background in Research

I will be exploring your experiences in school and research.

1) Tell me about your college experience?
   a) Did you enter college right out of high school?

2) Did you get an advanced degree after college?

3) Did you do any undergraduate research? Explain.
   a) What was your topic?

   b) What was it like being a science researcher?

4) Did you do any graduate research? Explain.
   a) What was your topic?

   b) What was it like being a science researcher?

5) Have you ever worked in scientific research after college? Describe your position?

Section 3: Journal Clubs

I will be exploring your experiences with journal clubs and reading research.

1) Do you know what a journal club is?
   a) Describe what you do in a journal club?

2) Have you ever been in a journal club? Where and when?

3) If yes? What type of articles did you read and discuss?

4) What is educational research? Science education research?

5) Do you ever read educational research?
   a)What journals or type of articles?

Section 4: Learning theories

I would like to next understand your views on how teachers learn from their practice and learn about new theories and strategies in teaching I would like to read (also have a handout of this statement for them to read) you a statement released by the

The National Board for Professional Teaching (1987) on five core principals teachers need to know. Proposition Four stated:

Teachers Think Systematically about their practice and Learn from experience.

1) National Board Certified Teachers model what it means to be an educated person-they read, they question, they create, and they are willing to try new things.

2) They are familiar with learning theories and instructional strategies and stay abreast of current issues in American education.

3) They critically examine their practice on a regular basis to deepen knowledge, expand their repertoire of skills, and incorporate new findings unto their practice.

1) What do you think teachers do to stay abreast of current issues in education?

2) How do you think teachers examine their practice?

3) What do you think teachers do to become familiar with learning theories and instructional strategies while teaching?

Section 5: Community

Finally, I would like to ask you about learning in a group.

1) Do you enjoy doing your work with others or alone?

2) Have you ever been on a sports team or in a research group or any formal group activity? Explain.

3) When you have ever read and then discussed a book or an article with others, did the discussion ever change your thoughts on the book or the article?

4) What do you do when you need help with a problem?

APPENDIX B

INTERVIEW 2

At the end of the journal club

Turn on recorder and state date and name of interviewer.
Note: These are possible questions. This will be a semi-formal interview.

Section1: Journal Club

The questions will deal with how comfortable you were selecting and presenting articles.

1) Did you have difficulty finding an article?

2) How did you choose an article?

3) Did you find it difficult coming up with a problem or issue to examine?

4) How did you prepare for your presentation?

Section 2: Application of Article

These questions deal with the how pertinent the articles were to your teaching.

1) Have you used any of the information from the articles you presented in your practice?
   How so?

2) Would you use any of the information in your future practice?
   In what way?

3) Have you used the articles that were presented by other people?
   How so?

4) Would you use any of the information from articles presented by other people in your future practice? In what way?

Section 3: Theorizing

This section deals with your experience in the journal club and the impact on your practice.

1) Do you think the journal club helped you read and critically analyze research articles?
   How so?

2) How did presenting the articles help you think about your teaching and the classroom?

3) How did the other people's presentation help you think about your teaching and the classroom?

4) Would you think of looking up an article in the future when you have a problem in practice?

5) Would you think of reading a research article and discussing it with anyone in the future?

Section 4: Community

These questions deal with the role of community in your thinking.

1) In what ways, did the discussions inform your thinking of teaching?

2) How did you like the articles other people chose?

3) In what ways did hearing other teachers concerns and issues inform your thinking of teaching?

4) How did reading and discussing articles in the journal club compare to reading articles in other classes?

5) How do you think the other teachers in the journal club contributed to your understanding of the article?

6) Did you feel safe to express your thoughts and ideas in the journal club?

7) How did you feel the group worked collaboratively? Did all members have equal status?

8) How do you feel you contributed to the journal club?

Section 5: Being a science teacher

1) Why do you want to be a science teacher?

2) What are your goals for teaching science?

3) If goals have changed ask:
   a) Have the articles read or the discussions in the journal club influenced these goals for science teaching?

b) Has any component of the preservice program (courses, assignments, student teaching etc…) had any influence on your goals for science teaching?

APPENDIX C

MID-POINT FOCUS GROUP

I conducted this interview about half way through the journal club

Turn on recorder and state date.

The purpose of this focus group interview is to find out how things are going at this time.

1) How are things going?

2) How are you trouble searching for the articles?
   a) Do you find what you are looking for?
   b) Does it take awhile?

3) How are the presentations going?

4) How are the groups working? Are you dividing the work evenly?

5) Does everyone feel they have a voice in the discussions?

6) Any changes we could make to improve the discussions and include everyone?

7) Any changes we could make that could improve the presentations?

8) What is not working?

9) Do you like the articles you are reading?

10) What do you wish you were reading more of?

11) Any recommendations to the journal club?

APPENDIX D

FINAL FOCUS GROUP

Conducted after the journal club is completed.

Turn on recorder and state date.
Note: These are possible questions. Some new questions may be developed from observations of the journal club.

Learning from articles:

1) Which articles did you like the best?

2) How did the articles impact your thinking of teaching?

3) What did you hear in the journal club to inform your practice that you have not heard before?

4) How did the discussion of the articles inform your practice?

5) How did hearing other members concerns and problems of practice inform your practice?

6) How helpful was it to analyze an article?
   a) Do you feel confident reading a research article?

7) Do you see yourself reading research articles in the future?

8) Do you see yourself discussing research articles with other teachers in the future?

9) What do you think was the most important thing you learned in the journal club?

10) Has this experience changed your thoughts about teaching in anyway? How so?

Community

1) Would you say knowledge was shared in the journal club, and if so, give examples?

2) Do you feel the journal club was a community? Why/why not/ in what ways?

3) What would you say a community is?

4) Describe you learning experience in this journal club?

5) Is there anything you wish had been different in terms of learning or community in this journal club? Can you give specific examples?

6) Any differences between reading articles and discussing them in the journal club and in classes in the teacher education program? If so, please describe.

7) Would you be in a journal club again or start one?

APPENDIX E

CONSENT FORM

Consent to Participate In Research Study

I am Karen Tallman, a doctoral student at the University of Massachusetts Amherst in Teacher Education and School Improvement. You are invited to participate in this research project. Your participation in this study is completely voluntary. This study is for preparation of my oral defense in my doctoral studies. The chair of my committee is Dr. Allan Feldman, he will be advising me throughout this process.

Purpose and Benefits:

The purpose of this qualitative research is to explore how a journal club prompts science teachers to reflect, through talk, on the formal theories of the articles and the practical theories they hold on teaching. This study has potential significance for science teachers learning during teacher education. No individual teacher is the focus of this study; the study instead is on the community and the discourse in the journal club that leads to this reflection. Hopefully, you will build community with other science teachers and begin to understand how research literature impacts teaching practice.

Procedures:

If you agree to participate, I will interview you on two separate occasions. Each interview is approximately 60-90 minutes long. I will audio-record the interviews and later transcribe them to facilitate analysis. The first interview focuses on your academic background, professional experiences, and experiences learning through reading and working in groups. The second interview will focus on your experience in the journal club and professional goals.

You will participate in 12-15 forty-five minute long journal club meetings. We will meet at a place and time decided by the group. You will be asked to bring an article to a problem or concern you are confronting in your practice to two of the meetings. Guidelines as to how to present the article to the group will be provided by the researcher. You will be asked also to read other articles presented by other participants at the meetings you are not presenting at. The dates you will be presenting will be decided by you and the other participants' in advance of the journal club meetings. Any changes in dates can be arranged in advance of the meetings. I will also audio-record, and write field notes from our journal club meetings. Data will also include the articles presented, evaluations of presentations, and any e-mails exchanges.

I will also audio-record two group interviews I will conduct on the journal club. One on how it is functioning and the other on what you have learned. Both of these focus groups will be conducted during the journal club set time.

Risks and Confidentiality:

Your participation in this study is voluntary. If you decide to participate you are free to withdraw from part or all of this study at any time without penalty.

Anonymity of the participant is a priority so that he or she can share freely and openly. Because of the small number of participants, I understand that there is some risk that the participant may be identified in the study.

Although I cannot fully guarantee anonymity, I will take the following steps to protect your identity.

1) At no time will I identify the actual names of the participants or the university's name in the reporting of data collected during interviews and artifacts collected for this study to anyone with the exception of the chairperson of my dissertation committee, and only then if necessary.
2) Pseudonyms will be used for all participants and the university.
3) Audio-recordings will be stored and labeled only with a pseudonym. Names will be removed from any documents provided by the participants.

Participants should understand they may be quoted directly from observations at the journal club meetings, interviews, and focus group but that their names will not be used in any part of the report. I plan to use this material in my doctoral dissertation, presentations at professional conferences, published research articles, and courses I may teach. By signing this form, you give me a release to use the interview, journal club observations, group interview, and any other material described above.

Participants have the right to review any materials related to them on request. This allows you the right to comment on my interpretations of the situation and provide concerns or confirmations of the findings.

I appreciate your willingness to give your time to this project to help me understand the role of a journal club in science teacher education.

Below is a summary of this letter. If you have any questions or concerns about this study, please contact the researcher, Karen Tallman at kmtallman@comcast.net or (413) 575-2974.

Sincerely,

Karen Tallman

CONSENT FOR VOLUNTARY PARTCIPATION

I volunteer to participate in this qualitative study and understand that:

1) I will participate in the journal club meetings. I understand that Karen Tallman will take field notes and audio-tape the 12-15 meetings to facilitate analysis of the data.
2) I will be interviewed by Karen Tallman, privately and in a group. The interviews will be audio-recorded to facilitate analysis of the data.
3) I will submit artifacts in the way of articles, e-mail exchanges concerning the group, and reflective papers to Karen Tallman
4) I understand that there is some risk that I may be identified in the study. But pseudonyms will be used for all participants and the university. At no time will the actual names of the participants or the university's name be reported in the data collected during interviews and artifacts collected for this study to anyone with the exception of the chairperson of my dissertation committee, and only then if necessary.
5) Audio-recordings will be stored and labeled only with a pseudonym. Names will be removed from any documents provided by the participants.
6) I understand that I may be quoted directly from observations at the journal club meetings, interviews, and focus group but that my names will not be used in any part of the report.
7) I am free to participate or not participate without prejudice.
8) I may withdraw from part or all of this study at any time.
9) This material will be used for Karen Tallman's oral defense, presentations at professional conferences, manuscripts submitted to professional journals for publication, and courses Karen Tallman may teach.
10) I have the right to review material at any time by appointment with the researcher.

Your signature indicates that you have read and understand the information provided above; that you willingly agree to participate; that you may withdraw your consent at any time and discontinue participation without penalty; that you have received a copy of this three page form and that you are not waving any legal claims, rights, or remediation.

_____Participant's Signature and Date

_____Participant's Printed Name

_____Researcher's Signature and Date

_____Researcher's Printed Name

APPENDIX F

GUIDELINES FOR PRESENTING

Journal Clubs have been used in many fields (medicine, science, and nursing) to discuss recently published papers, articles, or research. The goals of journal clubs are to keep up with current findings in a field and to examine them with a critical eye and then reflect on how they inform your practice.

1) Think of a clinical question or dilemma related to your classroom practice and /or students learning. (Be specific)
2) Pick a single peer-reviewed article to help answer your question. (Find the article through ERIC or Education Journals or Academic Search or Google scholar. If you have a problem finding an article, please contact me at kmtallman@comcast.net).Let us know how you found your article. (Where? Key words used)
3) After reading the article, prepare to lead the discussion. In your presentation identify your question. Then summarize the main aspects of the article. Highlight the important points of the article as they pertain to your question. Many education articles have a background section that help place the article in context. You do not need to explain all the past studies mentioned, just a few sentences to summarize what past literature says on this topic.

   If the article is a study, a) who was studied b) the research questions, c) the methods used in the study, and d) the results and analysis, e) authors implications to field and further questions.

If the article is of a new educational technique, tool, or process a) Describe the educational approach. b) Describe the implications the authors feel this process will have on teaching or learning. c) What evidence do the authors use to support their analysis? d) Describe the further research the authors feels need to be done.

4) Prepare a few starter questions to begin the club discussion.

They can be specific such as “Have you ever witnessed descriptive feedback in a classroom situation?” or “How do you envision descriptive feedback would look like in the classroom?” avoid vague questions like “Would someone like to comment on descriptive feedback?”Questions can include what the significance of the article is and how will it impact practice. Questions can also address any opposition to the article and how the article was presented and the studied was conducted.

5) Begin by reading a summary of your article or you can provide a summary on PowerPoint. Then ask one of the questions you have written down and encourage everyone to respond.

6) It is your goal to keep the discussion on track during the meeting. If you notice that discussion is wandering from the topic presented by the article, ask another question to get it back on track. Try to keep the focus on the relationship between the article and practice.

7) Make sure that everyone gets a chance to contribute to the discussion. If you notice someone is talking for more than five minutes, politely step in and introduce another person to speak. For example, you could say, “That is a great

point you make, but let's hear from someone else to get more opinions on the subject."

8) Another person besides the facilitator will take notes at the journal club meeting. Notes will be taken by the note taker throughout the meeting on different opinions, critiques, and ideas discussed. These will be used at the end to conclude the meeting. You can also use notes to help when selecting your next article. The note taker position will be rotated around in way determined by all the members of the journal club.

9) The note taker will conclude the meeting by briefly summarizing all that was discussed. You do not have to summarize everything that was said. Just stick to the main points that were brought up and talked most about.

10) Provide the article well ahead of time so that everyone has time to read it and think about the article.

11) Are there any other guidelines or important information that anyone would like to add to these guidelines?

(Adapted from Nicolette, 2011)

APPENDIX G

LIST OF RESEARCH JOURNALS FOR SELECTION

These are just a few of the peer reviewed articles that you might find articles. Check with me if you find an article from a journal not on the list below:

Journal of Research in Science Teaching

Journal of Science Education

Journal of Science Teacher Education

Teachers College Record

Teaching & Teacher Education

JSTOR

Harvard Educational Review

Research in Science Education

Science Educator

Journal of Teacher Education

Journal of Chemical Education

Environmental Education Research

Journal of Environmental Education

Physics Teacher

International Journal of Engineering Education

International Journal of Science Education

The Urban Review

Theory and Research in Education

APPENDIX H

ARTICLES READ

Articles Read in the Journal Club 2012-2013

10/1/12: Aschbacher, P.R., Li, E., & Roth, E. J. (2010). Is Science Me? High School Students' Identities, Participation and Aspirations in Science, Engineering, and Medicine. *Journal of Research in Science Teaching,* 47(5), 564-582.

10/15/12: Brown, B.A. (2005). The Politics of Public Discourse: Discourse, Identity, and African-Americans in Science Education. *Negro Educational Review,* 56(2), 205-220.

10/22/12: Foster, J.S. & Shiel-Rolle, N. (2011). Building scientific literacy through summer science camps: a strategy for design, implementation and assessment. *Science Education International,* 22(2), 85-98.

11/5/12: Irving, M.M., Nti, M., & Johnson, W. (2007). Meeting the Needs of the Special Learner in Science. *International Journal of Special Education,* 22(3), 109-118.

11/28/12: Schwartz, M.S., Hazari, Z., & Sadler, P.M.(2008). Divergent Views: Teacher and Professor Perceptions about Pre-College factors That Influence College Science Success. *Science Educator,* 17(1), 18-35.

12/3/12: Potvin, G., Hazari, Z., Tai, R.H. & Sadler, P. M. (2009). Unraveling Bias from Student Evaluations of Their High School Science Teachers. *Science Education,* 1-19.

1/14/13: Kim, M.C., Hannafin, M.J., & Bryan, L.A. (2007). Technology-Enhanced Inquiry Tools in Science Education: An Emerging Framework for Classroom Practice. *Science Education,* 91, 1010-1030.

1/28/13: Yule, J.V., Wolf, W.C., & Young, N. L. (2010). Emphasizing the "Literacy" in "Scientific Literacy": A Concise Blueprint for Integrating Writing into Biology Classes. *Scientific Literacy*, 36(2), 15-21.

2/11/13: Aydeniz, M., Cihak, D.F., Graham, S.C., & Retinger, L. (2012). Using Inquiry-Based Instruction for Teaching Science to Students with Learning Disabilities. *International Journal of Special Education*, 27(2), 189-206.

2/25/13: Villanueva, M.G. & Hand, B. (2011). Science for All: Engaging Students with Special Needs in and About Science. *Learning Disabilities Research & Practice*, 26(4), 233-240.

3/4/13: Harwood, W.S. & McMahon, M.M. (1997). Effects of Integrated Video Media on Student Achievement and Attitudes in High School Chemistry. *Journal of Research in Science Teaching*, 34(6), 617-631.

3/25/13: Warren, B., Ballenger, C., Ogonowski, M., Roseberry, A.S., & Hudicourt-Barnes, J. (2001). Rethinking Diversity in Learning Science: The Logic of Everyday Sense-Making. *Journal of Research in Science Teaching*, 38(5), 529-552.

4/1/13: Hew, K.F. & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future work. *Education Technology Research Development*, 55, 223-252.

Additional articles suggested by members of the journal club but not read by the group.

Chuck, J. & Young, L. (2004). A Cohort-driven Assessment Task for Scientific Report Writing. *Journal of Science Education and Technology*, 13(3), 367-376.

Davis, K.S. & Synder, W. (2012). Fostering Science Education in an On-line Environment: Are We There Yet? *Journal of College Science Teaching*, 42(2), 24-31.

Krajcik, J. (2013). The Next Generation Science Standards: A Focus on Physical Science. *The Science Teacher,* 80(3), 27-37.

Schwartz, M.S., Sadler, P.M., Sonnert, G. & Tai, R.H. (2008). Depth Versus Breadth: How Content Coverage in High School Science Courses Relates to Later Success in College Science Coursework. *Science Education,* 799-826.

Verma, A.K., Dickerson, D. & McKinney, S. (2011, September). Engaging Students in STEM Careers with Project-Based Learning-Marine Tech Project. *Technology and Engineering Teacher*, 25-31.

Suggested Book:

Danza, T. (2012). *I'd Like to Apologize to Every Teacher I Ever Had: My Year as a Rookie Teacher at Northeast High.* Crown Publishers: NY

APPENDIX I

MEETING SCHEDULE

Meeting #	Date	Presenter	Journal
1	10/1/12	Karen	*Journal of Research in Science Teaching*
2	10/15/12	Phil	*Negro Educational Review*
3	10/22/12	Jilly	*Science Education International*
4	11/5/12	Mary	*International Journal of Special Education*
5	11/28/12	Beth	*Science Educator*
6	12/3/12	Eliza	*Science Education*
7	1/14/13	David	*Science Education*
8	1/28/13	Phil	*Science Literacy*
9	2/11/13	Jilly	*International Journal of Special Education*
10	2/25/13	Mary	*Learning Disabilities Research & Practice*
11	3/4/13	Eliza	*Journal of Research in Science Teaching*
12	3/25/13	Beth	*Journal of Research in Science Teaching*
13	4/1/13	David	*Education Technology Research Development*

APPENDIX J

DATA TABLES

Table A1: Background Information of Teachers

Name of teacher	Sex	# of years secondary high school teaching experience	Preservice/Inservice teacher	Type of school for teaching assignment	Teaching subject
Phil	male	0	preservice	urban	Physics
Jilly	female	0	preservice	urban	Chemistry
Mary	female	0	preservice	rural	Biology
Eliza	female	11	inservice	suburban	Chemistry
Beth	female	13	inservice	suburban	Biology
David	male	3	inservice	urban	Chemistry

Table A2: Background Information of Education and Research Experience of Teachers

Name	Undergraduate major	Graduate degree	Research experience	Teaching credentials	Journal Club experience
Phil	Astronomy and Education minor	M.Ed. in progress	none	Enrolled in credential program Secondary: Physics	no
Jilly	Biochemistry and Environmental Science	M.Ed. in progress	Yes as an undergraduate	Enrolled in credential program Secondary: Chemistry	Yes Chemistry journal club
Mary	Biology	M.Ed. in progress	none	Enrolled in credential program Secondary: Biology	No
Eliza	Chemistry	Ph.D. Chemistry	Yes in graduate school and postdoc.	Secondary: Chemistry	Yes Chemistry journal club
Beth	Psychology 2^{nd} degree later Biology	M.Ed.	none	Secondary: Biology	No
David	Chemical Engineering	M.S. Chemical Engineering	Yes, in graduate school	Secondary: Chemistry	Yes Chemical Engineering journal club

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Arani, M.R.S., Keisuke, F., & Lassegard, J.P. (2010). "Lesson study" as Professional Culture in Japanese Schools: An Historical Perspective on Elementary Classroom Practices. *Japan Review,* 22, 171-200.

Ball, A.F. (2012). To Know Is Not Enough: Knowledge, Power, and the Zone of Generativity. *Educational Researcher,* 41, 283-293.

Barak, M. & Dori, Y.J. (2009). Enhancing Higher Order Thinking Skills Among Inservice Science Teachers Via Embedded Assessment. *Journal of Science Teacher Education,* 20, 459-474.

Bauer, N.J. (1992, October). *Dewey and Schön: An Analysis of Reflective Thinking.* Paper presented at the Annual Meeting of the American Educational Studies Association, Kansas City: Missouri.

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Bell, B. (1994). Using anecdotes in teacher development. *International Journal of Science Education,* 16(5), 575-584.

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